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Region: New World Strains - The Americas, Hawaii and Caribbean

Family: Big Bud Strains

Strain: BC Big Bud

Strain Type: Mostly Indica **Origin:** Oregon/British Columbia **Breeder:** Unknown

Images:

Description:

"BC Big Bud is a stabilized 65% indica/35% sativa, the Dutch Big Bud (Sensi) has a tremendous resin, its the crystalline bud on the cover of the Cannabis Culture magazine. It has a citrusy scent. Usually only available in clone, (hence the crosses, its usually BC Big Bud or Mikado x BC Big Bud), it is now available in seed (pure) at \$50 Cl

largest I have (not that that information has meaning, seed size has no relevance persists about them). Very nice smoke, the Dutch Big Bud can be a good yield superior in the BC Big Bud version. The leaves in the BC Big Bud variety are

Specifications:

none

Growers Comments:

none

Strain: Big Bud

Strain Type: Mostly Indica **Origin:** Oregon, USA **Breeder:** Sensi Seed Bank

Images: [1](#) [2](#) [3](#)

Description:

“Winner of the Cannabis Cup in 1989. Mostly Indica. All plants have guaranteed something special to it. Usually the lower branches collapse under the weight of the buds. A true delight.”

Specifications: ~ Flower: 7.5-8.5 weeks – Sensi Seed Bank catalog

Growers Comments:

“Ed Rosenthal says Big Bud came from Portland, Oregon.”

“The Big Bud was the same as usual. The buds are large for sure, but this strain reached about 15 inches in height and yielded at least an ounce each. I've grown it and to be honest I thought it came out poorly originally because they were not consistent in batch, which was grown and dried as perfect as I have ever done, still pales in comparison to the last time I take up space with this strain.” – James Hetfield

“While I'm not going to say that Big Bud isn't a good strain, it's not as magical as some people think. The main problem is the name, Big Bud, everyone expects massive buds. They are usually larger than many other top strains. The potency is good but not knock you out. There are a lot of variations from plant to plant, some are killer and deserving of some of the love (not typical of high quality strains). Overall, a good plant as long as you don't expect a bowl of it myself.”

“Friend has been growing supposed BB for a while now, and let me say that he has selected a perfect mother (maybe just great luck?), but mine sure is different. It's more potent, amazing. 8-10 in my opinion. But even Sensi says that 25% are "Specimens". So a whole batch (pack) of seed as to give yourself a better shot at a primo Mom. If you've never grown any exotics before, try an easier strain. You really kind of need to know what you're doing. – Bdubs

“Piece of crap - hard to clone. I grew a few seeds from a seedbank selling Sensi. I wasted time and space with any more than 2 females. Maybe I was unlucky and got a large producer. Dunno. the plants were grown indoors under plenty of light. I got a small spread out bud yield. I was expecting fatty kolos, but nope. It looked more like lil

BB is supposed to be. Anyway, that's my two cents." - dak

"Afoaf has a Posi Big Bud Mom that is 70% pistils ripe, with cloudy heads in a nice. Its a real tough strain, eats ferts big time, not the strongest most devas long duration 4 hours, but a repeat for sure, the strain has really "grown on r strain, now if it took 55-60 days it would be history, its speed to harvest is a

Strain: Big Bud x Skunk #1

Strain Type: Sativa/Indica mix **Origin:** Oregon/British Columbia **Breeder:**

Images:

Description:

none

Specifications:

none

Growers Comments:

"(Big Bud x Skunk #1) 23.25 oz. Cured, VERY well manicured. Also made 2 lb (strong) and 10 grams of hash. There were 8 1/2 plants grown from clone(once know why I even let her live). Plants were vegged in an aeroponic/NFT system an AgroSun bulb. They were about 18-20 inches tall when switched. Each plant in an NFT system. The first 2 weeks a single 1000MH w/ AgroSun was used. / at the third week. Flowering took about 70 days. These were the most crystal I've ever grown. Slow cured over 1 1/2 months. First on newspaper, then into Smell is incredible. High is incredible. Normally I find BB a little less potent than me. High starts out mellow, upbeat, then when you start the second round of wave. Immediate couch melt. Cancel your plans, you're not going anywhere. somewhat sharp, which is the best thing about it. Overall I was pretty pleased of problems in the early weeks of flowering with mites, and then nearer the end So considering that I was pleased with the yield. Although it did suffer the type looser buds. I had one plant that was a monster! A good 8 inches taller than having to tie her down. 4 huge colas each around 4x11. That plant probably Content

Strain: Green Spirit

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Dutch Passion Se

Images: 1 2 3

Description:

"Green Spirit is a hybrid of Big Bud and Skunk #1. Was developed because E consistent strain, with very big differences among individual plants. By cross Spirit became quite homogeneous. Good results under artificial lights. Clear an explosive flowering trait and are extremely resinous. Very high yield.

Specifications:

Specifications: ~ Flower: 8-9 weeks ~ Harvest: 1st week of Nov." - Dutch F

Growers Comments:

"Green Spirit is a short resinous 8 week strain that crystals up nicely and has a drawback I see is the mold susceptibility trait inherited from its Skunk#1 for

Family: Blueberry Strains

Strain: **Blue Moonshine**

Strain Type: Indica **Origin:** Oregon, USA **Breeder:** D.J. Short

Images:

Description:

"A super potent Blueberry Indica, coated with a strong concentration of tall s long lasting very narcotic experience ~ body high blueberry. Short (80 cm) s dense, tight, rock hard nuggets of trichome coated bud. A true "hash-plant."

Specifications:

Specifications: ~ Flower: 9-10 weeks ~ Harvest: mid Nov." -Heaven's Stair

Growers Comments:

"Blue Moonshine IS NOT a White Widow cross. It is similar to the "Whites" on Blue Moonshine is a cousin to Blueberry, and is derived entirely from within i - D.J. Short

"I liked it a lot. It's mellow, weird, trippy yet down to earth. I crossed it with r NL-BM smells like heaven. I'd say it smells like Bubblegum, but I know there' name. But that's just what it smells like (right now.)

So anyway, I found B.M. a lot like the description; strong but don't get it if yo that way.) However, if you like mellow, different stones, I highly recommend hard if such a thing exists, quick: takes about two months or so; sorry I'm too about it. (and as I grow in about 12 CUBIC feet, you don't want my numbers. And these are only my experiences and current opinion. I reserve the right to Oddly, I'm just not sure about the Blue Moonshine, which is weird because I l Going to start all B.M. beans soon (Moving to bigger local and I swear I'm sta possession when I get there (and I'm going totally organic!)) and I'll know my Blue moonshine wouldn't be my choice if I could only grow one strain. But I'r

Strain: Blue Velvet**Strain Type:** Mostly Sativa **Origin:** Oregon, USA **Breeder:** D.J. Short**Images:** 1 2 3**Description:**

"An Oregon-Thai cross with blue hues and elevating energetic high. This is a sativa strain. She is truly a queen of the cannabis court and a favorite for 70's sativa growers. Grow on a stick and create your own royal scepter.

Specifications:

Specifications ~ Type: mostly Sativa, indoor. Start vegetate: 1 week after 10 days. Average height: 1-1.5 m. Yield: 250-300 grams / m2 (dried)" - Sagarm

Growers Comments:

"I like it ok as an outdoor plant. The flavor is very good, the high is not bad. I crossed it with a WW and WOW. Will try and get some photos of it up. I would grow it outside than indoors." - ncca

Strain: Blue Widow**Strain Type:** Mostly Indica **Origin:** California **Breeder:** NCGA**Images:** 1 2 3**Description:**

"Blueberry (female from British Columbia) x White Widow (Aloha male) APPE 80 cm- with short to medium internodes, no central stalk but rather many stems. Very tall. Fat indica dark green leaves turn more slender when flowering. Very colorful. Buds are all very uniform. BUDS: Budding is slow at first, then it explodes with orange clusters covered in abundant shiny glands, all possessing an unmistakable blue color. Branching will form dense solid buds with much resin everywhere in-between. Smelling like a strong house cleaner that tingles the nose, it is extremely tasty. HIGH: Very strong, nice up, clear high -exhilarating and more powerful, and has a much better high than either blueberry or white widow. It is high, being an easy to grow plant. Budding is slow at first, but then explodes with orange hairs and a very high calyx-to-leaf ratio. The AK-47 is a good yielding strain. It will out yield it (NCGA).

Specifications:

Very short plant -up to 80 cm- with short to medium internodes, no central stalk forming a bush almost as wide as tall. Fat indica dark green leaves turn more

consistent -height, nodes and density are all very uniform.

Growers Comments:

Top 3 NCGA's strains in potency according to Marcel (NCGA assistant): BlueWidow; G13 crosses; any NC5 series cross." - NCGA

Growers Comments:

"When looking at the BlueWidow it does best indoors. It does well outdoors but day length, clone it then place it outdoors. I found when it was grown outdoors single 6 ft bud. Not the best use of space. When cloned though it reaches the times as much. Harvest date outdoors California is 2nd week in October. If you wonderful and did well in the SF can cup." -ncga

"I have grown out a Blueberry x White Widow cross, BlueWidow. It is a definite strong berry taste(very strong) and a kickass buzz, more than just blueberry with a moderate yield, but yielded more than my NL strain. I will do a new grow awesome strains. you wont find BW but a F2 is out there called TwoBlue. Take important things IMO." -HJ

"Here's a great tip for you people just starting out. Don't get caught in the hype. Serious, Sagarmatha and Greenhouse are. They are very good but they are just strains have been around in some form or other for 5 to 10 years and lots of However... some of the new ones by NCGA tip the scales at excellent. BlueWidow is much better high than Sags Blueberry and Greenhouse white widow. Stoneberry, Stonehedge and Blueberry that it was made from. Stronger, sweeter with big blueberry. The reason NCGA's strains are so much better is because of hybrid is much much better." -Merry Gary.

"Supposed to be rock hard nuggets, very crystal-covered with a strong smell originator of this cross said it lost some of the funky sweetness when crossed more pungent and harsh. Potency is supposed to be sky high... Most of us are first results are from those who crossed the strain. (Some of us here have known have some of the same hybrids.)"

"I have the blue/widow at 43 days 12/12. I began flowering when nodes stagnate than a fair yielder, but I think this is going to be a very potent strain. The leaf area commercial buds. This is one NC strain that could become INFAMOUS!"

"Well I can tell you about BlueWidow or (BW) I'm the one that had the idea for a nice blueberry mother...BW grows short to medium nodes fat fan leaves that flowering...the budding is slow at first been then explodes.... She produces nice hairs very high calyx/to leaf ratio.... Smell like a strong house cleaner that tir berry taste...high is very strong nice up not very heavy high. Hope this helps

"BW is very nice STRONG body high but if your looking for something quite clear Kali Mist its VERY up and super clear great sativa energy, although BW is very I have yields quite good and is quite dense def. not what I've heard or it doesn't spicy with incense tones taste...I love it I got 9 clones ready to go with 9 AK... nice. So if you want a clear focused high then go for Kali. If your want a slam

AK...and if you want an EASY high yielding plant BW would be your choice. H

"My mcw's and BW's, as most of the ncga strains so far, have shown pre-flow light, it probably is the WW in them. By contrast, I am growing a few NL x Af show their sex so quickly. As the BlueWidow enters flowering the leaves go f sativa the side branching starts to fill out more. Should be some big colas an very good high exhilarating floaty very visual buzz. Another shrub! Looks like still drying too so... Early samples were EXTREMELY tasty! My growing partner in a freak deal and even he prefers this 1 for flavor. He says he can taste a s thought that said something for it. It's a good buzz too, but didn't seem to la mind I only have 2 goin'). J VERY CLEAR high taste spicy sweet height nodes BlueWidow."

"Those of you that are growing the BlueWidow are growing a very good strain leaves in fact its very short I have a mother that's 31 and hasn't got much to a bombshell thick dense ROCK SOLID buds covered in so much glands it alms and a strong smell that hurts the nose a bit its sweet hashy berry taste that IMO better than pure blueberry. You will fall in love with this hybrid very short form in thick rock solid clusters and have sooo much resin everywhere in bet smell that tingles the nose a sweet berry taste that goes BOOM in your lungs days into 12/12, and I must say very impressive. I always sample a little female have tried leaf from MCW, nc#5,nc#3,REW and the BlueWidow is in a class of finished product. I have finished some of the BW. It's gonna be a keeper for this strange growth pattern described below. My partner kept saying " the plants then they grow another node!" I wondered if he was nuts at first (he is, but then described it to a tee. Thanks for the insight and education Bang! The plants are they are tall. They all possess the unmistakable blue hue to the tops and a flavor wanting more. It isn't the most powerful stone we have, but the flavor more

"I took 6 clones off one and the growth pattern is unusual. Instead of growing this seems to have many smaller stems like a bush. I am only about 10 days as to what kind of bud formation to expect. Leaf is usually a good indicator a

Vic, I can see your concern about colchicine but you are in luck. Ncga has tall other killer strains to get crosses that are even BETTER than the blueberry. Stonehedge and Blueberry has got to be one of the best ever strains. Blue w a LITTLE bit of potency for flavor and quality of high." -NCGA

"I have 2 sets of Blue Widows, the first set is two clones at the end of their 5 about 32" (80 cm) and are almost identical, glistening with a thick coating of since I took the clones when the mother plant was almost done flowering, so second set is of 3 seedlings; they are also quite uniform. They are all on their branching. One does have a thicker trunk than the other two, but I attribute growth, they have all since been transplanted to larger pots."- Japedo

"I'm currently growing his StoneBlue, MCW, nc5 and BW but unfortunately he say ALL germinated (in soil) and all are now knee to waist high after a mid-range healthy, bushy, nice color and of the other strains now growing, his seem to bit slow but they are coming). The BW is the most impressive of the entire group looks, it's a winner! Wish I could give a critique on the potency/taste... ask n

"My two from-seed BW's look close to done, but I'm trying to restrain myself a week earlier than I should. The upper leaves on the smaller one have now like Japanese maple leaves. Very exotic looking and very resinous, but alas s really coming around though and looks about a week and a half from harvest. Harvested around Day 60 and 61 - 2 BW from seed, each very different. 6 clones. Smaller, more resinous, very-purple girl was a low yeilder (31g from a manic and fragrant with a very up high. Such a clear, functional high, in fact, that o after only half an hour or so.

Larger plant was a better yeilder, 46g 24" topped plant with 4 dominant cola difference in looks, the high is very similar. Energized, not wiped out. All in a 6 more clones coming along with a mother under floros. May keep a bit of th

Strain: BlueBell

Strain Type: Sativa/Indica mix **Origin:** California **Breeder:** NCGA

Images:

Description:

"Early flowering will also tend to produce hermies. It is best to wait for the pl flowering it. My BlueBell is a great example of an OUTDOOR plant. I have gro do also. But they use my natural day length method or grow it outdoors. The Yet when it hit the market I got several email complaining about it being a h recommended for outdoors this problem have been reduced to zero." -ncga

Specifications:

none

Growers Comments:

"This is by far the best plant I've ever had. I grew her to about 2 feet under f 12/12 for a couple of weeks before transferring her to the HID bud room. Pla the first few days and then I noticed that my HPS light was coming on, then p back on over and over again. Bought a new bulb and the plant quit stretchin at about golf ball size the top calyxes turned dark, bright pink and the small themselves with THC glands. This happened very fast.

I had a male that looked a lot like the female BlueBell so I grew him long enc one of the branches. This seemed to make the plant respond with additional just a timing thing?). Seeds are getting very large.

Plant is extremely easy to clone. It had approximately 20 nodes and I took th small side bud with a 1/2" of stem rooted ok. They seemed to have a hard ti back into veg mode but are growing very fast now.

After a week out of town and my plant only being fed once a day, most of th gone. The frosting of THC is at ridiculous levels. Fan that was blowing on the course a little and looks like the plant tried to save itself from the heat by co thanks to over active pre harvest testing) with THC. Smoke now tastes more losing the berry like aroma.

Probably could grow the buds another 2 weeks but have a bunch of clones o

room. Seems like you can harvest this beauty a little early for the berry taste to get the hashish tasting smoke that about knocks me out on 2 hits. Smoking gives me a strong rush that lasts for a minute or so." - tokertoo

"I harvested my first "full garden" of BlueBells. Growing 12 clones in a 10 sq manicured buds. Started to clear at 36 days into flower and harvested at 45. almost white with THC and sticky as glue. I sprouted a few seeds that I made looked really weak and could not keep up with the clones." - Tokertoo

Strain: Blueberry

Strain Type: Mostly Indica **Origin:** Oregon, USA **Breeder:** D.J. Short

Images: 1 2 3 4

Description:

"Blueberry is a mostly Indica (80% Indica, 20% Sativa) strain, that dates to the 1970s under optimum conditions. A dense and stout plant with red, purple and finally lavender blue. The finished product has a very fruity aroma and taste of blueberry. It has a pleasantly euphoric high of the highest quality and is very long lasting. Medicinal has a long shelf life and stores well over a long period of time." - Dutch Passion

"Another mostly Indica plant of superior quality. This fast maturing girl produces natural occurring bluish hues. The berry taste is unmistakable and very pleasant. A treat for all connoisseurs' Cannabis menu. Pick some Blueberry and have a happy day. Sagarmatha seedbank catalog

Specifications: Flower: 6-7 weeks (45-55 days); Harvest: 2nd to 3rd week of flowering (6-8 feet); Yield: 300-325 grams per sq. metre." - Dutch Passion seed catalog

Specifications ~ Type: Indica-Sativa, indoor and outdoor. Start vegetate: 1-2 weeks. center cola. Flowering time: 45-55 days. Average height: 0.7-1 m. Yield: 300-325g. Sagarmatha seedbank catalog

Growers Comments:

"Blueberry is a mostly Indica (80% Indica, 20% Sativa) strain, that dates to the 1970s under optimum conditions. A dense and stout plant with red, purple and finally lavender blue. The finished product has a very fruity aroma and taste of blueberry. It has a pleasantly euphoric high of the highest quality and is very long lasting. Medicinal has a long shelf life and stores well over a long period of time.

"I think all the seedbank versions of blueberry originate with DJ Short, but he has improved upon it though. Also, I think blueberry is predominately a Sativa. I remember reading in an earlier CC issue that DJ incorporated Thai into it to give it more of a Sativa character.

"The name "Afghan" (indica) was assigned to the original P1 Afghan stock that was removed from its region of origin via the northwest growing community (and eventually the name "Hindu Kush" was assigned to the "Kush" looking varieties

beyond) crosses of the P1 Highland Thai (sativa)/P1 Afghan (indica), and, P1 (sativa)/ P1 Afghan (indica) crosses. The resulting F1's of the P1 cross were universal and beyond were universally diverse. Among the variance developed what came "Sweet Kush", "Berry Kush", "Blueberry Kush" (among others).

To help clarify, allow me to describe the subtle differences that I observed between the Kush and stout with wide leaves and both matured early. The leaves of the Afghan were therefore closer to the main stem giving the Afghan a leafier look. The Afghan also tended to point more upward as they developed. The Afghan had more trichomes at the bottom of the plant. The Afghan also had a very distinct "skunky-musky-color" compared to the Kush.

The Kush is the least leafy with long stemmed fan leaves that tended to droop and dense, tight-to-the-stems buds (very little if any side branching) to more light fan leaves of the Kush were slightly wider (at the leaflet center) and "rounder" became notorious as the easiest plant to manicure and trim due to the long-stems that fell off at maturity, and the trichome-drenched, fat, dense bud structure (with sweet-ripe berries). The Kush was also more colourful and sported a "sweet-musky-earthen" aroma. The name "Hindu Kush" was reinforced (and partially borrowed) from Clarke's Marijuana Botany as it seemed best to fit the description.

Therefore, "Blueberry" (et al) was selected not only from "Hindu Kush" (sweet and round) (f2 and beyond crosses) but inevitably derived from Afghan ancestry as well (the Hindu Kush region (Northeastern Himalayas) is associated with Afghanistan and Pakistan, but this has little to do with the specific names assigned to these strains). I can clarify somewhat.

The line in the strain description of Blueberry that states "we developed Blueberry added (edited in) by Dutch Passion, my European distributor, for the European Dutch Passion description for Marc's catalogue. Perhaps, at some point, I should have noted that no genetic stock outside my own material is used in the production of any of our strains. If you are interested in using pure, land-race varieties acclimated in their particular region, and if they become available, I have plenty of my own stock (much still untested) to work with in the not too-distant future." - DJ Short

"1) DJ Short is the original breeder to introduce blueberry to the commercial market.
2) there are basically two phenotypes released to the public, the first Sagarmatha. The first phenotype had thinner leaves and more blueberry flavour. The second was more vigorous, and although sweet and fruity, not quite as blueberry tasting as the first. I got the first from a direct purchase with Emery, and then from seeds from a friend from Sag.

3) Sag and DJ had a falling out, and Sag now sells DJ knockoffs. These are not the original phenotype.

4) Dutch Passion is now the European source for DJ Short genetics. These are not the original phenotype.

5) DJ Short delta 9 collection is the North American source of DJ's genetics. A phenotype with a wider leaf. They are available from several sources including Emery's cafe.

6) And yes you got it; BCGA version is a knockoff like the Sag version. But that's not the first (thinner leafed) phenotype." - Vic High

"I used Blueberry from DP with great results, albeit in soil mix. Very consistent with what I expected. Yield was less than White Widow (which I grew along with BB) was. I'm Re-vegging now and will use clones in hydro. I topped twice, but am planning

hydro. Stems appear a bit woody for cloning but I think this is a strain-specific with 4x4 results but I've seen posts where other growers didn't seem so enthralled, the cost of power and the hassle of sexing made the choice a no-brainer <

"From 8 female blueberries grown from seed 4 were boring lowdown indica strains and they put a smile on your face I like the last three and will save them for

"Buds from the two blueberry keepers are my most popular, although not most potent and sweet. It's like it actually clears your sinuses but with a sweet berry flavor doesn't attract as much attention as my other main strains." -Vic High

"I would not recommend blueberry unless you want to become an experienced grower although a quality plant, will test a beginner's ability. It's usually the first plant I'm doing something wrong. If you're a beginner, why not go with a proven success

"I would have to say to give Blueberry a shot. I received mine from BC Seeds 10 seeds. No more. Blueberry in 65 days budding time produced 1.8 Oz per s.f., highly. The strength and the taste were a 10 on 1-10 with skunk #1 being a

BCGA: Blueberry and It's Yields

"Blueberry - 10 seeds purchased from Marc Emery at Hemp BC. Reported to be mostly indica plant 2 - 3' high that mature produce large crystalized buds with natural occurring blueish hues and an un

Of the ten seeds, I got 5 males and 5 females. They all started out looking very variegated and variegation. At first I thought it was due to excessive inbreeding but later treated with colchicine. Two males and one female were precocious and went into flower on a short light cycle. These were discarded. Of the remaining 3 males, two would not shed pollen (the pollen would not drop). These were also discarded. The fifth male (BL-9) fortunately did shed pollen. It was used to pollinate select mothers. Two of the clones that didn't smell like blueberry so seeds were collected (BL-9 was father) and 10 females were what I was looking for (BL-8 & BL-10). Very robust and they produce a lot of smoke. Clones of both were kept as mothers and seeds produced with BL-9 as father. These clones mature at about 3 feet tall. with a few side branches. All defoliated for flowering plants and successive clones. They have very thick stems. The main colas are covered in crystalline oval buds. They appear to be well suited to sea of green application. Buds are bluish and purplish and smell like such sweet blueberries. The smoke is very sweet and good tasting and the high yields. These are my favorite. The smoke is very sweet and good tasting and the high yields.

Yield Trials

To date, the blueberrys have been grown to 18 to 24 inches, placed into bud and yielding about 1 to 1.5 ounces per plant. They have been grown in 5 gal grow mix. To try to figure the best pruning method, the following trial was conducted. Started with 35 clones (18 BL-8 and 17 BL-10) that were placed into 5 gal grow mix. When they reached 20 inches, 13 were placed into flower (Group A) which were pruned back to 12 inches. When these 22 clones reached about twenty inches, 10 were placed into flower (Group B) and the remaining 12 (Group C) were pruned back to 18" and placed into flower. These clones were grown amongst other clones in a 12 by 12 area lit by 2 100w fast moving suncircle. One HPS was in a horizontal reflector, one in a vertical parabolic reflector. This worked out to about 20w per sq ft.

All weights are dry weights unless otherwise specified.

Group A harvest:

Harvested main colas and then let the rest of the plant continue for a week s
out. tops = 8.52oz rest = 3.55 total = 12.07oz mean = .92oz per plant
Each plant took up 1.5 sq ft for a total of 19.5 sq ft. This means that I yielded
the plants in their natural form (no pruning).

Group B harvest

Harvested main colas and then let the rest of the plant continue for a week s
out. tops = 10.02oz rest = 9.15oz total = 19.17oz mean = 1.9oz per plant
Each plant took up 1.5 sq ft for a total of 15 sq ft. This means that by pinching
sq ft. This is a 109% increase at a cost of 2 weeks veg time.

If the entire 12 by 12 area was filled in this way, a total of $1.28 * 144 = 184.$
produced by just 3 lights. This works out to be about 3.8 lbs per light over a
efficient for a low yielding strain such as blueberry!!! Didn't even use CO2!

In order to get an idea what wet bud yields I weighed some colas after they
the stalk (just prior to hanging to dry). They weighed 46.2 oz. After drying and
weighed 10.02oz. This means that dry weight = 22% of wet weight.

Group C Harvest:

I harvested these all at once as there were no big main colas. I got a total of
oz per plant.

Each plant took up 1.5 sq ft for a total of 18 sq ft. This means that by pinching
per sq ft. This is definitely NOT the way to go." -BCGA

"Bank- Dutch Passion

Supplier- Jock

Started with 5 seeds. A cracked seed, the only damage on delivery of batch
kicked it about 4 days after sprouting. Of the 4 remaining 3 were female. The
twisted side but grew out of the awkward looking chit pretty quick.

All 4 plants were very similar in both growth and appearance prior to flowerin
had more oval shaped leaves than the others. The rest were typical indica sh
on the leaf blade serrations. Once the plants went to flower differences were
a mutually shared stink while vegging too.

Note: The male developed leaf mold and since it was the only plant of many
history. Of the three females two were keepers, for now, while the other was
1- The most prolific grower during flower with decent branching when trained
Having the most bud of these 3 isn't much of an accomplishment for any res
harvested at approximately 50 days. Buzz was slightly higher than average f
For a bud description see 2.

Note: For a reference point a typical commercial weed is considered below a
2- Was the most compact grower of the bunch with little branching. Again yi
buzz was. Buzz was better than average and was different and very promisir
done since it was only smoked a couple of times from seed. This plant finish
The short flowering time was likely due to the size of the plant, very small. It
bigger and getting more light, it was on the edge and shaded somewhat this
Buds on this and 1 look the same. White pistils and a heavy covering of resin
every node that were pretty tight considering they lived on the edge of the c
light would help this plant to pick it up in the yield department I suspect. As
on the web page.

Maybe its colorblindness or something but all that's seen is deep, dark and fl
at the buds when the light is at a certain angle they do look like they have a

reflection of the resin glands and the deep green color. Maybe as it gets older. For now if you really want blue weed: You could make believe whenever that you got it and maybe take a picture.

Note I suspect like many plants this plant will show colors outdoors if it does. 3- This plant grew well and would have had an acceptable yield except it slacked and didn't produce resin. Slack isn't even the word it's more like failed. It almost literally failed. The other 2 were nice plants this one was given a second chance before meeting the grade when grown from clone it didn't. Meet its maker it did, good. Aroma: These babies stink. They smell when they're young seedlings, veggie smell from just 2 vegging plants, 1 and 2 caused more noticeable odor than flowering NL x Shiva's.

No. They didn't smell like blueberries to me but did have something added to that has a berry quality to it. It is becoming stinkier as it ages too. For those impressed with smell this would be a winner. Max security calls for paying big for the grow with these. Except of course for 3 which doesn't smell like anything. This weed would present a packaging challenge if you need to move it for so long. Buzz: As stated the two remaining plants had better than average potency for indica types buzzing with 2 being somewhat unique with a heady floaty type they're older but I will say the buzz has some unique qualities compared to others more than likely.

Taste: Distorted by feeding. Not bad not memorable but there is something to some kind of berry taste about in the mix but we'll see.

Yield: Below average at best.

Comments: Both 1 and 2 will be kept until older and decisions will be made on them. This decision will be made on buzz and as far as 2 goes how long it takes to harvest when grown from clone it may be kept for a cross or two in a search for better.

"I hadn't planned to use Blueberry as my outside crop this year, it just sort of seemed like a plant useful outside in this climate, with some qualifications.

The seed came from Marc, and all individuals appeared to be the same. I ended up with 3 different females, but the plants were not distinguishable. The plants were really tall, loose, open bushes (until height restrictions forced cut backs). The stems were a red-purple, a nice addition to the camouflage, as the eye reads the color as blue. The leaves were a medium green, thinner than an indica, but not sativa thin. The stems were on thick purple stems, drooping gracefully.

The plant was normal in its resistance to mites, that is, not very. I did use a fungicide, the poison, but for the reproductive chemicals, and that was fairly successful. On the other hand, the plant was as mold resistant as anything I've grown. It got mold spots in the middle of October, and I pulled the plug about two weeks later as the weather turned impossible (50's, constant wet), before nature laughed at me this week.

The flowering period was amazing! The buds were purple from the get-go, with the older the plant got, the more it became purple, all the way down to the fan leaves. The buds were not sweet, rather it was skunky; mild, and not noticeable from a distance. Now, there were some problems. First, of course, it did not mature when it was supposed to. There may be many reasons why (I'm working on it), so it's too soon to tell if it was nature. In Seattle, if this plant performs as it did this year, it wouldn't work near as well as the other contenders, and was mold free almost to the end.

Second, the production. Blueberry isn't known for production, and I only cleared

manicured) from four 5 1/2 ft. tall plants, each with 10-15 main flower spikes (times), and a couple of much smaller plants with three flower spikes. That's Another two weeks probably would have added 2-3 ounces, maybe (a guess) another 3-4 ounces (gland covered only, I didn't screw around with partially Finally the high, or lack thereof. Oh, it's strong, not quite as potent as others done. But jeez Louise, the stuff is absolutely the stupidest pot I've ever smoked about two hours, and it doesn't have a nice mild letdown, like my sweet indica sleep on the letdown, but I wouldn't call it sleepy pot at all, just, duh!, stupid had different genetics, I don't know, as I haven't seen this pot described as an initial head rush, but after that, try to remember your Mom's maiden name and any kind of reasonable order.

So, what is this stuff good for? Gland hash, I'm thinking (varietal differences hash). I couldn't see smoking the pot that much. I don't like the high as much definitely isn't daytime or driving pot, no way, and it's not narcotic enough to lovely, as advertised, but so what? Aside from the great beauty of the flower don't see what the fuss is about. To the skuff machine with it." - cha cal

Strain: Flo

Strain Type: Sativa/Indica mix **Origin:** Oregon, USA **Breeder:** D.J. Short

Images: 1

Description:

"Original Flo is a Sativa/Indica cross (60% Sativa, 40% Indica) with very Sativa also matures very early. The large, tight, spear shaped buds are made up of calyxes. The plants are taller and like to branch out. Indoors the buds are full sixth week. Outdoors the plant is a super producer when multi-harvested over are ripe around the third week of September. About every ten days after that harvested through the end of November, if the plant can be kept alive that long greenhouse production. The motivational "high" produced by the "Flo" is quite Nepalese Temple Hash. A most pleasant and enjoyable experience.

Specifications:

Specifications: ~ Flower: 6-7 weeks ~ Harvest: 3rd or 4th week of Sept." -

Growers Comments:

"I've had Flo for a while now (grown a couple crops w/ her)...As for the potency all, the high is pretty clear (meaning it's not confusing or stupefying like some you want to go and do things (not like my NL cross, that's couch-lock stuff). It's not the longest lasting stone (but certainly respectable - maybe stoned for ~ but definitely worthwhile. Really unique, but not *the* most powerful stuff. The yield is way down there compared to other strains. Hope you like her as much I'd recommend this variety IF it isn't the only strain you'll be growing. I say that small calyxes in small spear-shaped buds. This is definitely my lowest-yielding unique. It really does taste like Nepalese hash. Also, the plant is beautiful to stems w/ dark green leaves. Nice smell, too, not skunky or stinky at all, it's a One of the big advantages to this strain is its primarily sativa heritage (I've h

"I've grown 4 crops of Flo. It is very difficult to clone and not very hardy. I lost 2 plants when my hydro system was shut off accidentally. All the other strain the Flo dried out beyond recovery. This is not an easy strain to work with. This is because of its fragrance and taste. I love the hashy fragrance and taste. It is in this regard. The seedlings I grew were not very uniform in this regard, which might be due to much odor. Revegging this strain takes a very long time." - potattic

"Yes it was ok but not great. the buds were pretty leafy and I didn't get very high. I like it but better is Romulan strawberry blonde surprise. Both are 50% blueberry. Mileage may vary." -BeenThereDoneThat

"Why is it so hard to get her to turn back to vegetative growth after 12/12? I "sexed" for maybe 2 weeks and then the lights were turned back to 18 hours. She flowered...she is growing new growth but calyxes are growing with the new growth." -Eric

"I have grown it and didn't like it. Yours may be different but on mine the buds were high but weak. I let it go for 70 days and it still wasn't finished so I cut anyway. Yield was about the same as princess but out of a small circle of friends nobodyz

Strain: Northern Berry

Strain Type: Indica **Origin:** British Columbia **Breeder:** Undetermined

Images:

Description:

"Blueberry crossed with Northern Lights #5. A combination only a stoned mind can appreciate." -Specifications:

Specifications: ~ Flower: 55-65 days ~ Height: 100-120 cm ~Yield: 250-300g
catalog

Growers Comments:

"NL5 x Blueberry. Got them from Emery. Potent, resinous. Under 60 days. A Kush high. Good yields. Squat, muscular vigor. My only disappointment is the coloration." -gilman

Strain: Romberry

Strain Type: Indica **Origin:** British Columbia **Breeder:** Vic High, BCGA

Images: 1

Description:

"Is a very vigorous F1 hybrid of the pure Romulan female and a select Blueberry. It gained stronger stems and fru large sticky and stinky buds of the Romulan. It gained stronger stems and fru Blueberry. Colas should become larger and more frosty than the Romulan bu This one is also very easy to clone.

Specifications:

Specifications: ~ Flowering: 55-60 days ~ Height: 90-140 cm" - BCGA cata

Growers Comments:

"Romberry has become a fav of mine in the last few grows (Thanks BCGA!) T leaves me with a warm happy glow and a stupid grin on my face. High-- 8- 8 really keeps me coming back, the Romulan taste, well, exotically sweet is th it, with the Blueberry giving a full, rich sensation to the smoke. Romberry lik organic ferts, lots of light (20 w psf. min 30 w and up is best) and at least 8 v weeks 12-12 to finish. Believe me the extra time is worth it!" - greenbear

"I grew out BCGA's Blueberry (f2) and it is a good indoor choice. Nice yeild, r Romberry." - Greenie

"Well it started with six beans via HS (Excellent Service:-) 3 females, Veg to pots BCGA "Super Soil" recipe "Bio-Blend" organic two part ferts for "Soil app 12/12, and after 50 days of 12/12, today 2 Rom ladies 404grams un-cured b resin heads cloudy under 30x mag. The height was about 23-31" tall. About . on plant in hopes of continued ripening. So each one should finish with over says volumes about the strain, Romberry is outstandingly vigorous, and is a to achieve a solid top cola 11' and 3" in diameter and as dense as any dank, lamp. But this was accomplished with a 400hps. And early quick try samples withstood a couple of abuses of rookiness, and really came through with big colas that really lend credence to the fact that this strain does not need vast impressive colas. I guess that my extreme-joy is in the fact that I read "Don't First grow" and I took it to heart, and the Roms surprised me (Thanks to a lot here and at BCGA's board) cause I have four main colas between 46-79gram photograph, they are really impressive." - Budm

"Well if I had to use flouros, Id go with Romberry, it produces very dense tigh per sq. ft. The breeder Vic High, in trying to make a guess on Romulan's heri objectives, has posted that he feels that it had its roots in California back wh guesses its a Blue Indica, and was breed to do well under flouros, and it still situations." - Budm

"Ended up with 1 Sage, 2 GWS, 2 Cinder, 1 blueberry, and 2 Roms. Actually, had "sexual problems". No big deal. Watch your Roms--and look for females keep in mind that I like to veg for a long time--2 months min. This time I let t wouldn't have done it if I didn't have those pH/slow growing problems--but e Each plant yielded 1-2 oz. each. Not bad for a tiny closet. Hell, that's enough

Comments: Romberry's a peach. What a nice high--ya can't get that grin off as the cure progresses." - shaggy

Strain: Shishkeberry**Strain Type:** Indica **Origin:** British Columbia **Breeder:** Breeder Steve**Images:** 1**Description:**

"The heavy early. Large production mother (mostly Afghani) crossed with a g
flavor. Frosty leaves produce exceptional screening dreams. F1 to Shiske mo

Specifications:

Flowering Period: 6 Weeks Outdoors: Early Oct. Yield: Huge (up to 3lb per lig

Growers Comments:

"I've grown the shishke topped and cola style on two occasions and would sa
with tighter spacing and no topping. When I topped shishke at the 5th-6th no
The best yields I've seen with that plant were in a friends garden at 4 per sq
branches pruned, it produced very solid foot long colas in a 2 foot garden. Pr
experience gives better growth to everything above them wait a few weeks
a good idea of which ones to clip." - Shiva

"I was impressed with the quality and the amount of resin. Yield was pretty g
my stupid girl partner killed my best shisk mother). Flowering time was 40 d
How did yours compare. My high was of the deep hit you with a hammer bur
much blueberry influence though." -The Chronic

"I just harvested 3 HUGE Shiskeberries grown outdoors (ask sly about them).
out approx. the same amount of finished product. The biggest one had the h
smallest one's ratio was reversed and the 3 made up 1.9 lbs. total of dry, ma
(still 5.5' tall) having the biggest colas (2 14-18" beer can size colas from a c
biggest (just under 11'tall w/o pinching) having a large assortment of "branc
cola...and of course the middle one fell in between (also unpinched). Good b
out there imho. Too much waste overall in my experience with it compared t
trim-work to make them look nice. But it is a pretty plant that's fun to watch
last winter indoors (finished outdoors) that never got to the size/quantity/qu
only got 1 f out of 5 with the indoor and 3 f's out of 5 with the outdoor grow
all 10 did germinate in just the simple "finger poke in the soil" method. Btw,
HBC in person." -m.g.

"I received an order of Shiskeberry from Laughing Moon some time ago. The
very hashy almost mocha smell. So far no purple, but two of them have a ve
upon pictures of Blueberry I have seen, but with a definite Afghani influence.
Shiskeberry is the smell. It is very strong and although not entirely distinguis
make me paranoid about someone catching a whiff of it outside." Duke of He

"On Shishkeberry: I just finished up the Shiskaberry and I have a few notes o
friend made my seeds; parents were Breeder Steve's seeds. The notes below

Shiskaberrys that I have tested. With further testing I will find the definitive 9
Aroma - The smell put a smile on a friends face tonight when I pulled out da'
smell a thing. Allergies are a killin' and ka ain't a smellin'. A bunch of Shisks
them.

Buzz- The first time I smoked some Shiskaberry yesterday it really didn't sto
:) A few hits on the way to school were a few too many, it hit and I became u
and I finished off two bowls and it was quite the experience. Fair amount of v
which lead to tears and falling on floor. Totally a fun indica. I place it a little b
level, but still above average. I'd put the Shisk in the social indica category, v
unsociable side. I did have to pull myself from the couch also.

Taste- Taste is mostly hashy. Expando in the lung is nice, exhale is smooth a
sweetness/berryness aftertaste. Taste is good, this sample I would put taste
what kind of differences there are in the mums.

Yield- While there were some runts in the group, most of the plants ended up
started tight but eventually spaced at 1/ft2. Two or three a sq. ft would have
fattest buds with the top yielder being a topped Shisk. Yield would be well ak
considering flowering time, which ran me 49 days. For comparison the Shisk
nlxshiva next to it.

Bud appearance- Buds look silver because they are so covered in crystals. H
remain are dark. Buds look great, in this reviewer's humble opinion. Bud den

General notes- Shiskaberry is freaking leafy and takes tons of time to manic
There is so much resin on leaves including fan leaves that screening is a pos
Shisks were around 80 days old from seed and were done quickly in search o
drying has finished I'll offer up some weight numbers. Plants sizes were from

"I'm on my 4th crop of Shishkeberry. I've grown topped and untopped. I wou
internode. Depending on how much room (height) you have. Clip lowest 2 si
normally not make it to the top of the canopy and won't produce good flower
will have from 8 to 12 colas per plant. The plant will finish between 2.5 and 3
growing 2 plants per container and its too crowded. Because Shishke is so bi
more than 1 plant per sq. foot." - Shishke

"Shishkeberry did great in the desert. very stony, stupor inducing indica with
during flowering...so use caution where ya plant it. it's as easy to grow as an
stiff branches/trunk so hard to train during veg w/o breaking stems. not terri
suggest it be grown at 45-60 degree angle from start if finish plant-height is
large "beer-can-cola" (among the best buds I've ever seen) buds on main ste
producing...so I'd say above avg. yield too. IOW, I would never kick her out o
degrees latitude +/- with long, hot season but Shishke finished around end o
correctly. it did finish before the majority, at any rate." - m.g.

Strain: StoneBlue

Strain Type: Indica **Origin:** California **Breeder:** NCGA

Images:

Description:

none

Specifications:

none

Growers Comments:

"More information on StoneBlue: Day 37 of 12/12- Very uniform hybrid, indica sub-phenotypes. More resin at this point than nc5a or blueberry; the individual buds are very profuse. The smell is very similar to blueberry and nc5a. Appears that the aroma is much better in blueberry. Sample tokes at this time produce quite a strong physical effect, but not a strong indica stone. I expect flowering to be in the 60-day range. Some fan leaf curling appears normal as all other parameters are in order. Yield estimated from visual inspection looks much better than the other two strains. StoneBlue has very good lateral branching. Of 5 seedlings I ended up with 4 females. This plant will need more time to reach sexual maturity, at week six of veg the nodes had just begun to alternate." -

Strain: **Two Blue**

Strain Type: Mostly Indica **Origin:** California **Breeder:** NCGA

Images:

Description:

none

Specifications:

none

Growers Comments:

"Two Blue (F2 Blue Widow) from HS - Have 3 females in day 23 of flowering. They are very different in shape (1 is tall and lanky - me no like, 1 is short and stout but very short, stout, bushy and bud crazy - mmmm, me likey. Hope to pollinate 1 branch for seeds. Will let you know in about 30 to 45 days re: buzz and taste. Two Blue, variables." - Air Cooled

Family: Central and South American

Strain: **Colombian Widow**

Strain Type: Mostly Sativa **Origin:** **Breeder:**

Images:

Description:

Colombian x White Widow

Specifications:

8-10 weeks bloom period

Growers Comments:

"Colombian Widow is a cross of Greenhouse's WW and a skunky two hit Colo was chosen for its robust growth, relatively short flowering time for a tropical two hit lady with a piney aftertaste. She is crossed with a WW male with good branched, sticky Colombian with an intense mind bending high. The plants are ideal for scrog. In fact have several under the screen now and I would say it's long branches through the screen. Expect buds to really begin putting on the finishing. It can get big so I flower at 12-15" no more. If you are not scrogging should easily get multiple colas." - Santa Marta

Family: Durban Strains

Strain: **Durban Thai x Cinderella 99**

Strain Type: Sativa **Origin:** Holland/USA **Breeder:** Mr. Soul, Brothers Grimm

Images:

Description:

"The Super Sativa Seed Club (SSSC) bred a Thai strain for four generations to cultivation. SSSC's famous Durban Poison male was used to pollinate a particular fourth generation. The hybrid was called "Durban Thai Highflier" by SSSC is for Cannabis "Old-timers". They exhibited the best genes from both sides of the remaining reasonably compact due to the Durban's influence. True Thai weed with the Durban, the hybrid took on a taste distinctly like black licorice. Bros particularly early-maturing female SSSC Durban Thai with a Cinderella 99 male now available. Expect a hybrid that is heavily Sativa-dominant, yet suited to Seeds catalog

Specifications:

Flowering: 60 days.

Outdoor Harvest: Late September

Height: Indoors, under 4 feet. Outdoors, up to 10 ft.

Yield: Indoors, 2 ounce/plant. Outdoors, 1/2+ lb./plant.

Growers Comments:

none

Family: Hawaiian Strains

Strain: **Black Hawaiian**

Strain Type: not listed **Origin:** not listed **Breeder:** Undetermined

Images:

Description:

"These buds are very compressed with many seed husks. They are a deep a brown from a distance and are sparsely covered with brown hairs. The scent chemical and a very little green. Since the Hawaiian comes from a long dista greatly altered from its travels. It seems to have had many crystals, and its c its shipping. When smoked this bud tastes very full, almost meaty (BBQ) with The smoke is not particularly expansive but is very harsh because the buds l The high comes on very quickly and is very stony and will leave you dazed. I have received an even higher mark. ****1/4" – Homepage Amsterdam

Specifications:

none

Growers Comments:

none

Strain: **Cotton Candy**

Strain Type: Sativa/Indica mix **Origin:** Hawaii/Canada **Breeder:** Federatic

Images:

Description:

An old Island strain that comes out of Afghani and Blueberry seedlines. Long thick and sweet with a pinkishhue after 8 weeks. Odiferous flowers with inte deep green colour on upper leaf surfaces, but the underside of the leaves ar white with crystal at maturity. Recommended by my carny friend "Resin Ren

Specifications:

Height 7 feet Flowering time 8 wks.

Veg 1 wk for sea of green. Yield 9oz full size. 1oz ina 2 gal. pot. Harvest outd

Growers Comments:

none

Strain: Hawaiian Indica**Strain Type:** Sativa/Indica mix **Origin:** Hawaii/Holland **Breeder:** Sensi Seeds**Images:****Description:****Specifications:****Growers Comments:**

Medical: Spasticity and pain

"The Hawaiian Indica by Sensi (and that is the Hawaiian used in the excellent Hawaiian, as well as the Classics Hawaiian Indica, Hawaiian/Kush) is like a strain that I can identify more readily than any other strain of the fat cola bud type, where the buds, (usually white), are wide round buds, offering great dreamy high yields. Hawaiians indicas, somewhat like Thai indicas/ especially sativas, done in a proven environment of conscientious grow room care should be the phase you want to experience. A Hawaiian Indica really adds flesh to small yielding indicas (I have crossed Hawaiian Indica, I think that might have profound benefits and influence on the experience, are good medicine for the spasticity and pain ailments also. Hawaiian Indica used to be more popular 10 years ago, when there was more marijuana shipped off outside of Hawaii. With the severity of the Marijuana Extermination Act, outdoor is simply not found outside of the former Sandwich Islands these days.

"Lighting was a 50/50 mix of 1000w MH and HPS. The plants were grown in soil before planting. The plants started out under 40w fluorescent light in 16 weeks, then transplanted to 2 gallon pots under the MH and HPS. Plants were then the lights were turned back to 12/12. After the females were identified, they were moved to 2 gallon pots. No CO2 was used. The seeds were Sensi Seeds products purchased from Sensi Seeds. Two packs of seeds were also used for the Hawaiian. The germination rate for the Hawaiian was quite good. The branching for this strain was quite a bit more "vertical" with much less bushiness. Some were mostly a dominant main cola. I think this strain may be well suited for indoor growing. These plants were also subject to mold. Of the 12 best, finished heights are 47 inches for the tallest, with the average at 52 1/4. Dry, manicured weights are an average 48.6g. The flavor of this strain is a bit citrus. Some of the bud has a little bit of the smoke. A good up high, but I have to smoke a little more of it than most people like. Many of these showed some hermie traits, like growing anthers on stalks, but there were no seeds from these hermies, so no harm, no foul." - High Dog

Strain: Hawaiian Indica x Skunk #1**Strain Type:** Mostly Indica **Origin:** Hawaii/Holland **Breeder:** Positronics**Images:****Description:**

F-1 hybrid Sativa/Indica: mostly Indica Appearance: very wide and resinous buds
Smell/taste: musky hash smell Type high/strength: strong, physical Height: 10-12ft
date (Netherlands natural photoperiod): end Oct 12hr day exposure harvest

greenhouse A full, round, beachball-shaped plant” – Positronics catalog

Specifications:

Height: 1.5m Yield: medium plus Harvest date (Netherlands natural photoperiod)
harvest (# of weeks): 9-12 indoor / greenhouse – Positronics catalog

Growers Comments:

none

Strain: Hawaiian/Skunk

Strain Type: Mostly Indica **Origin:** Hawaii/Holland **Breeder:** Dutch Passion

Images:

Description:

“Mostly Indica (F1 hybrid) with exceptionally broad leaves. Lots of resin on leaves.
musky hash like aroma. Strong physical high. Yields are above average. Short
Specifications:

Specifications: ~ Flower: 9-12 weeks ~ Harvest: end of Oct.” – Dutch Passion

Growers Comments:

none

Strain: NL#5 X Hawaiian

Strain Type: Sativa/Indica mix **Origin:** British Columbia **Breeder:** Undetermined

Images:

Description:

none

Specifications:

none

Growers Comments:

“I am about 10 days from harvesting NL#5 and NL#5xHawaiian right now. They should
be a good ScrOG strain. It is very vigorous, very bushy, and has branches that are
rigid). I was thinking of doing this myself.

I got these from Richies but noticed that they started cracking open after being
weeks. 5 out of 12 cracked open and had to send these to my sister (she had
noticed that there were a high percentage of mutants. These seem to have a
same node. Looks like a cabbage. I got one mutant of the 4 seeds I started with
a mutant now (she got all mutants - the cracked open seeds?).

Of the 3 normal females, 2 are average and one is outstanding. The outstanding
and has 4 colas about 18" long each. These are really packing on the weight
amazing. I pruned all the lower branches and leaves before flowering but this

Everywhere you look is bud. Even the lower buds that don't get much light as the upper bud but I'm sure it will be tasty).

I noticed what seemed to be a male flower on one of the "normal" females and it was a male flower because it had a stem. I noticed the same thing on the other and it turned out to be a female flower "with a stem!".

I hung the pulled plant to dry for about a week and started smoking it (had no cure). It was the best tasting bud I've smoked in my 25 years of smoking herb. It is very fruity and had the sweet fruity flavour. The buzz was really nice, fairly strong, but only a little (and no cure). Really looking forward to trying the finished (and cured) product. This strain for ScrOG although if I were to order these seeds again I would not get

"Completely covered in brick-red hairs, this dark green bud has a nice thick layer of trichomes. It smells candy-sweet and lightly fruity. It looks and smells like a Sativa, but glances like an indica. When smoked, the bud tastes fruity and sweet too, but smells very indica-like."
***1/2" - Homepage Amsterdam

Family: Haze Strains

Strain: **Haze #1**

Strain Type: Mostly Sativa **Origin:** California/Holland **Breeder:** Undetermined

Images:

Description:

none

Specifications:

none

Growers Comments:

*** 3/4- These buds are made up of nug clusters that are entirely coated in trichomes. The leaves within the bud are a much darker green. There are long red hairs everywhere. It has a perfumy-organic scent and is tacky when broken up. The stems also taste like a different spicy and tangy taste. The high is quick, very stony and visual but can be a bit overwhelming. You may want to concentrate when/if necessary. (from reviewers in Adam)

Strain: **Haze #19**

Strain Type: Mostly Sativa **Origin:** California/Holland **Breeder:** Positronics

Images:

Description:

none

Specifications:

none

Growers Comments:

"Haze seeds were bought from Martijn, the heir apparent to Werner's gene "haze" was said to be a descendant of the legendary cutting "rescued" by Ne decided to take a chance.

Germination on Haze was poor (6 out of 10), not surprising as seeds looked a showed female, no hermaphroditic tendencies detected.

Phenotype was a surprise (even when Martijn said that this "haze" was of the a short node, short flowering indica for manageability), quite indica dominant medium-width short fingers, very light green, overall kind of "tender" looking variations in nutrient availability, short plant with sparse foliage.

The female that was selected for cloning was VERY short, very OILY and with cellophane and grapes (imagine simultaneously smelling the clear plastic co concord grape juice, and you'll have a close idea). High was intense, UP, head (never over indulged it though, to avoid possible paranoia).

Not a tremendous yield, averaging 1 oz for each 2.5 feet finished clone (clone dense but not fluffy either, under two 400 MHs., in a soil recipe closely reser Miracle Grow (vegetative) and Peters (flowering) in the fertilizer dept. The reference to #19 in this case is just the number this particular Haze see #19", no connection to Peak #19. The original Haze cutting (according to Ma to develop a seedline it had to be crossed with some male and reportedly to

This "Haze #19" plant is definitely NOT what you would expect phenotype-w hand the high is trippy and has almost NO body, the color of the leaves is pa (fruity when growing, spicy "Vicks vapo rub" when cured), it is finicky about i goes yellow)... all traits that one does not associate with Indica.

Not a "wonder" plant, I would rate it 7.5 overall, but its a compact plant, sho you still get a sativa-style of high with an agreeable, non-skunky taste. Good and flowering time, with a respectable high." -Adam Tripper

Strain: Haze Skunk

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seeds

Images:

Description:

"Winner of the fifth annual "High Times" Cannabis Cup by Dutch Passion. Ori strain. It is crossed with Skunk#1 to get a bigger yield, a softer taste and a s superior sweet taste. The high is incredibly clear and up energy. A very favor high yield for an almost 100% Sativa variety. Flowering period: 10-12 weeks end of Dec. Really tasty strong plant, indoor, 8 weeks." - Dutch Passion cata

Specifications:

Flowering period: 10-12 weeks Harvest time under natural light: end of Dec.

weeks." - Dutch Passion catalog

Growers Comments:

"I'm not sure how close the genetics are, but I recently did some haze x skunk had was-lots of hermies, only one true male out of 10 seeds, 4 real females, to mainly indica--yield low, taste sweet, sweet, sweet. High up, very potent. cola tops 3.5 ft plant with 2 weeks veg, and 8 weeks to mature. I had one of producing more resin than white widow growing with it but the high from this probably won't keep the strain long but I'm not sorry I grew it either." -stix

"I tried Haze skunk from clones. when flowered at 6-10 inches they ended up A pure thai i had ended up at about 5 feet when flowered from clones and cc

I just finished a couple of crops of this strain from Dutch Passion. Its a very s but sweeter) and if you get a good mother it can be pretty potent. Out of ten 5 females with one keeper (makes me wonder about the breeding). Its pretty if I have to keep moving while stoned. It is a very clear energetic high. Fairly very highly (I like more body in the high) although I enjoy smoking it." - Stix

"I'm not sure how close the genetics are (to Positronics), but I recently did so Passion. What I had was lots of hermies, only one true male out of 10 seeds, from sativa type to mainly indica -yield low, taste sweet, sweet, sweet. High sativa type, small cola tops 3.5 ft plant with 2 weeks veg, 8 weeks to mature was impressive, producing more resin than white widow growing with it but t intense tho. I probably wont keep strain long but I'm not sorry I grew it eithe

"Some DP strains are in the big leagues, they just aren't superstars. I present Haze/skunk that I really enjoy and smoke a lot, but from most standpoints se beat it on all points -Potency, yield, stability, etc. We aren't saying they are l yourself a favor and try one of the strains from the other companies." - Stix

"The NL5 x Haze has an unusual leathery or sandalwood taste, a VERY expar inhale it, it just keeps expanding in the lungs). The high from some peoples r I get so stoned on it I cant get up and move, dont know if it is difference in r friends who are heavy duty smokers who cant take more than a few hits of M the other hand is not an extremely potent smoke in the same way -its plenty the NL5xHaze is. The taste is much sweeter, but like most skunk strains, it b of it. Another curious thing about the NL5 x Haze, the high lasts for me about about the normal two. If you choose the NL5 x Haze, grow a less potent varie smoking, the NL5 x Haze is so potent it bums me out if I smoke it all day." - :

"The skunk x haze is a relative compact plant that looks really great. Its abou very nicely branched conically like a Christmas tree. The flowers seem to be internode) and the odor is very nice. Less pungent than skunk, but I doubt if seems to be a lot of skunk in it. It reacts relatively fast to a change in light re first flowers appeared." - Smurf

Strain: Haze Strains**Strain Type:** Sativa **Origin:** California, USA **Breeder:** Nevil**Images:** 1 2**Description:**

"Haze is a late sativa from America, widely agreed by experts to be the best the 70's, it nearly became extinct in recent years as growers switched to easier to grow strains. We have salvaged a few viable seeds from the last crop grown in America and we have bred some remarkable hybrids. Haze is known for an extreme, almost psychedelic space high and deep with a dry flowery perfume over a base of dark leathery animal tones. It has fascinating notes of depth and complexity to the taste, as well as a unique appeal to everyone, the most jaded connoisseur will often find haze irresistible". -The

Specifications:

none

Growers Comments:

"Regarding ...Haze, Ed Rosenthal says he knows (it was) developed by Cultivator in the 70's"

"Haze is the most difficult and challenging of any strain, perhaps Thai sativa. In a recent interview Ben Dronkers said a true Haze takes 8 months to flower! It's very pale, never dark. A seeded Haze takes upwards of 16 - 20 weeks for good seed. I would say even paranoid. In fact, I have reservations about recommending Haze due to its irregular behavior in some of its regulars. I think Haze is extremely powerful because it plays to deep emotions is what I have observed. That said, it also often a cross with Haze imparts the Haze flowering time and modest yield but it's very high. Ideal crosses would see the Haze stone with a quicker delivery, but in reality it's not. It indicates well, it's better suited to a sativa, whether that be a Skunk (as in Super Skunk) or the sativa high of a Durban, Hawaiian Sativa, Sensi Skunk, Joker's Haze/Skunk strain). I must say Willy Jack is busy trying to find the perfect Haze cross, as are Domina, Big Bud, Jack Herer, Early Girl, Hindu Kush, William's Wonder, and many others. To find the perfect cross, maybe take the 'edge' off the Haze as well as the dark tones. - Marc Emery

"Good luck finding pure haze, I sure didn't get it. My success was planting 6 Jock, kept them in the fridge until germ, and got a 50% germination rate. Of these, one was a beautiful male, with a sativa/indica profile, but nice internode lengths, medium yield, heavily serrated. Collected the pollen.... The other two turned out hermie like the others, its pollen on some others, the other which a few days before harvest started to drop pollen parts in the midst of the female flowers. The calyxes were very purple as we had them wide, dark green bud leaves - very indica looking. No pollen released on this one.

Am I disappointed? You bet. Had visions of pollinating a real, pure, sativa haze. After reading everything I've read, haze has been bastardized by the Dutch, it's no longer what it once was. Getting until you've "groaned" it out.

Being a little cynical, I don't think I'm going to order from overseas anymore.

another grower got from Homegrown Fantaseeds was very afghan like. Hear Passion and Homegrown are all affiliated, so, if I were ordering from of these "same" strain, I would go with the best price. Homegrown is able to up its price some of its stock at the Cup. This kind of crap will eventually hurt the Dutch growers, a big negative as far as I'm concerned. Think their interest lies in promoting rotten genotypes. If I am paying \$4 to \$25 a seed, I want a first class product some flowery ads. Unfortunately we can't turn to the BBB to claim.

Be sure to ask your distributor if he will guarantee his stock as the real deal.

"I know which one not to buy. I grew Homegrown Fantaseed's Haze and it has looks to be a Haze/indica F1 with the indica being very dominant in the high. that may or may not be worth growing out. In closing, don't bother with this

"I have tried HGF's Haze. It most certainly is not the real deal. There is a lot of indica if there is any real original Haze in it at all or if they just called it Haze for sale easily and even had a great pineapple smell. The potency on the other hand is low or otherwise. Don't do it." -RedDevil

Strain: Haze X Northern Lights

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Nevil

Images: 1

Description:

"1988 Catalog the Seed Bank introduced a Haze X NL #1 hybrid. In 1989 the Sensi Seed Bank offers NL#5 X Haze. I do not know if the listing of Haze in the listing today of NL#5 first in the "Name" has any real bearing on the formulation that the 88 version and the 89 version were indeed different.

Specifications:

none

Growers Comments:

88 version (Haze X NL#1) states 'Haze X Northern lights has been the most popular of our favorite smoke. It is a bit stretchy and difficult to grow but well worth it".

1989 version: "Due to tremendous customer demand, we have spent years searching for an Indica hybrid that is suited for indoor growing but still retains the unique sativa character. The Haze X NL#5 hybrid is the result of this search. A note of warning: Adverse effects have been reported in inexperienced smokers, particularly when combined with alcohol. Side effects include dizziness, fainting and loss of bowel and bladder control. Extreme introspective behavior has also been reported.

"One item that may be of interest is that in the 1988 Catalog the Seed Bank introduced Haze X NL #1. In 1989 they introduced Haze X NL #5. Today the Sensi Seed Bank offers NL #5. The listing of Haze first in the "Name" as opposed to the listing today of NL#5 first in the "Name" has any real bearing on the formulation of this cross. I do know that the 88 version and the 89 version were indeed different.

different.

"I grew that strain in '89 and your right, one of the wildest highs I have ever have been almost an inch long when they were fresh. It took 4 months for th it after the first stone." -Lady J

"Your main problem will be getting any real original haze I don't think its ava to sell it were positronics there stock went to Dutch passion and I think they modified by them as they state a finish time of 9 to 10 weeks to suit the hur least 14 weeks and the best ones 16 to 18 weeks."-Oldtimer1

Strain: Haze#19 x Skunk#1

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Positronics

Images:

Description:

none

Specifications:

none

Growers Comments:

"I would strongly suspect that this hybrid, despite it being carried by Dutch F and Positronics, originates in a single breeding operation (same exact genes three seed companies have been consolidated under one owner. Which help companies claim the hybrid has won a Cannabis Cup prize 'for them'. "

"Hehe... sounds like a strong sativa. I have a Haze19Xskunk#1 (positronics) 'heart racing' feeling. This bud keeps me wide awake. Zero to LSD in two tok those wishing to grow killer sativa outside and have it mature. I grew Haze # plants start flowering after 3 months regardless of day length. I have no exp Mike at TAC and he said that this is common with Haze #19 which is very va of daylight and my Haze has been flowering for two months. It is typical Haze experienced to grow it properly unless you have a good location. The reason spindly and it also grows very fast." - Dynamite

"I grew a haze19 X skunk#1 strain I got from jock, and enjoyed growing this delicious in odor ... sugary & citrus. The high from the buds is strong! The pl days. The scissor hash was incredible. With the 2 out of 10 ten females I gre the strain corral. The yields weren't too good with this plant. I'm very happy had some totally meditative smoking sessions with the shishkeberry ... detai relaxing, ahh! that's my kinda' weed. Good luck with the haze X skunk... if yo a great strain. I let my haze X skunk plant go, but I crossed it with a shishk n hybrid ..." -Shiva

"Bank: Positronics

Supplier: Jock

Started with 10 seeds, all 10 germinated and sprouted. Had 6 females and 4 practically identical. They grew and looked like clones from the same Ma and

kept after indicating sex, probably a mistake. This variety was a pleasant surprise, what a buzz.

Of the 6 females 5 of them were just about identical in growth both during vegetative and flowering somewhere between the indica dark and sativa light green with midsize width. The one that showed its differences during flowering. While the majority had bud covering nuggets at the nodes, thick tight ones.

Because they were so similar in growth just three were kept to be grown from their mothers though. As a matter of fact if you had to or wanted to do a seed crop now these would be a better choice than even my favorite the NL x Shiva because they are also from Posi

5- This one was the highest of the yielders and came in third in buzz with the others in the distant third just third. The plant matured in approximately 8 weeks. This may be based on what has been seen so far.

6- This baby was the lowest of the yielders but came in a strong second in buzz with the others in approximately 8 weeks.

10- This was the rebel of the bunch. Difference in growth weren't that noticeable but it showed its colors during flowering. The others had bud formation up and down the stem with chunky buds at every node. This made for a longer manicure but it was worth it. The buzz at this time by a noticeable margin. It's probably the best weed in the stable at this time. This was an 8 to 9 week baby. It's at the very least good enough for a high school champ Top 44 and NxS right now.

Aroma: Kind of a slight skunky smell on the sweet side. Nothing offensive nor too strong. Double bag when carrying stink without doubt.

Buzz Well above average. Ah what the heck.

This chit is nice.

Semi couch-lock with a kick is the best I can do. Not couch lock but could be, edge plus it creeps up on ya. You get a buzz and feel like that's it, next thing you're smiling 61514 At this early age the buzz is in the same class as the old ones and NL x Shiva. Imagination knows how the buzz will be when the plants are mature. The oddball - 10 with the superior buzz has more of an edge and leans towards the other two. The weed already has a nickname- Sunshine Weed; the buzz is better because the edge is taken off some with the sun beating on ya bean and it is a good. Can't be explained you'll have to do it.

One last note.. This weed rings some bells from days gone by?

Taste: Distorted by feeding- nothing to write about nothing to bitch about. Good. Yield 5 has production potential and was kept for that reason. The yield from

As a whole taking all plants into consideration yield was better than average getting much better with time and choice of method used to grow em. Good

Comments: The day this is puffed when it's older will be a great day I'm sure compares to the rest of the stable. If it gets just a tad bit better in the buzz could be the new stone champ without doubt. It could be already NL x Shiva is dusting

Strain: Neville's Haze

Strain Type: Mostly Sativa **Origin:** California/Holland **Breeder:** Nevil Schoon

Images:

Description:

"Pedigree: Almost pure Haze with just a hint of Indica (Northern Lights). Stre its kind on or off the market. Not recommended for inexperienced smokers -

Specifications:

Flowering Times: Indoors: should be started under 12 hours of lights. The ea (25%). Those that take much longer than this are usually discarded as not pr grown in the Tropics + started just before the on set of autumn. Yields are su flowering time is usually compensated with extra large yields, both in and ou or grower." -Greenhouse Seeds catalog

Growers Comments:

"The plants are still in early flowering. They were started Feb 23 under a 400 dark schedule. After that, light period was slowly decreased for two weeks, a 12/12 and flowered(about March 10). Sometime in late March or early April (went dead! Fortunately, the weather had warmed up so that I could take the and inside under a bank of florescents for some hours after that. Now, it's wa for 11 hours each day. I selected two females and one male which had the p discarded(gave away)all the rest. From the first, these seedlings had extrem female had very drooping leaves to boot. It was my intention to let the male seeds. Well, they've been in flowering about 6 weeks now, but stretching is j expecting another 8 or more weeks till finish. It was a mistake to flower then ft., but I did take clones from the females which I'll veg to 7 in., and those sh they're flowered. As I said, the ones I selected appear to be pure haze with n ones I let go were about a third NL, but these are pure! At least, for outward traits as well. Leaves are the longest and most slender that I've ever seen! Y top bud site looks like a small marble on top of a two foot pole. I don't know, yield would be on an unseeded, sinsemilla plant. I'm pretty sure that a five ft Grown in the tropics, this strain would easily get to 20 ft., and have an enorm definitely not suitable for SOG. But, if you're like me, you'd rather have a littl of some other."

Strain: Northern Lights #5 X Haze

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Nevil Schoenbot

Images: 1

Description:

"This hybrid is the pinnacle of achievement in Cannabis breeding today. The with a great Sativa high. In the 1994 harvest festival this variety was miles a yields compensate for the slightly longer flowering period. Hybrid vigour pro formation and abundant resin. A true champion!

Specifications:

Flowering: 65-75 days / 11 weeks Height: 150-180 cm. Yield: up to 150 gr." - description

Growers Comments:

"Big plant with big leaves. Light green. It will grow to 15 feet tall outdoors. Very sweet. An extremely sweet smell. A unique and high quality stone. Flowering: 9-10 weeks. See Richie's catalog description

"It is the "ultimate". Can do a wake-and-bake without turning into a couch potato. Stretches like a sativa. But gets plenty of crystals. Hash made from those crystals is a supply ... uh I forgot what I was going to say. Anyway, it's goood. And, it's potent. It can put them away like when you eat too much. Trip to the hospital, etc. -- not of mine. (It created diabetes complications. Extreme hypoglycemia. So make your own nutrition bars from your obnoxious network marketing friends, drink lots of water, be well prepared. Your brain cells are going to be going on a rocket trip ... they need to be. You go shopping under the influence of this stuff you'll spend too much money. I suggest the NL5xHaze. Heavy yielder, great sativa buzz however it does take a while to wait if its for your head." - Root

"A-1 I got some of those seed from Nevil in 88 and I've seen it make many effects. Euphoria, things-throw up, anxiety attacks-honest to goodness. I just recieved an order from Sensi. cant wait to compare it. I think Nevils seeds from the old Seed Bank days were the best.

"The haze/nl5 I had was the most visual, near acid-like high I have ever had. It was every nailbiting day of it (imo). You will also be pleasantly surprised with the potency. The dominant in that hybrid judging by the high. The NL just keeps the flowering time from anything. They didn't call Nevil "the king" for nothing... I had one plant stretch that was is something completely different from most sativas. When Nevil released the pure NL5 AND pure Haze both of which he found in the States." - Lady J.

"Was it you that had experience with NLxHaze? I now have two from Sensi that are in the flowering closet. They have almost taken over. My question is are these girls are causing. If not I am thinking of ripping them out now. It is really running rampant. Here's to hoping it is all you say. I will tough it out. I had a similar problem with Sensi. These did not preflower.They full on began to flower at about 6-7 weeks.When they would continue, I moved them into the flowering area. After a decent harvest about 5-6 weeks they began to flower automatically AGAIN. I have bred these plants just begun to break soil. I'll just go with the flow and play jr.scientist trying to breed a new genetic. It was great and worth the money but still not the best I ever had... I would have been a little better. The buzz was powerful and very up heady, a little disoriented. The taste was unique kind of a lime flavor with a fruity-tooty hint. mellow burn. excellent yield. jamacia. slow-slow-slow grower and quite pricey for the seed bank seeds. I need to wait. I waited longer and dried longer. I still have 5 seeds left and 4 clones so I am not sure of the technique. but it will be a long time for 2nd set of results. would I recommend Sensi funds or for the impatient grower. I love the taste though and the buzz... awesome.

"Remember how my NL5xHaze budded on auto? Well the harvest was somewhat heavy. It was damned stoney. At about 6 weeks reveg the plants went on autobud again. Went.Larger this time." - sb

"Being a big fan of this original cross by Nevil of The Seed Bank, I've been with Sensi's version of it. The original was the most potent, devastating high I've ever had.

The best plants leaned to the indica side in her traits, finish was longish but buds. Sensi's version today, however, doesn't come close to the original in buds, potency at best average, and I've honestly lost track how long they've been females not finished yet. I don't really think any of the females(9) I got from them to say the least I'm very disappointed, since I have recommended this strain. Successful growers of this strain use a mega amount of light since mine is only 1600w. I had to turn to be unlucky with the females in my order, but I'd never recommend them. It makes the memories better, but I swear the strains from 85-90 from SSSC are much better than most of what we get today, or am I getting old? It seems the hybrid era were much more vigorous than crosses today." -stix

"This hydro is light green with scarce long, red hairs and very crystalline buds. It has a sweet green scent, characteristic to Northern Lights. The buds are surprising. Smoked, the buds are smooth but very expansive in the lungs and will certainly have a mild overall bouquet if not a bit bland. The high comes on quickly but it's a bit spacey. *** 1/4" - Homepage Amsterdam

"As for the NL5xhaze, I tried it both on a table with 40+ watts/s.f. and in a 1000w tent with 30 watts/s.f. Using GH nutes with fox farm and EJ Catalyst in both systems. Males and females were moved to trays but a couple stayed short enough and bloomed pretty loose as could be. Ones in trays were more sativa and finished about 6 feet and had better-looking buds, though still loose. They are covered with resin. More light perhaps the sole reason my results weren't as good as your own. Air turnover is not as disappointed since I've sampled them since they've matured, the early ones all-I think they were worth the effort cause they do express the haze pretty well. A treat." - stix

"I have a few NL#5 Haze that I have just harvested, I was really happy with the buds, minimal stretching. and mine was from Mike, straight from Sensi. Mine were half-foot, they yielded pretty well as well. I bent them over and it increased the yield."

"I've just finished growing out ten NL#5 x Haze females. Firstly the seeds were good. You get 16 seeds to a pack. Germination saw 15 seeds pop, out of which 5 were female. They vegetate until 2 feet in height - mistake. On going to 12/12 the plants took off and eventually reached 6 feet and were a regular pain in the ass to look after; but they were running buds etc.... (I'm using 600W HPS in a 5 x 5 grow room). The plants were ready in 75-80 days.

I'm now in the process of drying and curing with the intention of selecting the best and cloning.

I must say that I'm disappointed in the quality at this point. The buds I've smoked have a nice taste and are very smooth to smoke. The high, however, leaves something to be desired. I haven't sampled the best bits on each plant I have yet to come across a NLH. This is 'extremely potent' grass. What does this mean? Extremely potent for me for years and my intention in buying these expensive seeds was to grow for my 'experienced' buddies.

There seems to be a high variability in potency among the ten plants. My experience is going to find a killer here. Manicuring a cola from a plant always gives me a good smoke with scissors and if it gets clogged up by resin I know I have a good smoke. Only a matter of time. Ability. However, I'm reserving final judgement until the plants are fully dry and cured (2 weeks) before I start ranting and raving.

Tips for growers of this strain :
Put on 12/12 when plant is under 12 inches.
Maturity will take 75-85 days.
You need LOTS of light.
Yield is o.k
Cloning is easy - I've tried it.
The buds will be fluffy, not tight.
No major smell problems with this strain." -Harry H.

Strain: Original Haze

Strain Type: Mostly Sativa **Origin:** California/Holland **Breeder:** Positronics

Images: 1

Description:

"Strong compact plant, very high. This homogenous Sativa type weed originates from a high level of THC. Grow it from fertile soil and add nursery supplements to the strain grows up to 1,75 meter and is especially loved by musicians around the world to grow but famous for its special qualities. A classic Sativa high, and good results wait a little longer. Strong, compact plant, mellow. Original lambsbreath from Skunk crossing. Flowering time 10 or 12 weeks. (1st two weeks 14 hours of light, last 2 weeks 10 hours of light). Has narrow leaves, a plant with yellow-whitish buds.

Specifications:

Type : Stabilized F1-Hybrid, 88% Sativa Flowering time : 8 - 12 weeks Cultivation: greenhouse Appearance : Slender leaves Aroma : Spicy odour Height : 1.50 - 2.00m
- Positronics seedbank catalog

Growers Comments:

"Haze (Katsu coffee shop) This place came highly recommended to me from a friend who said to have "the best Haze in all of Holland". Trippy buzz with a similar taste to Durban. Very, very cerebral in nature. Like the onset of LSD right before it reaches a comprehensive feeling with heart racing aspects. This bud is for experienced smokers, not a newbi consumer."-Prince Caspian

"The most mind-blowing weed BY FAR, that I've ever smoked (in 25 years of taking LSD. I can't even rate a second or third because NOTHING ELSE COMES CLOSE."

"Cleaner, cerebral buzz from the pure sativa. Haze is a super sativa of four sativas from South Indian. Haze is one of the few genuine, pure sativas in existence (the original haze from positronics. It has very long, slim fan leaves. the plant fans make the tops droop over kinda like a sunflower. its definately a pure sativa mature haze. i have some original haze barely budding and its already a killer. i have some limpy plants? haven't got to try any mature bud yet, but the 2 weeks of light gave me a better buzz than mature durban bud. unfortunately i just had to put the plant in 12/12 so maturity will probably be delayed. i do believe it will be some of the best i

-Toker2

"The original Haze from Positronics, which is a stabilized hybrid is said to pro 75% female. Out of 5 mother plants, there is one that is a little different from bit wider and the plant is definitely showing more vigor than its sisters." -To

"That's what I thought, Wernard at Positronics got one of the original clones. growing characteristics, how's the high? Is the Posi. Haze as potent as the H&

"In the seventies we tried several times to grow original haze in the uk all to and grolux and didn't know about hid's. in the eighties we tried again using : took 15 to 18 weeks on 12h and the start of amber glands. some of these we probably need less hrs to stop them. I don't think the so called hazes offered thing some quote 8 weeks some 9. Over the years we made a number of cro last two were the best [see post 24] . The high was very high, not at all para coloured edges to their vision unfortunately not me. We found it just too exp has left us with some high yielding hybrids with a touch of the haze high as a time down to was with super skunk m x o~haze f = 10w and o~haze m x ss

"I just finished some Positronics original haze for the most part under 44w/sc outdoor mothers. The outdoor buds at 7 weeks had far better potency and ta weeks. It did make some righteous size buds indoors and a nice yield, appro: just didn't have the kick of its outdoor mother. I really believe haze needs fa

"Haze is a sativa hybrid. If I remember right, they mentioned Mexican, Colon degrees. This would explain some of the variation I saw in the hybrids Nevil : sativa characteristics included one plant with a 6" sport in 24hrs. That happe flowering. Outdoors they would have been giants." - Lady J

"Posi haze is mostly Colombian x Mexican with small amounts of Thai and so Haze brothers" in California 20 years ago."

"Our Haze is indeed from Posi's genetics, the flowering times do differ. Hydro we find can take 1 - 2 weeks longer. 10 - 13 weeks would be most likely on a some variation from grow room to grow room, even though it's the same str: popular strains and is well worth the wait. A real up high of cosmic proportio seedbank

"This sounds close to my strain, except the very best go to between 16 and must have done what they call improving the strain to reduce the hrs to 10 t Positronics started with. In fact it is very close to what you get with an F1 cro original skunk No 1 which is probably closer to the truth. The other thing is tr light levels in excess of 100 w per s.f. are needed its not an economical crop

Strain: Pure Haze

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Homegrown Fantasy

Images:

Description:

"100% Sativa, it's a hard plant to grow, but famous for it's special qualities. For those who do not mind to wait a little longer. The plant that sets the standard, the prize winning selection for Homegrown Fantaseeds in the Cannabis Cup '99. Specifications:

Specifications: ~ Flower: 10-13 weeks"- Homegrown Fantaseeds catalog

Growers Comments:

none

Strain: Silver Haze

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Sensi Seed Bank

Images: 1

Description:

"Although the cerebral high of the Sativa is preferred by many, indoor growers know that Sativas get very tall, take a long time to finish off and produce skimpy yields for a superb Indica/Sativa hybrid suited for indoor growing. By crossing the Haze with the World, to a non-dominant Indica we managed to get the height and flowering time to an acceptable level and still retain the unique Sativa qualities of the high. The result was the '89 High Times Harvest Festival. Don't expect top yields but top quality top buds. -Sensi Seed Bank catalog

Specifications:

Flowering: 65-75 days. Height: 150-180 cm. Yield: up to 100 gr." -Sensi Seed Bank catalog

Growers Comments:

"This bud is so crystalline that it looks silver, as its name portends, but underneath actually dark-green buds with flame-orange hairs in clusters all around the buds. The buds tend to break up due to their density and leave a tacky (but tasty) film on your fingers. The nectar is sweet and pleasant and tastes mild but a bit piney. The smoke is stony, vegetative high that could leave you wandering around Dam Square very high. *****" - Homepage Amsterdam

"I have both silver haze and skunk x haze in early bloom outside right now. I have a lot of silver haze. The skunk x haze is a relative compact plant that looks really great. Its about 1.5m tall (at the very nicely branched conically like a Christmas tree. The flowers seem to be very small (at the internode) and the odor is very nice. Less pungent than skunk, but I doubt if it seems to be a lot of skunk in it. It reacts relatively fast to a change in light regime. The first flowers appeared.

The silver haze looks much more like a sativa with longer internodes and spaces between them. The flowers are very small so it wouldn't get too tall and this has turned out nicely. The plant is about 1.50 m in diameter. The appearance of flowers was fast (also +/- 4 days)

concentrated on the tops of the branches. The smell is much softer than the
(If you have smoked real haze you know what I mean, there is nothing like it

Strain: Super Haze

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seeds

Images: 1

Description:

"This variety made Dutch Passion the "High Times Cannabis Cup" winner in
called "Haze Skunk". Still one of the best for the Dutch Passion team. Original
is crossed with Skunk #1 to get a bigger yield, a softer taste and a shorter fl
sweet taste. The high is incredibly clear and energetic. A very favorite strain
for an almost 100% Sativa variety.

Specifications:

~ Flower: 10-12 weeks ~ Harvest: end of Dec." -Dutch Passion seed catalog

Growers Comments:

"I had the opportunity to acquire some Super Haze from Henk in late Septem
just fine. I germed in soil of a fine mixture in early October. Of 12, 11 germed
to be herms with largely male characteristics. 2 true males, 4 females. Fairly
serrations, and max 7 blade leaf structure. These babies grow fairly quickly i
320w supplemental fluorescent. Problem was though in flowering as this stra
about 6 months total. Very deceptive in that the buds will look beefy, but the
any other stain I have encountered. My guess is that this strain will perform
temperature situations. I am going to try outdoors now and compare. Under
some nice 6 - 8 inch colas but they were not as tight as a big light setup wou
pollinated more bud than I had intended to when my pollen collection cup hi
have enough seed to grow a small forest. And believe me when I say they ou
Next time I think I'll try something more suited to my setup like NL." -Patient

"In the new Dutch Passion catalog, Henk the owner insists on calling his HAZ
Cannabis Cup in 1993 now called 'SUPER SILVER HAZE'. The Super Silver Haze
Greenhouse Seeds. Henk is fairly proprietary about names, he has registered
fairly convinced the Super Silver Haze is an identical Haze Skunk cross." - M

"Isn't Dutch Passion's variety Haze/Skunk called Super Haze? The Super Silver
just at the Greenhouse and they have the genetic backgrounds of most of th
menu." - Sensi Claus

Strain: Super Silver Haze

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Green House Seed Co

Images:

Description:

“Pedigree: Composed of the most commercial strains, known to the civilized Haze. Royally bred from 3 precious High Times Cup winners. Awards: 1st place 1st place High Times Grand Cup '98. Strength: Overpowering combination of you gasping for reality. Flowering Times: Indoors: 8-10 weeks, with top yield: production. Outdoors: Finishes by end of Oct. in northern hemisphere, or end Hemisphere. This complex hybrid is the cutting edge in practical Haze hybrid grower and smoker alike. Highly Recommended.” –Green House Seed Co. ca

Specifications:

Flower period: Indoors, 8-10 weeks.

Growers Comments:

“Close sources say Arjan bred the SSH (nl x haze x skunk)in the Sensi Seed Castle) with royally bred Sensi strains. It's basically the same exact thing as difference. Arjan had some reputed misunderstandings with Sensi Seeds, and accidentally leaving behind his notes (woops!).

The key difference is that Neville donated his special pure isolated "Haze" st made it slightly better than Sensi's version. Neville went on to screw Arjan in over Sensi.” -Tobes

“I bought Super Silver Haze in Amsterdam directly from Greenhouse. Out of (including all kinds of hash), I smoked Super Silver Haze about 40% of the time tasting smoke in Amsterdam. Most Amsterdam smoke has little taste in my c from Greenhouse had a spicy taste, that everyone I shared it with commented. Most of the plants I grew with seeds bought in November are about 45" tall, so they are only about 26" high not including the rockwool. I get lots of vario top when fully mature, with a long top branch of buds about a 18" long that One plant I pruned in veg. Toped at the 4th node than again a week later. It or 5 side branches.. It is just about ready. It will be less than 30" mature (not not as wide) compared to the other Super Silver Hazes (and much easier to r to be a master at controlling the growth patterns. But if you know how, you c Hazes per Sq. foot, or at least 3 that could yield at least 22 grams of dry mar I have not had pure Haze so I can't comment on the existence of the Haze c crossed with Nevil's Haze, one of the world best Sativas.

The high is complex, slightly up. I need to study it more but it is up there wit per say. But most people will like this strain. Every one likes different things. I can tell you it was a relative bitch to manicure compared to Great White Sh other strains that have more compact buds before curing. It manicured like V formed after 7.5 weeks like WW would be after 10 weeks. You have to go in out a lot of little leaves that are best removed. It takes time. I'll always grow one plant every other grow. I'll keep a mother of the best and continue my s - Ananda

“(To breed SSH you need to start with a NL5 Male x Haze female. The main

from the Northern Lights #5 is the short height and, if possible, the trichome characteristics you seek from the Haze are the high and flavour.

Once you have a stable version of those two, cross a NL#5 x Haze male with making it "Super". The main reason Greenhouse Seed Co. created SSH was because a few people were upset with the consistency and potency of the NL#5xHaze. I crossed it with a Super Skunk to give it more stability and up the ante on potency something "new" to enter in the Cup.

The difference between Jack Herer and Super Silver Haze is the NL#5 is the female while Haze is the male in Jack's original cross. From what I can recall reading of favoritism towards it's tall, lanky Haze father. The SSH leans more towards the NL#5 daddy." -Geronimo

"I just harvested the second SSH female. and am impressed it has a strong Super Silver Haze sticky as g13and good yielder mine went 70-80 days." -la.bud

Family: Mighty Mite Strains

Strain: **Kush X Mighty Mite**

Strain Type: Mostly Indica **Origin:** British Columbia **Breeder:** Undetermined

Images:

Description:

"Heavy budding and lots of crystals makes up this plant, larger colas than Kush excellent high. Easy to grow, and great for both indoors and outdoors.

Specifications:

Specifications: ~ Flower: 8-10 weeks ~ Height: 4-5' ~ -Marc Emery Seeds

Growers Comments:

none

Strain: **MCW (Mighty Mite x Chemo x White Widow)**

Strain Type: Mostly Indica **Origin:** British Columbia/California **Breeder:** N/A

Images: 1

Description:

"MCW is a very nice strain to grow and smoke. Matures around 55-63 days. I'm resistant because 2 other strains I had developed a white "cottony" looking resin but didn't even though she had really phat buds. The buds are nice and tight. I have a stony, one has more flavor than the other does. The flavor is excellent in taste occasionally puts out a few sterile male pollen anthers, which has never polli

2 mcw's going for quite a while now and I prefer the one with the occasional has phatter buds." - ncga

Specifications:

none

Growers Comments:

"Ncga's Chemo cross (MCW) would do any garden proud! It's my personal favorite although it's a low yielder, the flavor/buzz more than makes up for it..."-Moh

"And, for what it's worth, IMHO, that MCW was the best of the bunch! Without going! The others were fine, but MCW just gave you (or me, anyway) that en you EVER have any extra of that let me know.... I'd drive across 3 states for t

"Planted my last 6 MCW (I think it also had a "?" behind it, or maybe an "x") for 1 extra large female (#1). 2 avg. ones (#2 & #3) along with exact same male and a bushy one and bred with #2. not much to say about #2 other than pods on a 30" tall, bushy plant. #3 is also unremarkable in its growth and bo grown outdoors last summer from same batch of seed (btw, 3rd week of Oct however, is a monster! 4' tall, easily 2' diameter and solid with bud (looks ve colas with many good size branches growing "candelabra style" with one pin outstanding yield from this one in particular... all are a lighter shade of green trichomes. And super-sweet aroma. It's a very long lasting, semi-heavy high I share it with. It's always been what they ask for anyway and works well for surgeries and 2 fusions).

All were grown in 5 gal. black plastic, nursery buckets filled with "Whitney farm third with "Whitney farms cactus mix". Vegged under 1 1000W Sunmaster M HPS...after sexing, reduced to 1 HPS and the Sunmaster in a 4 x 8 x 7 space. time. I don't notice much difference between it and plain flat white walls. My it will be gone as soon as the room is cleared." - del

Strain: Mighty Mite

Strain Type: Indica/Ruderalis mix **Origin:** British Columbia **Breeder:** Under

Images:

Description:

"Mighty Mite is a famous BC indica strain from the Himalayas cultivated for 1 suitable for indoor or outdoor cultivation. All Mighty Mite varieties and hybrid that explodes in the 6th to 8th week of flowering.

Specifications:

Flowering Period : 7-8 weeks. Height : 2.5'-3.5" - Marc Emery Direct seedbar

Specifications: ~ Plant: Jun. 1st ~ Finish: Oct. 1st ~ Height: 4-6' ~ Yield: 3-4 oz" - Bonhomme's seedbank catalog

Growers Comments:

"From Lesquiti Island in B.C. Seeds take up to 14 days to germinate. Huge col...
"Indoor/Outdoor. From a population of 3000, 50 of the best females were sel...
day strain. This generation will show a much higher consistency of commerc...
3-4 of Oz to Oz. for the experienced grower. For a smaller window of profile c...
as early as February indoors, and then placed outdoors in May. Mighty Mites...
August and finished outdoors in October. For indoor/outdoor germination to f...
grown indoors for 24 hours under continuous light. Not recommended for clo...

Family: Niagara Strains

Strain: Huron (Niagara X White Widow)

Strain Type: Mostly Indica with Ruderalis **Origin:** Ontario, Canada **Breeder:**

Images: 1

Description:

"Mostly indica. Mold resistant. Medium flower to leaf ratio. Large yield. Potent...
heavy.

Specifications:

Indoor Growth Outdoor Growth
Cutting height 36"-48" Plant Height 4'-6'
Yield (/m2) 300-400 g Yield (/plant) 125-150 g
Flowering 60-75 Days Finish Approx. Sept. 15-30
Frost Resistance - Spring Very Good, Fall Good." - Dr. Greenthumb seedbank

Growers Comments:

none

Strain: Niagara

Strain Type: Mostly Sativa with Ruderalis **Origin:** Ontario, Canada **Breeder:**

Images: 1 2

Description:

"A mostly sativa strain, early finish, sweet taste, mold resistant, high flower...

produce large yield. Potency: 4 out of 5. Bouquet: Earthy, heavy.

Specifications:

Indoor Growth Outdoor Growth

Cutting height 36"-48" Plant Height 6'-12'

Yield (/m2) 400-500 g Yield (/plant) 400-500 g

Flowering 60 Days Finish Approx. Sept. 15

Frost Resistance -Spring Very Good, Fall Good." - Dr. Greenthumb seedbank

Growers Comments:

"Out of 18 Niagara seeds I got 17 sprouts. Out of the 18 Niagara x shiva seen 9 were female. Out of the Niagara x shiva 11 were female. Clones were taken and put into my hydro system. Growth was better than I've ever seen; in fact both space heightwise, so had to bend them a bit. I harvested last weekend. They have no actual weight as both are still drying. I would say in the area of 400g look fat and dense. The Niagara buds have almost no leaf, just pure flowers like I have never seen before. The Niagara x shiva has more leaf as it is more indica. I have no idea how the Niagara I have been smoking is far more potent than anything I have ever grown. Some of my friends say it's too potent or accused me of spraying it with something more potent than the Niagara, and more physical but I would say it also is more potent than I have grown before. For those who like a very potent weed Niagara is the bomb that high. Overall I like both and plan to grow more in the future."

"I have some 5 week old Niagara plants that were ordered from Doc Greenthumb. They are 18 inches tall and appear to be very healthy. I germinated 10 seeds all but one. On a 18/6 light cycle and all have been preflowering and revealed their sex. 5 females and 5 males started flowering at 3 weeks and had to be moved out of room so it wouldn't pollinate. The staminate pollen sack looked like it would release the pollen anytime. Have you ever seen this at the vegetative stage. Have heard that some Ruderalis strains flower regardless of light cycle. Have heard from Doctor Greenthumb?" - edhassle

"I am down to 8 Females only out of a 30 seed order. And not the first PINK F1. I had to wait out the budding of them to sample the quality. Since they did not produce the strain I paid for? 3 of the males fully showed & produced pollen while undisturbed. I saved the pollen from those 3 males. There were a lot of hermaphrodites. 3 females showed under 24 hour also. I have dropped the females all down to 8. All males & hermies are dead. I hope they did not send me industrial hemp. Ruderalis? But they finish at different rates so I wonder was it stable at all? Can you have different types of seed? I thought that F1 hybrid seeds would produce even traits? I thought they would segregate unless I seeded the F1's? " - Country Boy

"This is my first attempt at growing it and it's about 5 weeks into flowering. It is a little tall and grew like a regular sativa. This would be an ideal plant for ScrO. It grows fast. Faster than one would expect from a sativa. I tried some of the immature buds. They are potent, especially for immature buds. The buds are starting to get a little big and strange because the pot that I have grown, buds don't fill out till really late in the season. I have used non-organic ferts like Shultz bloom plus (10 60 10) and miracle grow etc. It has really well. Niagara loves lots of light; it does really well under good lighting,

start flowering this variety at about the 4-5th node or you'll have a rather large size. I made that mistake and ended up with a mother plant to provide me with
Hvac Man

"11 days into 12/12 My Niagara X Shiva went Hermy. Arrggg! Too bad 'cause Very wide leaves. Fairly compact."

"They are two weeks into 12/12. All system go for flowering. Soil. Niagara X strain. I guess you get what pay for."

"Niagara is Sativa and is kinda fluffy. Its drying so can't say about potency. S formation. Yield...nothing to scream about. Niagara x shiva- a lot of variation others. Tight nugs. Some tendency to herm in all examples." - Flashman

"I got 10 seeds, 6 were female, all were very tall and showed sex under 18 h 2 had somewhat of a good yield and the other 4 should have been killed. One potent, but nothing special, all the rest including the 2 yielders were average sucks! What I grew did not look like the pictures I saw. This is no match for what I've grown out as far as yield, potency, TASTE, and growth pattern. This plant this seems to be a very unstable strain. Compared to everything else I have cake! I hope that you have better luck, and can process hemp, cuz that's what I simply cannot understand what all this hoopla is about Niagara. It might be good starting, but not for those of us who are striving for the ultimate kindest bud

"Niagara from HS. Promix/perlite/worm castings. Start & veg under flores. Flashed out of 6. Looked definitely indica, but were supposed to be mostly sativa. Tried 6 weeks preflowered and was very easy to distinguish. Fan leaves were wide Very few leaves. Buds production was not much to speak of (thought should be) Bud leaves had purple cast to them. High was average. Overall opinion - not as high. As far as production/high could have been me, but type was not as a

"The good doctor used two kinds of weed to make Niagara; a Oaxacan plant, which, he got from the original countries. The Oaxacan was late, and wouldn't mix with the Afghanistan, then selected for two generations to come up with a Afghan ancestor. So this is the origin of Niagara if anyone wants to know." -

"Started 7 Niagara. So far three have shown male under 18/6 photoperiod. Total definite sativa dominance. Leggy and long internode spacing One is 18" this is as the widest but is not very dense. The other 2 are runts sativa dominant but tall. One is totally different very indica influenced much more bushy and vigorous indica/sativa mix 14" this plant..." - germinator

"Started (with) clones from a 2 month Niagara female. The plants were grown in deluxe mh and 1k hps on light movers. Plants were grown in organic mix of veg until flowering. Then the Niagara grew too long and spindly and the tops never disaster for me in terms of wasted time and space.

The plants were fed with Foxfarm big bloom during flowering. At 5 weeks into small wispy buds that never filled out between internodes. The plants were taken 2 weeks of 18/6 veggie the plants went wild with uncontrolled spindly lateral growth

The plants were ok smoke but I really can't say because they were never finished
edhassle

"My understanding of this strain WAS that it was a cross between Afghanistan
no mention of Ruderalis in it's genes, but 3/12 of these little \$#@&'s are fl
from seed, so what's the scoop?

These plants showed preflowers at the 6 & 7 nodes at 6 weeks, which I thought
stars, thankful I could start weeding some of these out as things were getting
they're one approx. 10+ nodes and flowering! Also, the description of Niagara
indoors and out, which led me to think that this would do ok indoors." - Unha

"I haven't grown any of doc's strains to harvest yet, but, I have Niagara, and
now, which will be thrown outside sometime in may. I have read that the Nia
but I fail to see how this strain could possibly be grown successfully indoors.
vigorous, with quite a bit of variation between individual plants. They have q
really like to reach for the light with quite a bit of side branching. I'm sure th
grown outdoors, but I wouldn't chance then indoors." - S_Ont

"My experience (one grow) is this: out of 8 plants, two were bushy runts--one
to show sex and develop flowers. I axed the male because it produced a very
flower node greatly separated (4-5 mm) from the others. The runty female is
who looks like the pictures and descriptions of Niagara. The runty girl also ha
distributed like the male--definitely a lot of stem and few flowers.

To top it off, I discovered a few male flowers on a couple of branches of the r
plan to save any seeds from these runts anyway, but it was a great disappoint
undesirable Ruderalis-like runts) this variety is :-)

I don't have anything against some Ruderalis genes; the Doc has created a li
higher latitudes. He's a breeder, not a magician. I'm disappointed mainly bec
my own seeds to avoid the paranoia ordering out-of-country causes me. If hi
suggests that Niagara is closer to an F1 or F2 hybrid than a stable variety--so
though perhaps a stabilized hybrid, and an F1 of another, such as Ruderalis i
On the plus side, the other female is big, producing a good yield, has a mode
distal parts of the bigger bud leaves; has a very pleasant, aromatic odor (nor
though the grow-room smell was evident during the last few weeks of vegeta
flowering phase).

I smoked some quick-dried buds of each at day 56 of 12/12. It tasted like qui
some; I just crushed up the bud leaves and buds and rolled a fat one of each
better than average highs that seemed to last at least a couple of hours. It w
type of power, but it was good :-)))

I started with tap water (pH ~8) to clear nutes at day 53. I plan to harvest or
smoke this mother though I don't think the taste is going to be anything to b

"What strikes me most at this point is the variation in the plants. There is no
one plant outgrowing the rest of the garden markedly, which has that charac
have three with that characteristic Afghani look to their leaves. Another thre
to them. And, one with an indica look I have not seen before, very short and
mutt strain that has not been stabilized.

I use a 400 MH in a small 4'x2' space, so my wattage and lumen intensity is
growing well. No problems there. And, the side branching has already begun

the Afghani-like plants. Since I will clip their tops once, at the fifth internode, better.

All in all, it is an interesting crop to observe. I don't care about the variability best to breed and create my own unique strain. I am crossing my fingers the fast is good and potent."

"I have 3 Niagara females in late bloom now.

There seems to be a bit of variation in them. One is looking like a good yield, skimpily indeed.

Another thing is they are prone to going herm when you switch from 24 or 12 hours of light. I do this outdoors with the gradual decline in daylength (so I hear). All 4 females too herm and got the chop. As for the good female growing now it has lots of buds, but not so well. I can't wait to try the buzz for size. It's probably best grown outdoors than indoors.

"Started 10, 9 sprouts, 4 females, 4 males and 1 herm. I kept 1 Niagara that was the best. The mother plant was OK but not great. After a couple of clonings, however, the potency all rose quite a bit. Clones well, great branching and flowers fast (7-8 days to buzz). It slowly creeps up on you and builds into a fun laughter inducing high. It has more impact or couch lock of some of my other strains which makes it good for the keeper. Good one Greenthumb.

I have a feeling they will do well outdoors. I've only grown them under lights. The buds filled out pretty good for a sativa. Still a little bit loose and fluffy though one was worth keeping. The other 3 were very low yielding and poor in the T

"Finished my Niagara grow, starting with 8 seedlings. Bought my seeds not from Stairway. Six were male (one a slow-growing runt with very sparse flowers); the other two were female with fairly tight buds, good amount of trichomes, glossy leaves on buds. The flowers per cm or inch, (individual flowers separated by a few to several mm) were good. Bud leaves. Leaf characters were the same (I described all this in earlier posts). The runt never developed "buds," i.e. compact floral spikes. Both get me high, but the other is a runty female. [I've been sick since my harvest so can't really judge the high. I'm a bit light-headed with this terrible respiratory virus that's going around.] I crossed the biggest males, who tested about the same in potency. I don't plan to grow more than a year, and then I still have 9 from my original purchase.

Wait until a few weeks into flowering (2-4) and you should be able to tell if a strain is going to be worth keeping.

Apparently like you, I was disappointed because I thought this was a "stable" stable varieties (Dutch origin) that I was going to 1) produce seeds for my future other and with Niagara. Now, I believe I would have been better served by more Durban Poison, or one of Doc's Heritage varieties instead of Niagara. But hey, it's a potent weed I've smoked in a long while--if it is, it definitely is a subtle, up kicking high. I'll keep the best female about 1 week into 12/12, and have 4 Northern Lights about 1 week into 12/12 (they will finish at about the same time). My plan, assuming I've got a NL male, is to cross it with two, as well as produce some more NL seeds for the future." - T. Aich See

"So far I've grown Niagara (a disappointment, though I haven't given up on it yet). I'm harvesting Northern Lights (recent sample of green bud tells me I'm going to get a good buzz) but I like more body to my high--something to make me laugh and get me high and cerebral for kicking back."- T. Aich See

"I've grown it from seeds and clones indoors. I only had 2 females out of 8 seeds. The females were quite variable in stature and flower production. One female was quite potent and production. The more potent female produced a subtle high (little bit long-lasting. Personally, I don't like it as much as varieties with more "body" couch-lock high, but something with some "feel" to the high). It isn't a great "airy" side, though they plump up some at about 8-9 weeks of 12/12. It clones well and 5 weeks of 12/12 and it took 2 & 3 weeks for the cuttings to root and stay somewhat resistant to fungi (I had a fungus attack that wiped out my last grow of California Orange seedlings and Northern Lights clones were wiped out first). I'm glad I tried it, and I plan to grow some more to breed and blend (the bud time but only until I am able to find varieties that are more to my liking and which time I might smoke pure Niagara is when I'm going to be around people who like it high or when I have some serious thinking to do.' -T. Aich See

"I had some trouble with Niagara in the early seedling stage...I believe it must have been that the problem was coming from the roots of the seedlings...I never knew what it was but even still I ended up with some healthy plants...they are nearing the end of their life cycle. If you have a question or two to help me determine the proper time to harvest your plants, please let me know. At this time I have one with a more indica influence and one more sativa. Both plants have lost all large leaves and only have some small single bladed leaves left. flower buds are very aromatic. I would say that 50% of the pistils have turned brown. I can clearly see a percentage of white newly developed pistils...they have large white trichomes. I can see the globular resin glands on the small bud leaves you can clearly see the aromatic resin glands....you can see that there is a higher percentage of light colored resin. I noticed a definite stretch of the internode growth about 8 days ago. The humidity is high and so is humidity here...sunrise is at about 6:00 am and sunset is about 6:00 pm. Bud sample: We sampled some buds 8 days ago and only received a small bud sample. I noticed DEFINITE psychoactive highs... I love the strain and find the plants to be VERY strong and dense with buds... My end thoughts on Niagara is that

"Harvest time for me, would begin when the majority of the trichomes were clear globular including, when the bracts begin to swell....They'll noticeably put on weight and the buds will be heavy.

I sometimes in fact take 2 harvests, as it were, by taking the best colas, at a smaller lower branches, and what's left of the main, cola-bearing branches to be harvested for trichomes.

I don't encourage people to harvest Niagara in the clear globular trichome stage. In my opinion. Harvested at the right time though; it's a beautiful thing..." - greentalk

Strain: Niagara VE

Strain Type: Mostly Indica with Ruderalis **Origin:** Ontario, Canada **Breeder:**

Images: 1

Description:

Mostly indica. Mold resistant. Medium flower to leaf ratio. Potent. Medium to difficult areas (short season; cool spring & fall) Potency: 3 out of 5. Bouquet:

Specifications:

Indoor Growth Outdoor Growth

Cutting height N/A* Plant Height 4'-8'

Yield (/m2) N/A* Yield (/plant) 200-300 g

Flowering N/A* Finish Mid-Late August

*Indoor growth of Niagara VE is not recommended.

Frost Resistance - Spring Very Good, Fall Good. ." - Dr. Greenthumb seedbank

Growers Comments:

"Already grew out Greenthumbs Niagara and X Shiva. Not "da bomb" I was looking for better Dutch varieties. Please remember that this is strictly my opinion I have been very happy with what they grew! Different strokes for different folks." -

"My Niagaras are starting to flower! They were planted outside a month ago and I was surprised when I went out to water them today and some of them had just in time. The others were just starting to show white hairs. I wasn't expecting another month. My guess is that Niagara and Niagara x shiva auto-flower and

"If this is true, it would stand to reason that Niagara is just a Ruderalis that has Sativa in it. I've grown Niagara X Shiva before and found it too wily to have it were to grow outdoors I'd consider it I think."

Strain: **Niagara X Shiva**

Strain Type: Sativa/Indica/Ruderalis mix **Origin:** Ontario, Canada **Breeder:**

Images: 1

Description:

Mostly indica. Hashy taste. Mold resistant. Medium flower to leaf ratio. Highly rated out of 5. Bouquet: Earthy, with a hint of sweetness.

Specifications:

Indoor Growth Outdoor Growth

Cutting height 24"-36" Plant Height 4'-6'

Yield (/m2) 350-450g Yield (/plant) 100-125 g

Flowering 50 Days Finish Approx. Sept. 1

Frost Resistance - Spring Excellent, Fall Good." - Dr. Greenthumb seedbank

Growers Comments:

none

Family: Northern Lights Strains

Strain: **Aurora Borealis**

Strain Type: Mostly Indica **Origin:** California **Breeder:** Super Sativa Seed

Images:

Description:

"Yes it's The Brothers Grimm version of Northern Lights! Truly outstanding in our own UNIQUE true-breeding version of the classic NL#5." - Brothers Grimm

Specifications:

~ Flowering: 55-60 days ~ Height: 100 - 120 cm ~ Yield: 300 gm/m2

Growers Comments:

"This is my first crop with a 1K light. All 8 plants were grown in 2.5 gal conta Aurora B females from a ten seed pack. Vegged for 50 days and all finished t Aurora B came on strong in the last two weeks. I didn't really expect what I e bulked up well during the last two weeks of flowering. I topped the three tall more than the untopped, but the ones that I didn't top turned out to have so up being around 18 inches long and 3 inches in diameter, plus a cluster of sr the main shoot. Their scents ranged from pungent,(the big cola) to the lemon these plants produced, and all of them were very frosty. The smaller plants v like lemons. Overall, I ended up with just over 13.5 oz's, including 11 oz's of camper. The AB kind of creeps on ya. It starts out as a light feeling in your fc a couple minutes later you're feeling pretty damn good. After about an hour the couch and I found myself in a daze, trying to watch Rocketman on the Di time grower, and this is the first time I've grown a strain of NL, but I'd rate th complex buzz than Sensi's Hindu Kush and a much better producer. - Pauly

"AB potency doesn't get much better, if you're looking for an indica that is. It till I fall asleep after a few bowls.

It's my favorite, but it's making me fat!" - madam in Adam

Strain: **M39**

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Super Sativa Seed Cl

Images:

Description:

none

Specifications:

none

Growers Comments:

"We have been working from a m39 mother plant that is from 1987. This is a strain I have ever come across. I have purchased & grown many of the newer brag strains for something that will even come close to this strain. I'm not saying that this is the best that in my over 15 yr. search this is what I've found to be the strongest so far."

"M39 by SSSC was "Basic#5"/Sk#1, but I BELIEVE "Basic#5" was actually NL#5. You're actually looking for NL#5/Sk#1 which is available from Sensi Seeds -MrSoul"

Strain: Northern Lights

Strain Type: Indica **Origin:** Pacific Northwest, USA **Breeder:** Undetermined

Images: 1 2 3

Description:

Medical: Multiple Sclerosis "A pure Indica, won the Cannabis Cup in '88, '89, for it's strong and big buds. Famous throughout the world, everyone has heard of this potent stone."

Specifications:

~ Flower: 7-8 weeks" - Dutch Passion seedbank catalog

Growers Comments:

Northern Lights

"pure Indica 88/89/90

An absolute must for the indoor grower! For the last couple of years the Northern Lights has won various Harvest Festivals. Through selective breeding we have succeeded in developing the best plants in the world. On top of that, we have developed a strain highly adapted to indoor growing, powerful with a good yield and exceptional resin production. The most lucrative strain in the world. Flowering: 45-50 days.

Height: 100-125 cm.

Yield: up to 125 gr." - Sensi Seed Bank catalog

"IMHO a Northern Lights would be best, easiest, and have the best high. This strain has been around for years; it has great name recognition. It is disease free, and easy to grow. This is not perhaps quite as great as some of the Big Bud hybrids. It can be grown under SCROG. or bushy. An all around great strain." -Kohala

"Bank: Positronics

Supplier: Jock

Started with 10 seeds all germinated. One sprout was lagging far behind the

misery. Ended up with 1 female, 5 males, and 3 herms.
Again, like the rest of the Positronic stock grown out so far, these plants were
They looked very much like the NL x Shiva that also came from Posi. Too bad
in all respects.
The one female was not very impressive grown from seed and turned herm.
grew like chit. Very airy bud with little resin and a lot of leaf. The buzz made
clone one time to see if it could redeem itself. Because the buzz got better it
though it still showed male flowers, not a lot but too many. The second time
flowers again and didn't improve much in quality or growth. So now it's dead
To be fair it could be that this plant just couldn't handle being flowered so early
possible." - flick

Strain: Northern Lights #1

Strain Type: Mostly Indica **Origin:** California **Breeder:** Dutch Passion Seeds

Images:

Description:

"Developed in Seattle, perfected in Holland, Northern Lights has become the
must!

Specifications:

~ Flower: 45-50 days ~ Height: 100-125 cm ~Yield: 300-325 gr/sqM" - Dutch

Growers Comments:

"Northern Lights #1 = Described as a true breeding strain (Stable) of Afghani

Northern Lights #135A = Available commercially for just a short while (87-88)
Described as "a fast finishing hybrid of Northern lights and an Afghani". This
Sluder/Chronic."

Strain: Northern Lights #2 a.k.a Oasis

Strain Type: Mostly Indica **Origin:** California/Holland **Breeder:** Dutch Passion

Images: 1 2

Description:

"One of the most popular varieties, Oasis is our Northern Lights #2 selection
mite resistant. Good yield, excellent taste and excellent high.

Specifications:

~ Flower: 8-9 weeks ~ Harvest: 1st week of Nov." - Dutch Passion Seeds cat

Growers Comments:

"Northern lights #2 = originally a Hindu Kush X Thai cross. It was selectively almost all Kush type cross that is mostly indica."

"I haven't done #5, but # 2 (Oasis) was great. Most people say that the NL s smell, but my experience with #2 was that it had an oniony, garlicky smell a Couch-lock, but surprisingly psychoactive, given indica's reputation. I don't tl that highly touted." - Skunkman

Strain: Northern Lights #5

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Sensi Seed Bank

Images: 1 2

Description:

Medical: multiple sclerosis "This state of the art Indica is the result of over 20 for vigorous growth, high yield, and superb high. A must for growers who pre have an extremely frosted, resinous appearance and the yield is high.

Specifications:

~ Flower: 55-65 days ~ Height: 2-3'" - Sensi Seed Bank catalog

Growers Comments:

"NL#5 is NL with another plant crossbred. Part indica, part sativa. Grows gre a pretty good yield. I know a few that have grown it. Call it the "Christmas tr Thumbs up to it, it is a great strain." -V

"I got NL#5 never had any problems with cloning, also if its real NL#5 (which at all which is great if ya grow indoors. The ones I've seen really fill out at th sometimes looks like the yield will be marginal and then in the last couple of with most indica strains, usually they do not fill out till the last 2-3 weeks of t strain, one of my fav's too." -Unknown

"I grew Sensi Seeds NL#5 and it was one of the best plants I had ever seen. I agree with Skunkman, its like a psychedelic couchlock, the buzz goes for lo indoor plants I ever saw, very short and compact, mega-phat top-cola, pretty longer after inducing bloom, excellent flower/leaf ratio. I had good 400 gr./s. drawback I noticed was you better watch the air humidity, they have a tende are just too fat and sticky so the air won't go into. But when you keep moistu should do well. To my experience they are true-breeding, but on the other h: inbreeding out of a small number of species might cause some problems and you may not want to have. I heard of NL#5 F2 that smelled and tasted like s Shuzzit

"(For multiple sclerosis) my friend is currently using a pure indica (NL#5) wit

Strain: Northern Lights #9

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Sagarmatha Seeds

Images:

Description:

"After years of heartfelt requests for a Northern Lights strain, Sagarmatha has delivered the NL legend. NL#9 delivers the finest qualities expected from that variety: high potency, low stone and minimal smell. The flowering time is acceptable and fat chunky nugs are a bonus in gardens where smell is an unfavorable factor. Also fine for persons who desire a high. Specifications:

Specifications:

~ Type: Indica-Sativa, indoor. Start vegetate: 1 - 2 weeks. Flower for: 50 - 55 days. Height: 0.75 meters. Yield: 300 - 325 g/m2 (dried, indoor)." - Sagarmatha seedbank

Growers Comments:

"My 3 NL#9 girls were harvested last week, dried and are curing now. Plant height was 1.5 meters. I have to say that this is some of the best smoke of all time for me! Low burn, great taste, kick-ass high. I yielded about 5oz. off 3 plants. NL#9 is a Sativa. It's NLxWhite WidowxJack Herer. Pretty intense stone."-KGB

"I chatted with Rosa from Sag some months ago, she said it was WW, NL#5 and it is quite nice...2 thumbs up from all that have tried it...its an up high for me...but man does this shit stink when its in the baggie.... 2 layers of plastic can't hold it in. A friend of mine smoke 2 joints and was he fucked...he turned down the third joint. The next day he looked all hungover.... I've never seen him that high on grass. Shit"-Naughty

"Try NL#9 from Sagarmatha. This strain is NL#5, WW and Durban Poison. I've never smoked a better plant." - SK1

"I have been growing Northern Lights #9 from Sagarmatha for about 8 months now. My yield in hydro is a little over 2 oz's dry per 3 1/2 ft plant. The buds are HUGE and covered in trichomes/crystals. When growing the smell is very minimal but once the buds dry after harvest an 1/8th will stink up your whole house even in Tupperware. Another great thing is that the plant is ready to harvest in 45 days, 50 days tops. I also had a few problems with mold since I have corrected it I am expecting to get 2 1/2 oz or better my next harvest. This strain organically yields a little under 2 oz's using a 400 watt hps." -KB

Strain: Northern Lights X Shiva

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Amsterdam Aloha

Images:**Description:**

"Strong sweet weed, much THC, with big buds and few leaves. Improvement pure Northern Light. This is the # 1 in it's kind. Best for inside cultivation."

Specifications:

none

Growers Comments:

"The one I know is the NL X Shiva cross from Aloha which I like and have grown very potent, wonderfully aromatic and complex. It is also pretty easy to grow that it yields well! An all-around winner, IMO."- Moose

Family: Orange Strains

Strain: California Indica

Strain Type: Sativa/Indica mix **Origin:** California/Holland **Breeder:** Sensi Seeds

Images: 1 2

Description:

"A fine blend of sweet orange flavoured Californian strains, combined with a versatile plant which performs well under all conditions. The more heavily branched plants are big yielders.

Specifications:

Flowering: 45-50 days. Height: 100-130 cm. Yield: up to 125 gr. Flowering in greenhouse: up to 500 gr."- Sensi Seed Bank

Growers Comments:

"Lighting was a 50/50 mix of 1000w MH and HPS. The plants were grown in soil before planting. The plants started out under 40w fluorescent light in 16 weeks, then transplanted to 2 gallon pots under the MH and HPS. Plants were then the lights were turned back to 12/12. After the females were identified, 2 gallon pots. No CO2 was used. The seeds were Sensi Seeds products purchased. Two packs, 32 seeds, were germed in paper towels. These seeds were a bit slow to germinate, others showed a root, but failed to develop any further. Others branched but didn't grow any "adult" leaves, stopping with just the 2 seed leaves. I ended up with 3 looking seedlings, with 3 "runts." The runts were discarded. Of the remaining 29 plants, the plants physical appearance was very similar, with good branching. Finished at 52 inches with the average at 48.3. Dry, manicured weights are as follows: n

The smell and flavor was a little different for each plant, with the largest one a better stone and resin, however. The high is quite "stony," not couch lock, absolutely no hermies with this strain, but 2 were subject to mold, and the g you grow this, keep an eye out for the tell tale signs of "bud rot." If you can t ratio, I would recommend growing this strain." - High Dog

Strain: California Orange

Strain Type: Sativa/Indica mix **Origin:** California **Breeder:** Dutch Passion

Images: 1 2 3 4 5 6

Description:

"A stabilized hybrid, inbred since 1980. Can be extremely resinous, including Indica. Some plants have a pronounced citrus aroma and flavor. Very strong, slightly above average.

Specifications:

~ Flower: 8-10 weeks ~ Harvest: 1st week of Nov." -Dutch Passion Seeds ca

Growers Comments:

"Regarding California Orange... Ed Rosenthal says he knows (it was) develop California in the 70's."

"As far as the Cali O, wheeweee that is one excellent smoke too. This one c mom has been around for many years. Its hard to ever doubt that this is the citrusy it'll make your eyes water. Very coated with a pretty good bud struct Keeps you very stoned and mellow but will not put you down unless you smc most potent, this is definitely on the all time high list, for smell, taste, and qu

"I'm smoking some bud from an original Orange mom right now... she smells like tang, and has a great social high. The cuts can be traced back to Californ ~shabang~

"...This is the same cut of Orange that a few other people have passed arou you consider it is a 7-week strain. You can let it go to 52 or 55 days and it is You can get 1.5+ pounds of organic per 1K of light, in 7 weeks that's not bac Sorry no rough estimate yet Irish, will be ready in time for New Years though one and 2 smaller side branches; I prune off almost everything below what y They're usually an ounce and a half per plant, can go up to two.

I didn't mention anything on the smoke of it. I've grown her so much and fig going on about her quality of stone would be old hat. You got it though-- one Not the most potent but definitely strong enough.

I was smoking earlier samples while I was trimming and more than a few tim trim instead of sitting cause I had too much energy. Amazing the kind of hou you have a bud that doesn't lock you to the couch. The smell and taste are n overload. After rubbing off my scissor hash, my fingers smelled for hours like

of trimming buds. It was too nice of a smell to wash off so now everything ar
This cutting has been around for 20 years, originally from California. Cross-o
stabilized hybrid, looks more like the offspring of two unrelateds. Whether th
guess, but this cut is certainly what "Cali-Orange" is supposed to be. I consid
connoisseur-quality. The orange smell is unmistakable, high is first rate, and
Potency is good, but not great. It's really good smoke and you wouldn't think
live with her a while. I wouldn't be surprised to see a more potent line made
sometime soon. I say its connoisseur-quality for a few reasons:

1) The average krippy smoker wouldn't think twice about smoking the Orang
you high. Nothing outrageous about it, it doesn't hit you like a 2 x 4.

2) The experienced connoisseur will note subtle differences about her that m
crowd. Besides the fast flowering time and good vigor, you have to look at th
head high, the lack of tolerance you build to her, and intensity of the smell. T
excellent. It will range from strong head rush, to relaxing, yet quite energizir
Asking me to pick a favorite between Orange and DAB is a tough one. The D.
average smoker-- resin count, bud appearance; intense rush will make DAB I
Orange has a timeless quality about her. If I could only take one strain to gro
likely pick the Orange." - Shabang

Strain: Orange Bud

Strain Type: Sativa/Indica mix **Origin:** California/Holland **Breeder:** Dutch

Images: 1

Description:

"A 100% Skunk selection, grows with thick hard buds and orange pistils. A ve

Specifications:

~ Flower: 8 weeks ~ Harvest: end of Oct." - Dutch Passion seedbank catalog

Growers Comments:

"This pretty bud lives up to its namesake with light green buds, covered in b
tiny crystals on all the leaves and buds. Its strong skunky smell is actually ta
that accompanies it. Fluffy and light, the buds break up nicely, leaving your t
expansive strong smoke tastes a bit like a brown weed (earthy)--the skunk ta
some green taste lightly in the background. ***1/2" - Homepage Amsterdam

"Mine is also from Dutch Passion. I'll be honest it is not a great yielder. My fir
brown weed taste. My last harvest, #4, hydro/organically, the brown weed ta
undertone. By the way it leaves your mouth watery, not cottonmouth like my
but my friends prefer the OB."

"I prefer the OB to SK#1, one of the 2 other strains I own. I'm doing it in wat
basement with about 6'5" total height, kind a pain in da butt. My version of t

through Jock. Genetically it is about 6 months old, and in its 2nd flowering cycle it's brown but the brown you speak of is noticeable. The strain just isn't as sweet as you'd expect.

"...I've puffed orange bud all over the world from Amsterdam to London to LA. It's one of my favorite strains. At best, orange bud is hispid with very long bright orange pistils and above average crystal production. Very nice cerebral high, wonderful juice. One of the most common high-end strains in America and Western Europe." -Mac

"Orange bud is a great strain(at least Positronics version is.) Potent and fairly smooth. Orange bud due somewhat to its trippy nature. Very clear high. A little light colored. One of the 10 or so strains I've messed with it still rates towards the top. Wish mine was more orange." -kaka

"Oh, yes it sure will stretch during the first few weeks of flowering. I found that if you cut it to 3 inches from the top of the plant and placing a fan to gently blow the top of the plant, it will stretch. Also flush it out with plain water before switching it to 12/12 and adding bloom boosters. It's one of many of my fellow tokers' favorite strain." -Mota

Strain: Orange Strains

Strain Type: Sativa/Indica mix **Origin:** California **Breeder:** Cultivators Choice

Images: 1 2

Description:

Varies

Specifications:

Varies

Growers Comments:

none

Family: Sage Strains

Strain: Sage

Strain Type: Mostly Sativa **Origin:** California/Holland **Breeder:** Undetermined

Images: 1 2

Description:

not listed

Specifications:

not listed

Growers Comments:

"About the Sage--1 of the 2 was Female. She looked sickly all grow, but snap She was very haze influenced. The flowers grow in big, prickly masses. The p needles. It really looks bizarre. However, the haze also means fluffier masse: period. I finally stopped mine at 11 1/2 weeks. I'm sure it could have done be so. My real hope are my Cinderella88/sage seeds. Hopefully it will solidify the flowering period. Who knows? And the high? Well, let me just say that whate was the most devastating stuff I've ever touched. My sage has never quite d a nice energetic up buzz. We'll see how this goes after a nice long cure. All in great one to have around for personal stash..." - shaggy

Strain: Sage x Big Sur

Strain Type: Mostly Sativa **Origin:** California/Holland **Breeder:** Undetermin

Images:**Description:**

none

Specifications:

none

Growers Comments:

"Sounds very similar to the Sage x Big Sur Holy I tried in Amsterdam. Absolu small b-hit was all we needed for a good six hours. Seeing how it's a cross, th rather unstable. Emery has the seeds (but are they F1 or F2?). I got mine ac from him (\$200 for 10 seeds!) Buds aren't too big, but at 47 days they're jus window is supposedly 60-75 days indicating sativa. Taste is spicy, sandlwooc trichomes as opposed to the others like WW. It's hard for me to compare thi time, but I've also got one NL x Skunk x NL. Much larger buds, but they just c development or smell. Also, my closet temps are extreme--often 110F or mo Can't say anything about yield in terms of weight. I've only got 3 plants and only I don't want to get into this, but there's been a lot of talk on other board Unless I was lied to, these are real American genetics and not "merely" a ref (not that there's anything wrong with that!)" -Shaggy

Family: Skunk Strains**Strain: Apollo 11**

Strain Type: Sativa/Indica mix **Origin:** Holland/USA **Breeder:** Soul, Brothe

Images:**Description:**

"This indoor hybrid has a high calyx/leaf ratio & finishes flowering in 7 weeks lemon-scented female clone named "Genius" because of her CLEAR, energetic crossed with a robust Cinderella 99 male to create Apollo Eleven. Expect some of the best females are short, heavily branched plants with multitudes of dense, resinous buds. SCROG. The smoke has a sweet citrus flavour. The high is UP & HAPPY." - Bro

Specifications:

Flowering: 45-50 days ``Height: 100 cm. ``Yield: 1-2 lbs per 1000W lamp.

Growers Comments:

"This Indica dominant strain was created by backcrossing a male cross of ShivaSkunk brother (a JH f2) back to the ShivaSkunk mother. In "cubing" terms that would be a ShivaSkunk.75. Another grower I sent them to liked them a lot too. I'm glad you had success with my strains!" - MrSoul

"I believe Apollo 13 is P88 male X Genius (Princess' more indica type sister) I have a lot of seeds found at the 'Cafe in Adam. The new A11 is P94 or (C99 the more p

Strain: B-52

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seedbank

Images:

Description:

"A truly superior skunk selection. Grows with heavy buds. Top variety for comparison with other Skunks, superior sweet taste and aroma, the well known Sativa influence. Fast flowering for a skunky strain.

Specifications:

~ Flower: 7 weeks ~ Harvest: end of Oct., beginning of Nov."-Dutch Passion

Growers Comments:

none

Strain: BC Skunk

Strain Type: Mostly Sativa **Origin:** British Columbia/California **Breeder:** U

Images:

Description:

none

Specifications:

none

Growers Comments:

“Of the Skunks, I like the Federation's Island Sweet Skunk, which is originally Sweet Pink Grapefruit indica (sweet smell!) crossed with a 1992 edition of Sensi. A strong trippy high, still allowing mental alertness, good big buds, sometimes Skunk influence), very sweet lemony citrus smell and taste. Dana Larsen, the Federation's Island Sweet Skunk as his favorite Federation strain when I asked him to name his second choice. You can work especially well on the Hawaiian Sativa, the HAW, and the impairment there, either.

Dutch Passion uses a Hawaiian indica in their HAW/Skunk, which is a very big 65% indica/35% sativa.

The Federation Hawaiian Sativa crossed Island Sweet Skunk (tremendous potency, mostly sativa, 15% indica, and I would endorse it, and yields on the ISS and HAW sativa would take 9 - 14 weeks flowering.

My favorite Canadian breeder is Steve of Spice of Life, currently working with several marijuana farms that are there. However, I smoke a strain by Federation daily, so I am very familiar with many of their varieties at any one time to choose from, so I am very familiar with many of their varieties to be 5 out of 10 of my top 10. (Mikado, Romulan, Hawaiian Sativa, Island Sweet Skunk, Triangle Thai sativa).

To that I would add at least one Greenhouse strain by Arjan (White Widow), and one by Flo (D.J. Short, who is from western USA), when its from the Netherlands, nothing seems more affecting than the Northern Lights x Haze, but its hard to find in the Netherlands of Amsterdam even with Sensi Seed seed stock.” - Marc Emery

Strain: Big Treat

Strain Type: Mostly Indica **Origin:** British Columbia **Breeder:** Breeder Steve

Images: 1

Description:

“Dutch Treat Female x Big Skunk Male (Sensi '95) Faint smell. Frosted product, ready for harvest in 8 weeks.” - Spice of Life Seeds catalog

Specifications:

none

Growers Comments:

none

Strain: Euforia

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Dutch Passion Seeds

Images: 1

Description:

Developed by our breeders in 1996. A very fine Skunk selection, very common harvest, the famous Skunk high. Taste is not as sweet as our other Skunk favorites. Good for greenhouse as well.

Specifications:

~ Flower: 7 weeks ~ Harvest: end of Oct., beginning of Nov.

Growers Comments:

none

Strain: Lambsbread Skunk

Strain Type: Mostly Sativa **Origin:** Jamaica/Holland **Breeder:** Dutch Passion

Images:

Description:

"The famous Jamaican "Lambsbread" crossed with Skunk #1 (F1 hybrid). A variety with long slim buds, has a medium yield and is almost 100% Sativa.

Specifications:

~ Flower: 9-11 weeks ~ Harvest: 1st half of Nov. in greenhouse

Growers Comments:

none

Strain: Pole Cat

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Sagarmatha Seeds

Images:

Description:

"A synonym for a pungent skunk, this girl produces flowers and highs similar large with lime-green hues and orange pistils. Very nice for persons who enjoy tops and a strong stone. She is a fast finishing plant that gets you in and out for commercial enterprises.

Specifications:

~ Type: Indica-sativa, indoor and outdoor. Start vegetate: 1-2 weeks after root time: 50 - 55 days. Average height: 0.75 - 1 m. Yield: 300-350 grams / m2 (check catalog)

Growers Comments:

none

Strain: Sensi Skunk

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Sensi Seed Bank

Images: 1

Description:

A strong plant with that typical Skunky taste and high. It has a high calyx-to-
excellent yield makes this one an absolute must for the greenhouse grower.

Specifications:

none

Growers Comments:

“At first look, these buds seem to be red with light green leaves interspersed
really possible, but honestly it does look that way). These compact, spongy buds
skunky undertones. Broken up, the buds take on a green, fertilized scent. Well
tastes a bit spicy, like a smoky-curry flavor and is smooth and mildly expansive.
example of "creeper" bud in that it comes on slowly but expands over a period of
Homepage Amsterdam

“Plant Profile: Short internodes especially while a seedling through about the
serrated; sativa/indica phenotype.

Aroma: VERY skunky. One rolled joint sitting out in an ashtray is enough to *
Taste: Sativa taste; grassy, fairly smooth on the palate, not fruity nor piney.

Yield: Good, 4 3/4 oz. on a 27" plant grown primarily for seed production not
from Posi.

Bud profile: Buds (trichomes) very gold in color, tight nuggets, fairly bulky and
High: Excellent. Deceiving though: it is definitely creeper weed. Three hits from
keeps on expanding. 15 minute lag time at least before it really hits you. Still
"Haze" type high at all, cerebral with a nice body stone.

Comments: Nice plant, great high and excellent value. A few yellow male flowers
before harvest at 80% trichome browning (yellowing).” -Uncle Ben

“It was the LACK of a skunky smell that really surprised me. If you are growing
double. I can testify that this is a fact ...(5 year hydro grower, now back in sc
will turn hermie if you don't allow a veg time of 2 weeks or so before inducing
by clones. I had 5 out of 5 turn hermie from the same mother, and found the
according to Alan Dronkers from Sensi, this variety has recently been back c
chose out of 30 displayed a 60/40 Afghani -dominant characteristic. I will keep
in the Cannabis Cup each year as a "standard" if it weren't for politics, it sho
this to be a simple Mexican-Afghani cross, which might explain why it perform
mess that makes up so many of the popular varieties today.” -Siege Gun

Strain: Shiva Skunk**Strain Type:** Sativa/Indica mix **Origin:** Holland **Breeder:** Sensi Seed Bank**Images:** 1**Description:**

"This cross between Skunk #1 and Northern Lights #5 is a very reliable variety. The high yield and fast harvest time make this one a snap to grow. Works superbly indoors as well as in a greenhouse. The flavor is similar to Skunk #1, a rich sweet pungency, but with more resin and better yield. The buds are almost impossible to trim with scissors as very little manicuring is required. Ask the experts." - Sensi Seed Bank catalog

Specifications:

none

Growers Comments:

"I know that Nevil's NL#5 was the seed mother for the "Shiva Skunk cross. Her mother was Basic 5 (Basic 5 strain etc. As for Basic 5 being the same as NL #5, well, I'm taking Mr. Soul's experience etc.) One thing I can add is that I remember the original Skunks had a much stronger resin content than most of the skunks today. It may be just a fond memory but I recall the high being like a bell sound going off in my head after smoking skunks (10 years or so ago). Perhaps it was just an attractive strain for some. I'm not saying that today's shiva skunk is not as good as the original. I know this for a fact. I've only grown Nevil's, not Sensi's. If Dr. T's friend has a chance to grow a rare treat. "The resin Mother that started it all' so to speak." - Prince Caspiar

"I would suggest Sensi Seed's "Shiva Skunk" (NL#5 X SK#1). Very close nodal structure, high yield and it will finish in about 55 days. Very high calyx to leaf ratio. Great for SOG. I've grown for 4 years in a SOG format and I was very, very impressed. Very easy to grow. The only problem I had is that after about 3 years the high started to get a little weaker. It just seemed to lose some of its vigor. So if you used it for 2 years you are looking for." -imposter

"The most potent I have had to date is probably Shiva Skunk, a close relative of Skunk #1. It is very hallucinogenic. Not to be smoked if you have to operate any machinery with

Strain: Skunk #1**Strain Type:** Mostly Sativa **Origin:** California **Breeder:** Cultivators Choice**Images:** 1 2 3**Description:**

"Winner of several harvest festivals, and "High Times" Cannabis Cup. Skunk #1 is originally a cross between 25% Afghani, 25% Mexican Acapulco Gold and 50% Northern Lights #5. In 1978, now a stabilized homogeneous strain. Blooms with long, thick buds, very resinous and golden. Very high flower to leaf ratio. Soft and sweet aroma and a very strong high. Great for indoor growing or greenhouse with darkening system. Very high yields. Easy to grow.

a standard against which others can be measured.

Specifications:

~ Flower: 7-11 weeks ~ Harvest: 1st half of Nov. in a greenhouse." - Dutch F

Growers Comments:

"M9 originally developed by the Sacred Seeds Co. A winner of a number of h sought after strains in the world. Ten years ago the sweet Skunk #1 arose fr Thai. It is now a stabilized homogeneous hybrid with less than 5 % deviation: selected scientifically. The high is very strong and up. Examination tests sele percentage of THC. A THC percentage of 15% was indicated by gas chromat calyx to leaf ratio. Large long buds. It finishes the first week of Oct. Growing plant often has yellow shade leaves. Neither is deficiency. The yield varies fr average of 500 grams. Yields of up to 2000 grams (5 pounds!) have been rec growers can, by using the plantlet method, harvest 400-500 grams per squa catalog 1987-88

"Regarding ...Skunk #1, Ed Rosenthal says he knows (it was) developed by C the 70's."

"Skunk #1 = originally developed by the Sacred Seed Co. (Cali/ Holland) Sk# Colombian X a Thai. As far back as 1987 they were reporting its stability to 10 years later it has to be one of the most stable strains around." -Prince Caspia

"Original Skunk#1 is a relatively true-breeding cannabis sativa crossed cann with a heavy tendency to its cannabis sativa parentage. Original Skunk#1 w in the late 1970's for outdoor and glass house cultivation. It has also proved indoors under lights. Original skunk #1 is a medium green and medium broa that produces large, long floral clusters with very few leaves. The yield per s grown densely packed and strongly lighted can approach 40 grams of dry flo sweet & sour aroma and the taste is full-bodied and satisfying. The high is po Original Skunk #1 requires 8 - 11 weeks of a 12 hour photoperiod to mature. Skunk #1 makes an excellent choice for male breeding material. It was selec sativa cross c. afghanica F1 hybrid crosses for its consistent true-breeding q Skunk #1 is an inbred-line that came from a naturally combining hybrid sele breeding qualities, rather than a forced hybrid made in an attempt to blend t varieties with specific desirable characteristics. In other words, Skunk#1 has General Combining Ability (CGA). Simply crossing a select Skunk #1 with aln improve it. " -High Times magazine

"Well, that explains its massive popularity from 1980 - 1992, afterwards a de began. Skunk #1 and Big Bud , both powerful and good yielding when they c simply had been outpaced by the developments in the field of commercial & My favorite Skunk experiences include these strains: Island Sweet Skunk (Fe Spice of Life, which is Sweet Pink Grapefruit indica crossed Big Skunk#1 (Se citrus Skunk with a compelling high, and matches the description of the Skur Jack Herer, here, the Skunk makes the Haze work without paranoia, but its fi results at home.

By the way, in the CNN show Impact, 'The Prince of Pot' sequence regarding standing in a room of identical Skunk #1 single cola plants (154 in the room) Has anyone noticed that really reeking, road kill skunk smell that used to be pungent but less cutting smells. I think Northern Lights with its low odor gene market has in time reduced the skunky smell of pot, and NL and SK#1 are so The Sweet Skunk by Brothers Grimm may well be a further development of the I.S.S. by Federation." -Marc Emery

"I've grown skunk 1 and hybrids made from it for nearly 20 years. To get a run you need to be less than 40 deg from the equator it will need at least 10 weeks. With good cultivation will make 3 to 4 meters high and yield a pound or so of buds needs a minimum of 50 w per sq. ft and preferably double and takes 9 to 12 weeks. 75% sat and cant be grown like a modern indica hybrid but when grown properly a good run for the money." - Oldtimer1.

"Skunk #1: This plant is super resinous, has a marvelous sweet smell (does not burn). Harvested at day 57, it could have gone another 10 days. All pistils were brown. Calyxes were swollen. The smoke is about 40% body, 60% head. I like it for relaxing. Can maintain a buzz before lighting and during smoking. Buds are very dense. This one is a keeper."

"The high is nice. It is strong, yet mellow, and yet still pretty alert. For overall effect comparable to couch-lock indicas that we have today, but it is still a good smoke. It would be considered high-quality kryptie grade smoke, but it's not that one - a good plant to start with, very easy to grow, very cheap, and should be good source you get them from." -shabang

"I find that no matter what I do skunk just seems to be light and not dense. I think it's low in nutrients, but the stuff dried always seems airy. Its super stoney, sticky, skunky, but great for production strain." -sketcher

"I hate the taste. That's just me, most people just think "oh that tastes like good weed" but it's bad. It has a sort of sour-milk taste, kind of bitter. Hard to describe, it's really just the way the Dutch Skunk #1 tastes. When I first tried it I told him not to taste at all. Then he told me what it is and I agreed :-)

I have been growing sk #1 for years...my seed stock was bought back in the 70s from the seedbank. I think that sk 1 is a classic...very easy to grow, potent, good yield, grows well under many different growing situations, indoors or out. The plant has a lot of variation. It also takes topping well, with little shock, and you can grow beautiful trees by topping them. The taste is nothing extraordinary, and it takes a little longer to flower than strains... 'bout 70 days flowering." - ol'hippie

Strain: Skunk #1 - Basic 5 hybrid

Strain Type: Mostly Sativa **Origin:** California **Breeder:** Super Sativa Seed Bank

Images:

Description:

"M39 Skunk #1 crossed with the Basic 5. This hybrid was a harvest festival v a female clone which has been cultivated successfully in Holland for quite so demonstrated it's value very well in indoor growing as well as in outdoor gro proved to be the best during commercial cultivating, has been chosen by us hybrid. The Basic 5 is a small, solid and thickset indica plant with heavy buds suited very well for indoor growing, the high is extremely heavy. This hybrid indoor and outdoor growing. Using the plantlet method, an indoor yield of 20 square meter per year is possible. These yields can be increased still further when they are only 6 inches tall. Harvest outdoors: Oct. 1." - SSSC, 1987 cat

Specifications:

see description

Growers Comments:

"I believe Basic 5 was simply a name SSSC used in the place of NL#5 because wasn't yet a "household name".

This would mean that M39 = NL#5/SK#1 = ShivaSkunk.

I grew M39 back in the late 80's and I have been growing ShivaSkunk during genetic variation into consideration, they seem to be the same plant...although slightly superior plant - it's probably just nostalgia.

Sad story: When my ex-wife and I moved into our ex-house, I had a vial with box of old books. She was cleaning the basement one day and found the seeds. I acted like I didn't remember putting them there. She turned around and threw them on the stove. I don't miss HER at all - but I SURE wish I still had those SEEDS. I worked for SSSC for two years in the mid 80's. I never asked "Kees" exactly what I wish I did because I've lost touch with him over the years. I can't say for sure my impression." - MrSoul

Strain: Skunk Indica

Strain Type: Sativa/Indica mix **Origin:** Holland/USA **Breeder:** Positronics

Images:

Description:

"Outdoor / Greenhouse With 100% Skunk seeds, it's not possible to grow full the seeds were selected for growing under artificial lights. Skunk was crossed mature sooner and to make the plant stronger for outdoor conditions. This is out as a very nice outdoor strain. Flowering period: 7 weeks · Harvest time u September, 2nd week of October." - Dutch Passion seedbank catalog

Specifications:

see description

Growers Comments:

none

Strain: Skunk Passion

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seeds

Images: 1

Description:

“Skunk is the best known variety to the indoor grower. Skunk Passion is a seed variety that was based on early flowering. It’s not used for growing these seeds outdoors in Northern Europe (Skunk/Indica). The strong pungent smell is characteristic of this variety. Meant for indoor growing, over and underfeeding. Sweet and soft smoke, very high.

Specifications:

~ Flower: 8-9 weeks ~ Harvest: 1st half of Oct. in a greenhouse” – Dutch Passion Seeds catalog

Growers Comments:

none

Strain: Skunk Red Hair

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seeds

Images:

Description:

“The variety which made indoor growing possible since 1985. Still one of the best outdoor if care under right conditions.

Specifications:

~ Flower: 8-9 weeks” – Dutch Passion Seeds catalog

Growers Comments:

none

Strain: Super Skunk

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Sensi Seed Bank

Images: 1 2 3 4

Description:

“This plant is especially developed for Skunk lovers. Crossed of best Skunks

against this plant and the room becomes immediately filled with powerful Skunk #1. A very pleasant high with a little more body to it than the Skunk #1. One of the winners at the Harvest Festival where it clearly defeated Skunk #1.

Specifications:

none

Growers Comments:

"Super Skunk = Sk#1 X Afghani (a skunk #1 backcrossed to an Afghani indica)

"I've grown Super Skunk (sensi'95) and it performed very well (especially since it's an indica so). It would make a great commercial weed-- very resinous, nice fat buds, thick deep smell, I don't like it but many people do. The high is strong and covers you up and makes you sleep if you smoke too much." -shabang

Strain: Trance

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Dutch Passion Seeds

Images: 1

Description:

"An upgrade of the former variety Skunk/Indica. With 100% Skunk seeds, it's a very nice strain for outdoor plants because the seeds were selected for growing under artificial light. It was crossed with an early Indica, to let it mature sooner and to make the plant sturdier. This is the F1 generation. It has come out as a very nice strain.

Specifications:

~ Flower: 7 weeks ~ Harvest: end of Sept., 2nd week of Oct." - Dutch Passion

Growers Comments:

none

Family: Uncategorized Strains

Strain: Amstel Gold a.k.a. Passion #1

Strain Type: Indica **Origin:** California/Holland **Breeder:** Dutch Passion Seeds

Images:

Description:

Amstel Gold is an Indica variety developed in California in the seventies and Holland since 1980. Smokes soft with a citrus like aroma and has a good high compact resinous buds. One of the best green outdoor varieties in our collection.

Specifications:

~ Flower: 6 weeks ~ Harvest: end of Sept., 1st week of Oct.” - Dutch Passion

Growers Comments:

Dutch Passion was asked by AMSTEL BREWERIES to stop using the name for seeds are to be called Passion #1, but I'm not using the switch name yet, its changes while genetic make-up remains same.” - Marc Emery

Strain: Bazooka

Strain Type: Indica **Origin:** British Columbia **Breeder:** Undetermined

Images:

Description:

An excellent green variety. Not much known about this strain but the breeder results indoors and out.

Specifications:

Specifications:

(indoors) ~ Flower: 55-60 days ~ Height: 5-6' ~ Yield: Above Average (outdoor) ~ 1st ~ Finish: Sept. 15th ~ Height: 6' ~ Yield: Above Average” - Marc Emery

Growers Comments:

none

Strain: BC Hash Plant

Strain Type: Indica **Origin:** Afghanistan, British Columbia **Breeder:** Undetermined

Images:

Description:

none

Specifications:

none

Growers Comments:

“This strain is the BC Hash Plant. The origin is back in the pre Russia invasion Asian type weed strains smuggled back to the islands 25 years ago. The base Today this strain is reputed to be grown as large as 4 lbs. a plant in hydro system friend Norm of Arthrology had a picture of himself in such a room brought into

has also been grown on tables and dirt with good results. The colour is light and sweet pungent smell that loses its strength as the buds are smaller. You can smoke quantities without everyone in your immediate area knowing someone has smoked as long as it's fully matured and cured with a bit of time. Just one slight time. So in these seeds you will find plants with the back genetics of 100 generations. For an inexperienced grower what does this mean? You will find a higher than liked one. Secondly you will find a variety of height and strength with in each plant getting ten seeds that you will get any two to look the same. For the personal because each plant will give a different buzz. No tolerance builds up. For the germinating 75 to 100 plants to find two or three mothers that you like. Need want to here is there too. Hermies. You can expect that under any real heavy overfeeding, and problems in flower stressing, may result in a large hermie bud still may be a few stamens appearing. This is because the back breeding has preferred." - Bongblaster, Seed-Bank.com

Strain: Beatrix Choice

Strain Type: Mostly Sativa **Origin:** Mexico, South Africa, Holland **Breeder:**

Images:

Description:

Beatrix Choice was one of the original offerings from the Super Sativa Seed Company 1987-88 catalog, as well as their 89-90 catalog. Here is how it was described: "Plants were selected for the quality of the high. Extremely strong. The father strain and the mother was a very potent Indica/Sativa strain (Afghani-south African) - my own favorites. Very suitable for outdoor and indoor growing. You can harvest overpowering, trippy buds. Harvest in Holland: middle of September". - Super Sativa 1987-88

Specifications:

none

Growers Comments:

none

Strain: Big Mac

Strain Type: Mostly Indica **Origin:** British Columbia **Breeder:** Federation of

Images:

Description:

Specifications:

Growers Comments:

"If you like indicas then you can't go wrong with Federation strains. Big Mac is well, and the taste is almost a sweet hash like, the high is great unless you come with pain, only draw back for me was I could not sleep for hours after I tried (evenings) kept my mind very active but body was not going anywhere." -mo

Strain: Big Sur Holy Weed

Strain Type: Mostly Indica **Origin:** California/Holland **Breeder:** Undetermined

Images:

Description:

none

Specifications:

none

Growers Comments:

"When I went to A-dam in November, they had the SAGE bud offered by THS by the breeder in A-dam that Sage was Big Sur Holy Weed x Haze. I was also was his nicest yielding/tasting Afghan. Bud was top notch, hope this helps."

Strain: Blue Mountain Jamaican

Strain Type: Sativa **Origin:** Jamaica **Breeder:** Wild Rose Seeds

Images:

Description:

Sweet, earthy taste, rare to find. Resinous large buds with few sucker leaves.

Specifications: Cuttings of this strain can be brought to maturity in 65-75 rooting. Seedlings need to veg for 35-40 days. Flowering time 65-75 days

Growers Comments:

none

Strain: Bolivian

Strain Type: Sativa/Indica mix **Origin:** Bolivia **Breeder:** Positronics

Images:

Description:

"Imported, pure breeding Sativa/Indica: more Sativa

Specifications:

Appearance: looks like Mexican, slim buds Smell/taste: not especially great
Height: 2m Yield: med Harvest date (Netherlands natural photoperiod): end :
(# of weeks): 7-9 Indoor / greenhouse / outdoor Typical Bolivian, matures ea
catalog

Growers Comments:

none

Strain: Champagne

Strain Type: Indica **Origin:** British Columbia **Breeder:** Undetermined

Images:**Description:**

none

Specifications:

none

Growers Comments:

"Champagne is a Kush indica from Vancouver, BC I have the clone and as far as I know it's the only one. It's a great yielder with excellent crystal and ranks 8+ on my scale. Unfortunately it doesn't make the grade compared to my 9+ plants, but a good indoor plant anyway.

Strain: Chemo

Strain Type: Mostly Indica **Origin:** Canada **Breeder:** Undetermined

Images: 1 2 3**Description:**

A legendary potent British Columbian indica strain rumored to have been developed by the government as a medicinal strain for cancer patients. Now apparently found in BC.

Specifications:

none

Growers Comments:

none

Strain: Cream Sodica

Strain Type: Indica **Origin:** British Columbia **Breeder:** Breeder Steve

Images:**Description:**

>"Named for its live scent and colour. The finished product has a dry aroma with overtones of black currants. The heritage of this strain is the result of a cross between Gulf Island strains from neighbouring islands. The result of this cross has been

easily manageable and distinct strain in itself. It is intended for a hardy outdoor mold-resistant, cosmetically saleable buds. It works; the boys are getting rich

Specifications:

Outdoor Harvest: Sept. 7th (at the latest)
Outdoor Yield: 500 gm / plant
Indoor Harvest: flowers in 44 days
Generation: F7

Growers Comments:

None

Strain: Early Bud

Strain Type: Mostly Indica **Origin:** British Columbia **Breeder:** Undetermined

Images:

Description:

“Fast flowering, big buds. Fresh citrus like taste, nice high. Very similar to early

Specifications:

~ Flower: 8 weeks ~ Harvest: Sept.” Marc Emery Seeds catalog

Growers Comments:

none

Strain: Early Girl

Strain Type: Mostly Indica **Origin:** California **Breeder:** Cultivators Choice

Images:

Description:

“This is a mostly Indica variety, one of the earliest in our outdoor collection. hashy taste and aroma. These compact plants will tend to grow to one main balcony.” – Sensi Seed Bank catalog

Specifications:

Developed: inbred 10 plus years - Stabilised hybrid: not consistent Sativa/Indica many with columnar shape, tends towards Indica habit; some turn purple with coarse hash taste, not sophisticated Type high/strength: medium plus, physiological - Harvest date (Netherlands natural photoperiod): end Sept / begin Oct 12hr (weeks): 7-9 Indoor / greenhouse / outdoor Selected for earliness” – Positronic

Growers Comments:

"Regarding Early Girl, Ed Rosenthal says he knows (it was) developed by Cult 70's."

"Early Girl - This is a mostly Indica early variety developed in Northern California, very sturdy, and will tend to grow to one main stem. Very potent, medium yield. Inbred for 4 generations and carefully selected for quality and earliness. Early growers seeking an early Indica-type.

Outdoor Data -

Height: 4 - 6 ft.

Finishing date at 40* N.: Sept. 1

Yield: 1/2 pound

Price: \$50 for 15 seeds" - The Seed Bank catalog, 1989

"I grew this last year outdoors. about 5' tall at harvest, lots of short side branches. yield was about 4 oz. of average quality weed. excellent hashy taste which peaked early then started to decline. high was average and didn't last very long. maybe due to being susceptible to bud mold in high humidity." dr.atomic

"I grew it, or at least something called Early Girl, that I got from Holland in the 70's. It's all the way around in my opinion. About average yield, high, and everything else done at the same time and liked it a little better. That was a while back, though. The last few recent years." - Been There

"I don't know where they get that crap about it finishing Sept. 1st. I was at 40* N. and they didn't finish until about the end of September. I do remember that there were some seeds, maybe I just got some slow ones. Or maybe they were just lying too."

Strain: Early Pearl

Strain Type: Mostly Sativa **Origin:** California **Breeder:** Sensi Seed Bank

Images:

Description:

"Mostly Sativa with excellent potency. Sweet, resinous and mold resistant. A classic indica-sativa hybrid." - Seed Bank catalog

Specifications:

none

Growers Comments:

"Ed Rosenthal says Early Pearl came from the Midwest, but was a cross of Early Girl and California sativa."

"I've grown this both inside and out. If you do a search, you'll probably find some information written on this type; In brief, it is effectively pure sativa (though actually has some indica genetics).

recessive in all respects). Inside and out, it likes to grow large. Stretch continued for a respectable 8 weeks (the only virtue carried over from early girl). Bud: strong, very good sativa high- quite psychoactive (trippy?). Little paranoia, very big plants, yield is low, as could be expected from such a plant. At present I'm re-vegging started, but now it looks like it's going to go back into flower again. HUGE." - retro13

"I grew EP last year for the first time. I didn't get them to maturity, because of me, along with a VERY wet autumn, so my yield was almost nil. I planted out after frosts during which some purple showed. I planted them out after sexing because once these plants start to flower, they don't like re-vegging, so a couple of plants was the result. Water soluble slug pellets resulted in the plants being damaged soon after. I reverted to my other type of (non-soluble) slug-pellet and the damaged re-grew in veg form, the others continued in semi-flower. Something odd happened to take note of- I had 18" to 2' chicken wire fences around each plant, but some of the newly growing plants (this was early July)- rabbits that could CLIMB FENCES! around the top of the wire-tube, and this stopped the damage. Having been planted in July, the plants reached about 6' by week-1 Oct. During the whole summer, they were not rained on VERY heavily, and for the last month of their lives they were kept moist. Only one plant showed any signs of mold (and this one showed only a little). I'm extremely pleased with.

They're funny plants when it comes to cuttings. They seem to be much slower to take an amount of vigor that is inherent in the breed means that the cuts don't die- they just do much. I took cuttings of my over-wintering mother which took about 3 weeks to root. The cuts didn't look ill, and didn't grow, they just 'existed'. The mother plant died to get freaked out and started to flower. It flowered though most of winter, though I don't know why.

The smoke is good- smooth, sweet, menthol/lemony. It has a lot of central ancestry. The high is long lasting and 'happy'- a day-time smoke. The buds are in two phenotypes (ratio 14:2)- 14 plants had broad, long leaves, high vigor, high yield (finishing at 4-5'), more compact, started flowering earlier, but didn't mature with thinner leaves. Some of the large phenotype flowered with pistils the color of orange. It's not the easiest plant I've grown, and this may account for why it's not more popular. It's definitely mold resistant beyond any doubt. These plants get the yield from the density of the buds, so try to ensure a good size by July, and DONT pinch it off per plant this year- I've put them into my best patch." - retro13

"A FOAF grew Early Pearl for a couple of years. it's nice and versatile. a foaf grew in rockwool under a 400w it yields a/ just <1 oz. at 3 ft. by topping them. outdoors around the end of September out, 8 weeks in. A foaf think the plant is a mix of sativa and indica. node spacing than you may like indoors like a sativa, but it grows fat wide fan leaves. of mixed too, a little spacey, followed by complete body freeze. its nice..." - c

"I have a strain grown here for at least 10 years. I believe its Early Pearl due to the catalog. Inbred for many generations, but no signs of wackyness!! Some varieties are part short, very bushy and branchy. Thick medium length buds with many crystals however. High is excellent as well as flavor, sort of sweet but not fruity. Does not have the strain I ever seen for indoor production. Very fast to bud, 6 weeks to 7+. The plants are shorter than seven weeks. A 12" plant put into 12/12 will only stretch to 20-22", but

Widow which I like slightly better for taste and high (maybe from years of sm... the EP? is 3 times that of the WW and in 6-7 wks not 8 wks. I would like to ge... what it was so I could reintroduce some of the possibly lost genes. However, time. If this is EP, many don't know what they're missing, cause this is THE s... nugs. I don't know why it doesn't have a more known reputation!!!" -green h

Strain: Early Skunk

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Sensi Seed Bank

Images:

Description:

"A cross between Skunk #1 and Early Pearl. Finishes two weeks earlier than smooth high, mold resistant and a good yielder." - Sensi Seed Bank catalog

Specifications:

none

Growers Comments:

none

Strain: G-13

Strain Type: Indica **Origin:** Mississippi USA **Breeder:** U.S. Government

Images:

Description:

none

Specifications:

none

Growers Comments:

"The Headquarters Seed Bank in Amsterdam, later known as the C.I.A. (Can... called O.G.13b. The (mid-80's era) catalog stated:

Variety: mostly sativa

Cultivated: U.S. genetics manipulated in Holland

Breeding: stabilized hybrid

Smell/Taste: sweet and spicy. Effect: overpowering, stupefying high

Appearance: many flower clusters, covered with resin

Flowering: 11-14 weeks. Harvest date: late November

Yield: Indoor - 225 to 275 grams per square meter. Outdoor - 150 to 200 gra

Height: 2 to 3 meters (Indoors: Sprawling Sativa).

Also, The Seed Bank's 1989 Catalog sold G-13 x Hash Plant and G-13 x North 'G-13 is an outstanding pure Indica cutting reputedly discovered by the gove... Mississippi. Widely grown as a commercial indoor plant in the US, G-13 has p... breeding plants in our collection'."

"The G-13 pure, 55 - 60 day sativa (sic), doesn't exist in male form any longer offered in 1988 by Nevil's old bank. A description from an old catalog would someone out there will. Sensi's version is a female propagated by cuttings for female was pollinated by the stout afghan HASH PLANT male, and that is the I sell g-13 x Skunk by THC seeds of Amsterdam, but candidly, it doesn't get G-13 has become very strong since HIGH TIMES magazine featured a photo of 28%, the highest they have ever seen. Sensi responded to this interest, and it is expensive. I know no one who has grown out the seeds to fruition yet. So in female cutting: William's Wonder, Garlic Bud. Anyone can think of any other

"From an article about what Nevil Schoenmaker grew: G-13 is a very potent short internodes but a longer less webbed leaf. Although very strong, it seen excellent plant for breeding." -Hightimes, September 1990, page 50.

"If you are in the Deep South like Mississippi or Alabama, there are lots of ch Sometimes people sell blowaway as "G" short for g-13. But looking at the pic more like a Kush than a fat indica leaf." -Johnny Reb

"If you want the best of the best then I suggest you start searching for the p is strongest bud today (I've never smoked straight WW but have had crosses a very strong head buzz it pales in comparison to the G13 strains). I have a C with huge fat blades. This baby produces trichomes with heads instantly with finished its just has thick white golden look all over has a deep penetrating n told that smell is a 10 cause it's so deep and pungent, with a deep orange fla size golden nuggets (I have a 400; maybe with 1k it will do a lot better). The you up for a high lift, then suddenly it will slam ya back with force. VERY STR tried against 6 strains: NL5 Sensi, AK47, Kali Mist, Yumbolt, Blueberry, Jack f in potency taste and smell." - Dankmaster

"It seems to be predominately indica, but it could be anything. My particular came from the Mississippi farm. Fat leaves, red stems (leaves), usually only even seven. Super resinous, and a fast finisher. This is definately a hybrid. At k something worthwhile." -Airborne

"The G-13 was 43 days in 12/12, and while I might have let it go to 50, I need have let it go to 64 before and it was MUCH too long. The G doesn't yeild as buzz is outrageous. I'm so spoiled that I won't smoke anything else. The yeild than my previous harvest in soil. Also, with this breed I think a good veg time

"For what it is worth, I always heard the name G-13 came from the person w standing for Government and 13 representing the 13th letter of the alphabet Government marijuana" - Prince Caspian

"Sensi Seed offers g13xhashplant and that was it. It is the same as the one s of Black Domina. I learned this at the Sensi Seed shop 1 day after I bought th Dronkers hands at the Pax party house. I spoke to Tony about the Mantanusl smoked it and none is ready yet. I picked up 10 Mantanuska and 5 peak19 b Stonehedge) for 300gilders (about \$175american). Adam from T.H. Seeds (T the Bubblegum and Californian genetics) told me its "Sag's big bud" with "gr in potency" and that the Stonehedge was a "more rewarding high/plant to gr

perfect compromise/partnership." - Damion

Strain: Kali Mist (a.k.a. Western Winds)

Strain Type: Mostly Sativa **Origin:** Oregon, USA **Breeder:** D.J. Short

Images:

Description:

Medical: Multiple Sclerosis“ Serious smokers know, pure Sativa is a smooth s forgotten. Kali is a superb Sativa with a high calyx-to-leaf ratio, and long run buds. Expect this goddess to produce a high resin content with spiral buds th Kali Mist won the 1st Place Cannabis Cup in High Times 1995 hydro competit expert gardeners!

Specifications:

Sativa, Flower: 70-77 days (63-65 days in actual reports) Yield: 275-425 gram 1.2-1.5m.” - Serious Seeds catalog

Growers Comments:

" Kali Mist from Serious Seeds was another winner (at the 1996 Cannabis Cu high-energy, uplifting high that could cut through a dissipating high from a p joint(not Kali) one night at about 11 p.m., another at 2.00 a.m. and then Kali cut right through my fatigue and fog, energizing me enough so that I couldn' saw colors and patterns the likes of which I haven't experienced from mariju from the bud's appearance, Kali appears to have much Southeast Asian char full or weighty as any of the other samples. I suspect if it were grown outdoo complete until very late in the year.

I grew Kali Mist ancestral stock in the early 80's in Oakland and those plants into December. The looser, somewhat feathery buds of Kali Mist would prese looking for weighty buds. Despite these shortcomings, I liked it very much -it were to grow for personal stash, I would grow Kali." -Mel Franc, High Times M

"I got to smoke some KM bud this week (sent to a friend from a friend) The t -floral, spicy with a funky stank that I've only tasted in types that come from only rate the high at 7-7.5 AND it took 14 WEEKS to finish!!" - greenbear

"I have clones from two females that I'm growing for the second time, so I ca who are curious about this strain. I got my seeds from Serious Seed Co., whi authentic article. I read Mel Frank's review of Kali Mist in a sidebar article of couple of years ago. He gave the description (and provided a matching pictu strain that sounded quite like Original Haze. However, when I grew the seed: like a NL#5 had been crossed with the plant Mel described. The leaves were dense...only the individual floral clusters growing off the sides of the colas lo The flavour and scent are spicy and delicious - the high's very pleasant, but GOOD, as the colas are rock-solid, but the flowering period is an awkward 9

“(The Dutch) have bred some excellent strains which have become popular, to be ruined by back-crossing to an Afghani (presumably to increase yield). Sensi's Durban.

That's my personal "pet peeve" of the Dutch strains. Once a strain is established and available, it should remain the same. Or, if the breeders change the genetics else it's fraud. Serious Seeds has never (to my knowledge) admitted that the ones now are NOT the original genetics...but many of us here know that today's K

Strain: Kong

Strain Type: Indica **Origin:** British Columbia **Breeder:** Laughing Moon Seeds

Images:

Description:

“Kong is the next step in plant genetics for yield. Easily capable of yielding 4 misprint! Kong is not Big Bud, or a Big Bud derivative. They're has never been cannabis production. Kong will be the benchmark by which all other plants are purchased for \$40,000. And now after a year of intense testing and experimentation crossed the Kong super plant mother with an early and potent White Russian of these plants are from diverse genetic gene pools you can expect very good days and potency is extremely high. It doesn't get any better. This plant will Colas for this plant will reach sizes equal to a 2 Litre Coke bottle! This plant in last 2-3 weeks of flowering.” - Laughing Moon catalog

Specifications:

none

Growers Comments:

"I've been promising you all a report on Kong when she finished. She's just finished sending ~S~ pictures and maybe he'll post them and give everyone a looksee Pheno-types from it's hybrid crossing. I call one tall and the other bush. The Russian x Bubblegum side. Long slender buds up to 16". The smell and taste I've ever tasted. Ok what everyone's wanted to know , the potency. One word with my best. I can't honestly report on the yield yet but well over a pound a yeah I know , taller than tall , has dense , chunky buds and will be the biggest not as sweet as it's sister but holds her own well. The potency is very good. production. I just got a first class digital camera and will show you through ~ these seeds until June. If you're wondering should you try Kong? I give it my work , Paul , you've got a winner!" - Danbo

"This is my first time growing. I used 2 1K lights, 6" pots, 8 X 4 flood table, G formula. The flood table fits 36 6" pots. However, I only grew 10 female clones 10 males were cut down. I didn't take care of my garden very well, and that Females that I grew are very fat. Extremely fat. With huge, fluffy colas. The f = 35 ounces potent pot. The final weight for the ten plants after 1 week of d 33.125 oz + estimated smoking of 2 ounces during process. I've been smoki

years, and Kong is definitely rated as "better than good" high in my books."

"He said he grew them in 6" pots spread out on a 8'x4' flood table. He got SL square foot. Which is pretty typical. So far NO ONE has come anywhere NEAR claimed for KONG." -MrSoul

"I averaged over a pound each on the Kong. As far as the best commercial weed choice. I've seen it go over 4 lbs. though it usually averages about 2 lbs. per

"Still in veg. Put a few of them at 24 hrs light. (Scared a bit for hermies) They (when the leaves go down for their night light or not). The leaves stay up 24/7 weed. What I am seeing look to me like I'll get the largest yield VS plants in my life. Incredible. I took a lot's of clones so they are only 4 feet high but they look like they are already easy. The cloning was easy too so many branches. Very happy so far. Thanks you posted. Salt ferts used. In pro mix #4.

One bad side: looks like I have 2 strains here. One looks more productive than I was expecting something more stable. But then I won't lose money on both seeds. Easy to grow. But for the cash cropper, you will have some work to do. (kinda nice so you clone and clone :)) I had one very weird looking male very unproductive at all what was that? Never saw this leaf shape before. I had one plant that was a male the other female, talk about weird. In 18 years it is a new one to me, I'm gonna test this thing to death." - Orchid Man

"Potency is good, definitely gets you stoned. It's about on the potency level of AK, the real kills like AK, but it is a strong weed. The plants are super-vigorous and grow very large and are not good SOG candidates-- they need big bushes. I did a lamp-full, but the yield looked above average. The pheno that I got was the best. The smell and taste were just of rank, strong weed-- not fruity-- kind of musky." -

"I agree that Kong (hybrid) sure seems indica to me! Mine have wide leaf structure "Afghani-like"/"indica-like". Very prolific plants. It is my understanding that there is a male within the hybrid strain from LM. You got your Kong momma crossed with (C Russian, which I believe is White Widow/AK-47. Also, according to legend, Kong is a LM strain.... gene splicing....???"

"Well there it is... 380 gr. dried buds on 1 plant. The newbies would say, wow! The plant was beside my old faithful strain and the buds on my old strain were small. PLANT WAS SO BIG THAT IT SHOULD OF GIVEN 2 POUNDS (oops caps locks) ! I was so happy with my old strain than fucking around with the Kong. I know that many breeders use only one super productive mother in those 10 seeds, but these seeds are so different from my old strain, 2 principal ones, which one to clone??!! In those 10 seeds 5 plants were female (and 5 male etc) plus another bad side is: My old strain was not affected by the white mold but is prone to fungus attack. Not good for a humid Place like the pacific northwest. I will not buy some other Kong seeds; I will reveg my old faithful strain. Only one seed was a mother. This very plant did pass near of being thrown away because at birth it had 20 branches, one male the other one female, talk about genetic aberration. So I was a bit of a goof in front of my friends because I did believe in a story that was false. And I know the effort that I did spent on those mothers that won't give shit... So... the man is

I have to say that the clones are behaving differently from the mother, more

but then the mother did look promising at first then she did stop after 1 pour
ride and contribute to pay for their 40,000 mother that they did not take the
they start to sell those seed saying that it is a cross of 3 strain, it is going to
be the one who will try it for sure. For 250\$ I was expecting more stability. E
Keep you posted about the clones, it might be another story...they look good

"Kong update, for those who would like to try the Kong, don't waste your time
unstable and almost no resin glands. The yield is not so great and you would
right mother in this mess of strains. My old strain, (northern light derivative)
same yield. There is absolutely nothing special about the Kong, I am very mad
effort to this unstable strain. It was grown under 1000w hps and 4000w MH,
supposed to be at least 2 pounds. For the same space and light, I would of had
strain." - Orchid Man

"Here are my final thoughts about this Kong story. These clones did give a real
lucky to find the right mother.... It is indeed the largest yield by square/foot I
the time factor in mind (2 months and a half to flower) compare to 7 weeks for
of formation of visible resin glands, I would suggest the Kong growers to use
2-3 weeks, more resin glands this way than under HPS. The clones under HPS
yield and potency than the ones under MH or the Sunmaster. The most potent
white MH. I took the HPS's out of there completely when I have seen this. If you
it is very humid, be aware that this Kong is very susceptible to fungus attack
meaning that during the same time that the Kong took to give me this yield,
a faster flowering strain because I could of done 2 harvests of the faster strain
that the Kong is lagging. For those who like potency and resin production, then
cash cropper with a lot of free time then it might be a good strain, but the buds
on the budz, it can be a problem for those who sell their crop. If I compare the
harvests I have seen, there is nothing so special about the yield of the Kong,
still very unstable judging by those last Kong report we have read lately. So I
not buy the Kong for my own personal smoke (potency, buzz and ordinary taste)
this strain for a future crop even if the yield was really good, because of the
newbie would find this strain very interesting and he would be happy to tell
of a good yield. I can't give the Weight details on the board, but I can say that
the double weight of the northern light but it took much longer to achieve it

"They are big plants, even if you give them only one month veg. from seeds
month veg and they finish at 7 feet. They become rootbound very fast. They
main mother plant was drinking 4-6 liters a day. They have a very extensive
grow very fast and need a normal fert dose, not more than other.

They won't give many visible resin glands under HPS but will still be decent
MH. So a ratio of 4 MH for 1 HPS is good.

Unfortunately, they are not the best producers that I have seen but only one
we think at all the time needed to finish the crop. I have had some of the ears
changed since.

The best way to do it is to use clones only, they are much more manageable
many strains in these 10 seeds; I had 4 different strains in mine, 7 females 3
the less exotic for the mother, the exotic looking ones (largest leaves) won't
looks like somewhat paler green with elongated leaves and a very extensive
containers." - Frenchie

Strain: Matanuska Tundra**Strain Type:** Mostly Indica with Ruderalis **Origin:** Alaska **Breeder:** Sagarm**Images:** 1 2**Description:**

"This variety brings back that majestic legendary marijuana from the great A recommended by the best fishing and hiking guides in the Matanuska Valley Danali "Mt. McKinley herself. A glacier of THC crystals frosts her colas and p polar bear. Persons prone to altitude sickness should use caution.

Specifications:

Type: Indica-sativa, indoor and outdoor, Start vegetate: when the roots show Average height: 0.5 - 0.75 meter, Yield: 350 - 375 grams / m2 (dried)." - Sag

Growers Comments:

"As a matter of fact, almost all the Sagarmatha strains I tried were pretty av standout was the Matanuska Tundra or whatever Tony calls it. When I went t Matanuska Thunderf*ck and they weren't anywhere near the same. The real "woo-hoo, I am high!!" kind of high... Sagarmatha's products all seem to be i rest" strains. Even Western Winds, with it's "soaring cerebral high" was indic

"Alaska hasn't any indigenous strains, so it would make it very, very difficult Matanuska is a hybrid that grows like an Indica and has a Sativa high, that r pure strain. It was named Matanuska because that is the name of the Matan of Anchorage, where the strain was first produced when it was brought into A For reference, the original name is Alaskan Matanuska Valley Thunderf*ck. T was made up by the Sagarmatha Seed Company in Amsterdam. Supposedly, went to Alaska and pirated some genetics that were available, took them ba Dutch strains, Peak-19 being one variation. Now, seeing as how Matanuska T Alaska, it makes it unlikely that Sagarmatha's version is Matanuska.

Exception to the rule, after years of being cultivated in Alaska, some version acclimatized and, in theory, could be called " true " Matanuska. Maybe... Rok found someone with some "true" Matanuska SEEDS he could smuggle back t met not a single person with seed, only clones. Also, Thunderf*ck is some of Alaska, getting someone to give up a desirable seed or an even more desiral God. So, I would lay money Rob didn't take "true" Matanuska home with him already an expatriate(the U.S. frowns on these individuals), I can't imagine I customs with a cutting.

By the way, the weed in Amsterdam is cultivated by private growers and sold regardless of what shop the Tundra was purchased at, the seed originated fr

Strain: Oakland Indica

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Super Sativa Seed Cl

Images:

Description:

"M14 - One of the best commercial indica hybrids in the U.S. We have got the grower who has made a lot of dollars with it. The yield is enormous, a modulus Holland it flowers at the end of September. Some individuals will take up to 10 plants in the picture turned purple because of a very cold fall." - S.S.S.C. catalog

Specifications:

none

Growers Comments:

none

Strain: Romulan

Strain Type: Mostly Indica **Origin:** British Columbia **Breeder:** Romulan Joe

Images:

Description:

not listed

Specifications:

not listed

Growers Comments:

"One thing is for certain, the original pure Romulan has much more sativa than more aroma as well, it's pungent pine bud aroma is what makes it stand out. The original mother clones have been around for about 20 years. Another term for describing Romulan is the old California blue indicas. I met with Romulan Joe and Romulan's heritage, I think I recall him mentioning some Mexican sativas but I was taking notes, haha." - Vic High

"It has been one of Vancouver Island's best kept secrets for a few years. Up until now Romulan Joe from the island was all Vancouver knew of Romulan. Then I showed him some bud and photos looking for advice about good genetics to cross it with. He was commotion. I was offered some serious dollars for a clone. I said no but that he could give me something out with some seeds. For you breeders, take note that 18 months ago we have access to Romulan genetics.

At that time both the Romulan that Joe was bringing to Vancouver and my Romulan were six months ago I returned and Vancouver's Romulan was now more potent than the original flavor. I also noticed that Emery was now selling Romulan/white widow F2 hybrids that they got hold of some Romulan/white widow hybrids from Romulan Joe and I was also told that they were the source of Steve's Romulan. Steve is saying that when I grow out the Romulan/strawberry blonde I'll know the truth. Pure Romulan produces very uniform F1 hybrids. If Steve's hybrids are uniform, then we'll know it's and not the Romulan/white widow that Emery used. I'll also know if Steve ever had a pure Romulan plant and bud close-up. Buds pictured in Cannabis Culture and High Times and are more than likely Romulan/white widow crosses. My Romulan gets big

I'm only posting this to clear up some of the confusion. Emery's Romulan wh bud. Steve's Strawberry blonde is very good and whether crossed with Romu should produce very pleasing results. A third source for Romulan genetics wi offering Romulan/blueberry (Romberry) F1 hybrid seeds.

BTW: The only reason I feel confident that I am lucky enough to have pure R genetics and how long it's been in the area. Emery, Shaun, and the others do -Vic High

Strain: Strawberry Blonde

Strain Type: Mostly Sativa **Origin:** British Columbia **Breeder:** Breeder Ste

Images: 1

Description:

"Strong mostly Sativa hybrid. Heart racing paranoid cannabinoid profile. Toa shaped bud. The edges of the sugary leaves curl with crystal! The golden ste personal! F2.

Specifications:

Flowering Period: 10 Weeks Outdoors: End of Oct Yield: Average Sea Of Gree catalog

Growers Comments:

none

Strain: Sweet Tooth

Strain Type: Mostly Indica **Origin:** British Columbia **Breeder:** Breeder Ste

Images: 1

Description:

"Sweet Pink Grapefruit x Blueberry Male x Grapefruit F1 Backcross to Mother backcross. Very sweet, mostly indica. Fruity, frosty & fairly fat. Mostly lime g Outdoors the calyxes are prone to purpling completely. The sugar taste is all

Specifications:

Height: squat bush indica Flowering Period: 7-8 Weeks Harvest Outside: Mid Sea Of Green: Thick and Plump" - Spice of Life Seeds catalog

Growers Comments:

"This whole garden was Sweettooth, and it turned out very nice, took 9.5 wee totally made up for the increased wait. I can't wait to get the CO2 going with is going to be fun.

I harvested 644 grams of smokeable bud with a 600-watt light, very efficient new thing for me. I didn't calculate under developed buds, they have already trim leaf. 46 grams per sq./ft of beautiful colas...;-)

53.7 grams per sq./ft, 50 watts hps, 2.5 per sq./ft, clone, GH, coconut medium Sweet Tooth is a fun plant to grow I'll hopefully have some pics of the harvest plants between 24-28 inches tall, some colas were solid to 12 inches. Very nice and the high is pretty strong. Sweettooth doesn't require much odor control as a plant. I think I've got my garden down their isn't too much other than CO2 worth for me during the summer because I have to ventilate all the time but winter should be great." - Shiva

"I've been growing both Shishke & Sweettooth for a while and would choose to have both of them for over a year. The Sweettooth is a large yielder (50 grams per large contiguous colas even on short plants. The visual of the cured bud is great yielder; I haven't quite decided if the Sweettooth can out yield the Shishke in Shishke and Sweettooth are both blue berry hybrids and I notice a lot of similarities in plants, but the Sweettooth has a sweet scent (no ozone required), and can tolerate live). Shishke smells kinda musky, doesn't like heat. If heat stressed it will heat in a different garden have no herms ... otherwise, very easy plant to grow and high from the Sweettooth is just like the SOL ad "keeps us giddy & high all day buzz, the Shishke has a hashy taste, and the Sweettooth is sweet & berry." -

"I was pretty surprised by the 'up-high' of the Shishke the first time I puffed it before with just a hit. It's nice to have for stash, but for me I build a tolerance joints of it after being all too acquainted). Sweettooth hits like a nice funky ~ smile on my face everytime, the buds smell so sweet, encrusted with trichomes that a fun to handle ... two tokes are plenty ... social indica, you can bring it to anyone." - Shiva

"I can't really describe the phenotype differences very well with the plants in distinct looking phenotypes I've recognized. My mothers look almost identical pruned many a time & I didn't document any notes from their seedling stage to them and see what happens when I flower them, when I start from seed. One of the phenotypes makes fluffy looking, but tight strawberry shaped buds (Sweettooth in CC). The other phenotype makes a more evergreen looking bud with lime green bract color & large, bigger than your hand blue/purplish fan leaves. One thing to note, the pictures that are/were on Bongblaster's site don't look like I have. Must be just a little bit different or maybe it was an earlier cross. I think this is a first backcross, so a few differences are to be expected, but I think both phenotypes are of good quality. The I have let them go as long as 63 days of flowering time and can't say the quality of smoke is much better around 50 days, although yield is improved ; I've seen too many different looking blueberry type plants to really be able to pick a shape. I think the one with the more evergreen shape might be a tad bit more cerebral to me. If I smoke too much before bed I usually have to go to bed floating 4 feet above the bed. Sweettooth is spacey smoke, not too heavy of a smoke (as a sentence I wrote before & laugh)." - Shiva

Strain: Texada Timewarp**Strain Type:** Mostly Indica **Origin:** British Columbia **Breeder:** Undetermined**Images:****Description:**

none

Specifications:

none

Growers Comments:

"Texada Timewarp is the famous outdoor strain grown originally and still today on an island in the Georgia Strait. I have been there, just off the coast of Powell River, British Columbia, on pilgrimage because I felt sincerely, " I should go to these places and find out what it's all about. I often end up as spokesman for "us".

Here's what I learned:

Texada Timewarp, this summer's planting, comes from an 18 year old clone that still exists, only crosses are available in seed form.

Texada is outdoor, on Texada most Timewarp was 5'-7' at harvest, but I have seen it in Texada and in neighboring Gulf Islands.

Though it grows tall, sativa like, often with sativa like leaves, I'm not sure (it finishes October 1st." -Marc Emery

Strain: Western Winds**Strain Type:** Mostly Sativa **Origin:** not listed **Breeder:** Undetermined**Images:** 1 2**Description:**

"An almost pure Sativa with a soaring cerebral high. A favorite amongst Rastafarians for its relaxing and invigorating effects. Fantastic for conversation or romance with its relaxing and invigorating Oriental aroma and spiritual high. Whether smoked in the morning or evening, it is rewarding and pleasurable. So put Western Winds in your sail and ride the high seas.

Specifications:

~ Type: mostly Sativa, indoor. Start vegetate: flower shortly after roots show. 70-75 days. Average height: 1.2-1.5 m. Yield: 300-350 grams / m2 (dried)" -

Growers Comments:

"These puffy, compact buds are a uniform deep green and textured with a thick layer of fine, short, and thin scattered orange hairs. The scent is a strong, tangy, citrus bio-scent. The buds are small round budlets; the stems taste a bit citrusy. When smoked, the buds taste like a mix of citrus and earth. The buds are expansive in the lungs. The high comes on quickly and is visual, stony and cerebral. Amsterdam

"Medium to tall sativa Thai like plant. Will grow medium length nodes with big buds. Produces fat size round buds covered in a furry fuzz. Had a spicy like smell.

taste; the high is very strong UP clear and focused...the yield will determine a great one out of 2 seeds"-sloppy seconds

"INcredible BuZZ!! The most unique flavor I have yet to encounter. Strong e & space with your eyes closed or open." - Prince Caspian

"About 70 days to flower, and turn up the lights!! Don't expect a large harve for your personal enjoyment considering the time you'll have invested in it. I good. If you can do it outdoors, then good for you." - The Big Weenee

"Kali mist is a winner. Matures in 65-70 days...but from what its description s the same with the one I got. Mine grow 1-2" nodes and grew to 3' and yielde dense too not fluffy and not small too softball sized side buds, really high cal trimming, a very spicy smell and taste with tones of incense, very clear UP fo noticed with my mother is that light got messed up and she is flowering a bit temperamental."

"Vote for the strongest ACTIVE/CEREBRAL high? Kali Mist! Hands down on th high clear and focused...the kind that great when you need concentration. H sativa actually its pretty short too for one not medium nodes big Thai like lea been told it yields shitty well I must have a good mother I got about an oz fro its been said that it also makes airy buds. Mine made some of the fattest rou grown. Good density was not airy at all very crystallly looks like fuzz to the na totally covered has this strong spicy smell/taste with incense tones it about t super UP strong very clear and focused a very good high for times when you decided Kali get it from serious and not sag's western winds they are alike b Dankmaster

"In the case of multiple sclerosis an indica is a good choice, but I don't think with using a strong indica to ease the pain is that it also fries your brain and incapacitated. I would suggest either a 60/40 cross between Sativa/Indica or Winds is an excellent pure Sativa and White Rhino is a great 60/40 cross bet

"Kali Mist is a Serious Seeds strain. This Strain is also available from Sagarm Western Winds. Having grown this strain, I would recommend getting Sensi S very similar but the Jack has a bit more weight to it." - Prince Caspian

Strain: Williams Wonder

Strain Type: Indica **Origin:** California **Breeder:** Super Sativa Seed Club (S

Images:

Description:

"Described as a special indica hybrid, that is short and squat in stature. It is U.S. The 87-88 Super Sativa Seed Club catalog states that it can not flower induced inside first. So this indica hybrid was selected solely for indoor grow

Specifications:

none

Growers Comments:

none

Strain: Yumbolt

Strain Type: Mostly Indica **Origin:** Oregon, USA **Breeder:** D.J. Short

Images: 1 2

Description:

"Yumbolt brings back that old-fashioned flavor from the hills of Humbolt Co. stone with an outdoor aroma, she will often induce heavy eyelids with a sativa the last the taste remains. A producer of large succulent flowers, this girl will Let Yumbolt produce nice dreams for you.

Specifications:

~ Type: Indica-Sativa, indoor and outdoor. Start vegetate: 1-2 weeks after rc time: 55-60 days. Average height: 1 meter. Yield: 350 grams / m2 (dried)." -

Growers Comments:

"I found that Yumbolt is very similar to Black Domina. I have smoked Yumbo favorites. I noticed a similarity between it and the Black Domina that I have I have grown out the rest of my original BD seed and of the 2 that I have trie female tastes exactly like the Yumbolt. It was one of the fastest also, harvest you have to take small tokes or risk coughing up a lung. I think Sag offers 20 B.D. 15 seeds for 175 fl." - pud_420

"At one time it was hybridized, but has been around a while. I e-mailed Rosa was a strain given to them by a friend from Humbolt Co., CA. She said there original strain, and through selective breeding were able to stabilize it. She s (typical of Humbolt varieties) and a very heavy stone." - Caterpillar95

Region: European Strains - Holland and Switzerland

Family: BubbleGum Strains

Strain: Bubbleberry**Strain Type:** Mostly Indica **Origin:** Holland **Breeder:** Sagarmatha Seeds**Images:** 1 2**Description:**

"A Bubbegum and Blueberry hybrid. This plant produces larger buds with more Bubbegum. Pungent sticky flowers with an overpowering aroma provide the lasting buzz. Sure makes blowing bowls of bubbles more fun!

Specifications:

~ Type: Indica-Sativa, indoor and outdoor. Start vegetate: 1-2 weeks after transplant. Flowering time: 45-55 days. Average height: 0.7-1 m. Yield: 300-325 g per plant. Sagarmatha seedbank catalog

Growers Comments:

none

Strain: Bubbleberry X Williams Wonder**Strain Type:** Mostly Indica **Origin:** British Columbia/Holland **Breeder:** Sagarmatha Seeds**Images:****Description:**

"We have blended the strength and vigor of Bubbleberry with the growth characteristics of Williams Wonder. Both plants compliment each other with their unique qualities. The smoke is smooth and has the scent of a flowery bouquet. The high is heavy and long in duration, leaving the user feeling relaxed and mobile. This hybrid exhibits a shorter, rounder version of Bubbleberry per bud and an earlier flowering period. Fantastic for stash and production purposes. Definitely a winner!"

Specifications:

~ Type: Indica-Sativa, indoor and outdoor. Start vegetate: 1 - 2 weeks. No need for special care. Flowering time: 50 - 55 days. Average height: 0.5 - 0.75 meters. Yield: 300 - 350 g per plant. Sagarmatha seedbank catalog

Growers Comments:

none

Strain: BubbleGum**Strain Type:** Sativa/Indica mix **Origin:** Holland **Breeder:** Sagarmatha Seeds**Images:****Description:**

"1995 2nd place winner, with little details about the strains that produces it. high. "

Specifications:

none

Growers Comments:

"I grew out the H.S. "original" version of Bubblegum. I had two ladies that were in hydro, 400W MH. They grew (untopped) to 4 and 4.5 feet high respectively. I flowered them at 12inches tall grown from seed. Very sativa-like pattern with a huge stretch indoors. They had very strong stems and with coke can size colas stood up without support. Flowered for eight weeks for one, eighth and a half for the bigger one. They came in with 22 inch and 24 inch colas, and the smaller cola weighed 5 ounces wet. I didn't get to weight them again in whole. All my friends loved this smoke! They all said the taste is one of a kind, and the high was sativa-like...up and Had my one buddy "drumming" on the table non-stop:) They were grown along with some GWS and some NL5; both of which were very more narcotic body high. Most folks asked for the Bubblegum, which had in one case very reddish look developed buds that were brown/red looking. Both had the same taste and seemingly the same great high. Will keep it for a long time in my grow..." - Lancelot Link

And now for the Bubblegum, a little background: Definitely Adam (TH Seeds) brought from cal. to Holland a sweet smelling i (no male) he gave it to Tony (his buddy, subsequently the owner of Sagarma Cerebral Seeds split up into Sagarmatha and Serious Seeds both seed banks The next year Bubblegum was 2nd place winner (1995 Cannabis Cup). Sure it was the same (only!) female available at the time. Serious Seeds took over four years to improve (cube? or further....) that fem: You can find their reasons in the mail above. What I have to say is that, after having spoken with Adam himself, I've decided Mr.Bubble® which is a hybrid of the original cal. Bubblegum female and a or of Kali Mist (the one that was developing at Cerebral Seeds, in fact after the Mist/Western Winds). I think Mr.Bubble® is an outstanding hybrid because it's made of the ORIGINAL It is now a F4, almost stable, hybrid." - Dr.Turner

"Bubble is available for 150 NLG and has 22 seeds. This has to do with low germination rates at the last tests and making up for that. I don't know the one Adam sells personally, but do know that they derive from the same genetic background. It took a while before I was pleased with the product and there was also a personal thing involved, with the person who brought

the genetics over to Holland. I waited till that was resolved to satisfaction." - Simon, owner of Serious Seeds, Amsterdam

Strain: Double Bubble

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Undetermined

Images:

Description:

"These buds are army-green colored, crystalline, and evenly covered with long trichomes. Broken up, these buds release the scent of sweet freshly cut grass or even hints of citrus undertones. The smoke is smooth, non-expansive and has a mild sweet taste that hits you right away, it first creeps through your body making you feel stoned and cerebral, allowing you to concentrate on any task at hand. **" - Homepage

Specifications:

none

Growers Comments:

none

Family: Jack Herer Strains

Strain: Apollo 11/13

Strain Type: Sativa/Indica mix **Origin:** Holland/USA **Breeder:** Mr Soul

Images:

Description:

"This indoor hybrid has a high calyx/leaf ratio & finishes flowering in 7 weeks. It's a lemon-scented female clone named "Genius" because of her CLEAR, energetic genetics, crossed with a robust Cinderella 99 male to create Apollo Eleven. Expect some of the best females are short, heavily branched plants with multitudes of dense, resinous buds. SCROG. The smoke has a sweet citrus flavour. The high is UP & HAPPY." - Breeder

Specifications:

Flowering: 45-50 days ``Height: 100 cm. ``Yield: 1-2 lbs per 1000W lamp.

Growers Comments:

"This Indica dominant strain was created by backcrossing a male cross of ShivaSkunk brother (a JH f2) back to the ShivaSkunk mother. In "cubing" terms that would be a ShivaSkunk.75. Another grower I sent them to liked them a lot too. I'm glad y

success with my strains!" - MrSoul

"I believe Apollo 13 is P88 male X Genius (Princess' more indica type sister) 1 of seeds found at the 'Cafe in Adam. The new A11 is P94 or (C99 the more p -Webfish

"GROW THE A-11 FIRST!!!, it is WORLD class smoke!!! But I have to warn you of Cinderella 99 and Genius, 90% of everything else you grow won't come cl you let this one slip through your fingers you will be bummed!!! The bud fro taste, and a high that gives you the energy to go out and do something...eve is!!! Every one that has smoked the A (my version is the A-13, Genius crosse even better than A-13 according to BG!!!) has said it is some of the best the

"AFOAF grew some (Apollo) recently and got an indica phenotype that finish phenotype that took 60 days.

The indica phenotype is very resinous, clear high. Not racy nor paranoid. Der The Durban phenotype has a stronger high than pure Durban, very clear, ver fluffy, and they flop over from their own weight. Definitely a creeper phenoty The mom of A-11 is Genius, an F2 of Jack Herer crossed to an unknown male of A-11 is Cinderella.

Genius expresses the NL and Skunk side of the gene pool. Cindy expresses t imho, for the A-11 to have 2 phenotypes in the F1, one of which is fluffy, swe that the Durban gene is in both Apollo and Cindy." - Zorro

Strain: Cinderella 88/99

Strain Type: Mostly Sativa **Origin:** Holland/USA **Breeder:** Mr. Soul, Brother

Images: 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Description:

"This strain may be the "Holy Grail". The result of painstakingly backcrossing progeny over 3 generations. This hybrid was specifically bred for indoor cultiv branched, this plant grows LONG, dense colas with an EXTREMELY high flowe production. The breeder has observed a "giant leap" in potency with each pro expected, Cinderella 99 has topped all previous results - her high is heavily ir & devastatingly psychoactive. A plant with all of the above is rare enough, bu after a scant 50 days of 12/12! Above-average yields of crystal covered buds be harvested every other month once a mother plant is selected and asexual preliminary results from the breeder indicate Cinderella 99 will breed true..."

Specifications:

~ Flowering: 50 days. Height: 100 cm. Yield: 1-2lbs per 1000W lamp.

Growers Comments:

"Cinderella 99 will be available from Brothers Grimm in January ('99). This is from backcrossing Princess 3 times with her successive male offspring. Expect same short flowering period, tropical fruit flavour, and soaring cerebral high.

"Clone flowered under a 400watt, 42watts/sq.ft. Grown organically in a soille: potting mix, perlite, & worm castings. Finished about 16"-18" tall. Nice high fi be a breeze if it didn't have so much resin globbed all over it. Nugs were den: they are under the big lights. I flowered for 53 days, last 24 hours no light. I a (Neptune's Harvest) for food. Total yield about 15gm of very frosty & very po flavor, but a STRONG smoke. Very "up" high. I can get a lot done instead of ju grown. No shit." - Bill Clinton

"C88 is the best so far. It has blown the socks off every Dutch variety I've gro smkr

"The photo at the web site is Cafe'Girl, she is the sister of Princess (Cinderella: mother I'm using to produce "Dylan's Diamond" which will be released in Janu yielder of super DENSE, crystalized buds in fairly LOW light levels. Scent/flavo MrSoul

"Princess was obtained from growing out seeds found in buds of Jack Herer th the "Sensi-Smile" coffee shop, an authorized outlet of Sensi Seed Bank. Thus, generation Jack Herer. The seeds were found only in the deepest part of the l an unusually early-maturing JH that the growers missed at first." - MrSoul

"Princess is a female which resulted from a seed found in a Jack Herer bud I b Sensi Seed Bank at "Coffeeshop Sensi Smile". The bud came in a 2 gr. cello-p expected sinsemilla, but it had about 10 seeds so I assume she's an F2 JH. He wanted to create seeds that would "replicate" this plant. She has the KILLER DELICIOUS pineapple/evil scent, 50 day maturation in 12/12, and incredible n yet clearly Sativa-dominant! Last but not least: Never a hint of hermaphrodis different styles of grow.

I wanted to "cube" Princess but add a little beef to her branches because the harvest and branches needed staking to keep from flopping over. I crossed m the males from the same group of seeds that Princess came from. THIS cross crossed to Princess, creating "P.50" (using a shorthand notation I developed t genes in the cross).

Each generation is the result of crossing a male from the previous generation know).

Blow-by-blow description of the generations:

P.50 = Heavy, single-cola type plants with mellow high (too much influence fi scent/flavor. Unstable in most traits - for example, 10 days difference in faste group of 20 seedlings.

P.75 = Plants leaning MUCH more in the direction of Princess in floral cluster turned more "tropical" like pineapple. The stability was becoming better - two (potent too) or tall/HUGE (Not so potent).

P.88 = Renamed Cinderella 88 when first released on the market. It grows fa FROSTY buds in 7 weeks! Generally uniform seedlings with minor differences variance, but the smoke is quite consistent from all plants - Dense, heavy nu (like wild berries) and covered in resin glands, the dried buds have distinctly

And now P.94 = Cinderella 99. This project has been a huge success. The str "net"work of growers with rave reviews. The Bros. Grimm too have been rec combination of quality products and unparalleled service after the sale. There it's breeders on the net answering questions from "newbies" 40 hours/week,

details of their breeding strategies are openly discussed so that the seed buy products BG offer.

I personally think the plants these Cinderella 99 seeds produce are every bit herself (or better). I say better because the flavor of no two plants is "identical" living things. Like Princess herself, Cinderella is sweet & fruity to the palette & you're BLASTED...with the same "racy" high as Princess! The improvement comes from a greater yield and a stronger branch structure, which I accomplished by starting with the original father in the cubing process. I knew I'd blend out the majority of the original cubing process, but I was hoping to incorporate the ShivaSkunk's stronger branch structure and tendency to need supports in the final two weeks of flowering. As it turns out, the name suits the strain IMO - it's a true Cinderella Story." - MrSoul

"Jack Herer is an unstable strain bred from an unequal combination of Sk#1, NL#5, and female Jack Herer creates an F2 generation which has a HUGE number of genes. I grew out some Jack Herer F2s and discovered a SPECIAL one, "Princess" (a cross of improvements on the original JH such as a shorter flowering time, denser buds, and a stronger scent/flavour. I have been continually back crossing Princess with her male offspring (the next generation) which eventually creates a stabilized strain having her special characteristics. I have females grown from those seeds. Each generation is composed of a 50% genetic contribution from Princess (since she's the seed parent) and a 50% contribution from the pollen parent (the next generation percentage of Princess' genetics with each generation). The progression goes P.97...at that point it's considered stabilized (a male and female P.97 can be crossed and are essentially the same as the parents). I have been VERY pleased with the way the P.75 generation was rather stable in the sense that the individuals were all rather similar. P.88 seeds are available now, and the P.94 will be available around Christmas. It's a combination of genes from Sk#1, NL#5, and Haze, creating a plant which has characteristics of Jack Herer, and I'm creating a stable strain from this plant... it's legitimately MIGHTY!" - MrSoul

"I used Shiva Skunk from Sensi Seeds as a minor component in the development of Princess. I crossed a fine female Shiva Skunk with a brother of Princess, then grew a male from that cross and crossed it with Princess in the process with." - MrSoul

"C99 is has more of the Haze type of high because the mother (Princess), has a back-cross to her the next generation gets a bit more of it. Smoking PURE Princess is "speedy" and paranoia-inducing for most people. But she's so RESINOUS (see the resin) so delicious and fruity that I knew back-crossing her to her offspring over several generations was actually BETTER than the original mother in terms of a more PLEASING high than my expectations.

The progression I went through was:

P.50 = Princess/(ShivaSkunk/Princess'Brother)

P.75 = Princess/P.50

Cinderella 88 = Princess/P.75

Cinderella 99 = Princess/Cinderella 88

Each generation exhibited a MAJOR jump in potency (P.50 was rather mellow, P.75 was a body/mind high with a citrus flavour, Cinderella 88 is cerebral & paralyzing with a strong citrus flavour, Cinderella 99 is "TRIP WEED"...with more of the fruity flavour and speedy effects.)

"Princess.75 finished outside in northern Kentucky Oct 15, (killer smoke!) The do intend to find out! No mold and it was quite wet too." - 27yrs

"I grew out Cinderella 88 and in my experience the Great White Shark is a m admittedly my luck with C88 was not the best. The one female I was vouchsa tree and is difficult to clone and cultivate. However the psychoactivity of the stone is complex and very cerebral. This is a very potent plant, indeed. But if confess I might have let this plant go a while ago. As it is I am trying to find w finickiness because of its lineage. But I wonder if the BG's cross between the House male White Widow (Ice Princess) might not be a more propitious way c in one's garden. The hybrid vigor that results from crossing two great plants c creates the best stock for cultivation, in my opinion." - Moose

"I want to comment that your result with the Cinderella 88 is NOT typical: I h I have never seen one that was remotely "vine-like". They're usually Sativa-d moderate leaf width, short & stocky stature, heavy branching, extremely high resin production. The flowering plants smell like fruity cotton-candy. In my ex a 2 inch rockwool cube in 10 days...and I don't even use rooting hormones." -

"Cinder: There's been a lot of talk about this strain. All I can say is that I'm ve yields, great high. Harvested at 49 days--maybe even a little too long. While occasional bud out of my jar is simply wicked. I actually got lost a few blocks happened in 10 years." - shaggy

"There are 10 C99's flowering at day 32 in the hydroponics online 2-liter bott nutes and Pure blend at about 1600 ppm(they could probably take more!!). I unbelievable! The situation is that the buds are becoming too heavy for the b colas. It looks like some of the side buds will be scraping the floor by harvest

"I agree that c99 appears to be something special. Great resin production, gr major odor(yet.) The thin leaves allow great light penetration. Sometime in th Cindy. What GH mix are you using on the c99 right now? She has been the m kaka

"C-99 is very uniform. I have 4 females grown from seed that just finished the only variation seems to be their height, the shortest being 3.5 feet and the ta once. They were started under a 400 watt MH for the first month and have be of sunlight since then, and their cola's are HUGE. Wait'll you see how well the Feral

"My estimate for Northern States would be early October. I have a friend who (48 degrees N?), it was about 3 weeks from finished in mid-September. Unfor ripped off. If you're growing in an area prone to mold, you may have problem in the Northeast we don't have such a problem with mold. I can only tell you t seen the photos, haven't you?)...so it could be susceptible to mold." -MrSoul

"If its Fruit Punch that you want, you should check out "Cinderella 88"....I've s backcross of, and YEEEEHAW she kicks ass. The smell is very similar to the H (ok I) was a kid... remember Bubbalicious? Or Hubba Bubba chewing gum? Th and there ya go-- thats what it smells like... A sickly sweet fruit punch gum, a

with it. A first class high too... (Not to turn this into an advertisement, just a r personally tried this strain and it will do it for you just like the Hawaiian)." - S

"I'm kind of trying for either Kali Mist or their Himalayan Gold, essentially I'm that I can grow manageably indoors. -See if you can get Cinderella 88 from M tried this smoke and it is the best, most lucid sativa high you could ask for. Tl talent into this one! Kumquat I do have 3 6' princess " crosses in my garden. growing with them, as someone mentioned...looks closer to Ncga's BW but w preflowered in early June which made it much easier to plan the garden spac would get so tall. The secondary branching is quite thick and well developed be a good yielder. It has handled our 100+ degree days w/o any problems, u with them) and even took on a Great Dane bending one over flat on the grou of temporary splinting and bracing to be the fattest plant in the garden...whic seedbank offerings of last year." - Desert Rat (a.k.a. M.G.)

"My head just turned full circle...This shit is good! I have to say to the brother flying colours...the effect is very heady and almost hallucinogenic...very muc pearl... with a smoother, fruitier taste and no nasty tickle at the back of the tl

"I can only answer question #3 (Does it have as strong a sativa high as haze least the sample of Cinderella 88 I had was. Very tight nugs too! It was growr to be even better (just the way it turns out for me). Very fruity, mellow hitting has a definite creep to it. The buzz is very sativa-ish and tends to make the n something. But the energy to keep looking is there! I highly recommend it! B nearby to mellow it out! All above is strictly MHO and based on MY experienc

"The only person I know who has disliked Soul's weed is BB. Taste is a person politics may have also played a role there. The buds of the ones I'm growing plants are a little small for my liking and probably won't make the grade, but bud." - Vic High

"The princess I have smoked was indoor grown by a friend of mine. It is a VEl paranoia at times. I found it's best when there's a bowl of a nice indica aroun do the trick (it creeps up in about 15-20 minutes)! Very nice sweet, fruity flav have growing outdoors in the hot desert are doing great. They have the typic very hardy. Planted 6 eggs, got 5 plants with 3 being female. It will become a - Desert Rat

"Remember that Cinderella (88) is a Sativa-dominant hybrid, so you can expect grown from seed. However clones from a good mother will stay quite short - I 2-gal containers of organic soil to produce a 2.5' plant which yields about 2 o AMAZING...the stalked resin glands appearing on bud leaves as early as 3 we FUR!" - MrSoul

>

"My report on C99....

1. Bought 10 seeds for 150 from Heavens Stairway. Took 10 days to get to m
2. 9 out of 10 successfully germinated and grew into healthy plants
3. Kept 5 of those. Gave 4 to a buddy who pitched in for the seeds. All 5 of m

know about his.

I used pro-mix soil. This is a sterilized and nutritionless product. Make sure to use pro-mix and 7.5ph tap water comes out 5.5ph so make sure you add lime to get to 6.3 or so pH. This is important I used one-gal containers.

I used GH nutes 1/2/3 ratio for grow and 3/2/1 for flowering, 1100-1450ppm and check your overflow water after each watering for PPM. If you do this you will catch it before that about every 3rd water should be plain water or you will overfert. I've had to do this due to laziness and not checking.

1000mh about 40w/square ft

4. Took 50 clones and 95% were successful and rooted in about 7 days

5. Cinderella is a most interesting hybrid. It was selected/bred for indoor cultivation and dense colas. The most interesting and handy feature is that you can actually keep them about 12-14 inches tall. If it is a female, the two telltale pistils are evident at the top.

6. On my 5 females, I put them on 12/12 when they reached 24 inches. They explode within 10 days. You can harvest in 50 days

7. They have a fantastically pleasant fruity smell and you can see the resin glands and excellent yield, require very little time to cut and trim off of the plant which is great. A creative, up high. Puts you in a good mood and gets you doing things. I cleaned her whole house and had a good time doing it - You find humor in everything.

I have only praise for this plant and a tip of the hat to the Brothers Grimm. The

"Nexus> I have a Flat ScrOG that's W=3ft,L=6ft,H=1ft from bottom of plants to top. air-cooled + on a light rail III, Well my question is how violent of a stretcher is Cinderella should I let her fill up? I don't want c99 stretching so much she hits the light and I have to move it. #####

=Soul=> I flower my clones at 12" tall and they end flowering @ 2 ft tall yield is great. You should let the branches grow to 8" above your screen then switch to 12/12. This allows allowing your lamp enough distance from the plants (the light mover HELPS).

Nexus> I got 4 c99s and 6 Mr. Nices in the screen growing in a drip/NFT custom setup 2 weeks away from flowering depending on c99? Also how powerful of a yielder is Cinderella? I see so much spam in the past about her.

#####

=Soul=>It's easy to be misconstrued as "spam" when a strain is getting valid attention in the case of the Cinderella line. It's truly impressive to have combined rapid flowering and resistance in a potent, tasty, good-yielding, true strain. That's BOUND to earn attention. To illustrate the yield I'll simply say that a 12" clone of C99 consistently flowered an average yield of 1.5 ounces, depending on how densely they're arranged. I have found that 4 slabs @ 4 plants per slab) in a 4'x8' area is about optimal. I grow the plants with a main cola. They are supported by using twist-ties to attach each cola to wire mesh. This increases yield by forcing the garden into a light-efficient profile. When you stop supporting another" the final 2 weeks of this abuse takes its toll on bud production. It's best to be supported...you'll get a fine yield.

One C99 distinction that helps is the high flower to leaf ratio. When your buds

and less leaf - that's a BETTER kind of yield." -Soul

Strain: Jack Flash

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Sensi Seed Bank

Images: 1

Description:

none

Specifications:

none

Growers Comments:

"Jack Flash does go a bit long in the flowering, it grows in two types one very huge "Heads on Sticks" that dried at over 1 oz. each! there were 5 of them and it took about 76 days, but was worth every day. The other type grows very Indica like this type, that was very fruity with a nice trippy high that gave way to a little indica-dom. takes about 60 days to flower, also very well worth the wait, was amongst the best Indica they had ever smoked, and the taste cured is fantastic and easy to take care of. It was really nice, and it yields great in both forms. Out of Romberry and Jack Flash are definite repeats, as they are both in the Veg club. I'd place to get Sensi stock (IMO) but the price is OK considering they give ya 100 seeds a/b \$5 each. Sorry for the long post but its a favorite and I wanted to give ya

"Afoaf has grown and continues to grow Jack Flash, its a great strain, although very unique and all are quality in there own way. Here's the way the first grow went. Super Soil recipe, there were 3 different ladies, one was in a 5 gal pot she was very big she grew out in a "heads on stick" fashion, big huge heads, she was topped off with big heads, each dried to 20-35 grams she yielded just over 5 oz's, of great taste and sativa smoke. Another lady was sort of the runt, she was in a 3 gal pot also produced more of a indica phenotype, nice tight colas with red pistils, great smoke very good about 20 grams. The 3rd lady was awesome, also in a 3 gal pot, pinched at the top the densest nugs, smelled like lemon, tasted like lemon/hash, and the high was very provoking, but its best attribute was its wonderful taste, she yielded about 1 lb of strain. The haze influenced lady was crossed with a Posi Big Bud in hopes of a shorter flower time 63 days under 80 watts/s.f. of mixed spectrum light." -Budm

"This is a really good plant. it finished at 50 days has a lemon taste/ with a punch but no sleepiness. I was afraid that it would be too similar to my Cinderellas due to the fact Jack Flash is very different in taste and high. jack flash is lemony and Cindy is like the other is sour. The only drawback is an increased paranoia level. The up high is a discomfoting "edge" , but Its mixed in with a lot of laughing (which I like), and intriguing ideas), aphrodisiac effect (a must, he he)and yield (big calyxy buds) someone looking for an up high, lemon taste, and good yield." - Triage

Strain: Jack Herer**Strain Type:** Sativa/Indica mix **Origin:** Holland **Breeder:** Sensi Seed Bank**Images:****Description:**

"Combining three of the strongest secret varieties kept by Sensi resulted in the creation of Jack Herer through years of selective breeding. Highly resinous.

Specifications:

Flowering: 50-70 days. Height: 150-180 cm. Yield: up to 125 gr." -Sensi Seed Bank

Growers Comments:

"Jack Herer = Sk#1 X NL#5 X Haze. This multi cross has been stabilized over time and is now reported to be very even and consistent."

"I grew Jack one time. The plants varied incredibly. One plant was done in 7 weeks. Dark, lush, green. Dense buds with a deep sweet odor. Great heavy indica body. On the blue spectrum, I had one plant that took 10 weeks to finish. This one was very hairy, purple color and scent, but the buzz was strong with the heart pounding sensation of a strong haze buzz..... So I would have to say that Jack Herer is an excellent bud. Although all the plants had excellent results when finished, I found that growing (less than 10 plants) was sort of frustrating because of the 3-week difference in flowering. In conclusion, if you grow jack keep your eyes open for both very early and late flowering. It seemingly forever, was well worth it." - smoking man

"Pros: Grows well, healthy, vigorous, bushy plants, lots of foliage and big (for a clone) yield. Fairly smooth smoke with a sweet citrus smell/taste.
Cons: Medium-long flowering period, not nearly as potent as one would expect from many more potent varieties that have a significantly shorter flowering period. Again. A friend who also grew it had the same opinion. AK47 still has my vote for the most very potent." - Sabre

"This light forest-green colored bud is made even lighter by its tiny white crystal trichomes and hairs that are few but noticeable. The buds seem to be made up of smaller buds on small grapes. This bio has a mellow, steady, sweet, green smell with just a hint of citrus. Dense buds surround tiny (and tasty) stems. The smoke is tasty, sweet and smooth with a good expansion in the lungs. The high is quick and expands for quite some time with clear effects. ***1/2

Strain: Jack Herer x Haze**Strain Type:** Mostly Sativa **Origin:** Holland **Breeder:** Sensi Seed Bank**Images:****Description:**

none

Specifications:

none

Growers Comments:

"This sweetly scented mix is forest green in color with few, long, brown hairs. Hearer lineage, while the color is most certainly descendent from the Haze. I shaven carrots, and are very sticky when broken up. The nodes are coated in bud releases thick clouds of sweet, tangy, tasty smoke which expand substantially quickly and really sends you for a whirl - it is visual and Trippy. This mix sure buds.***1/2" - Homepage Amsterdam

Strain: Polm - a.k.a. Jack Herer

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Positronics

Images:

Description:

none

Specifications:

none

Growers Comments:

"I ordered the Polm special from Jock. He said it was Jack Herer."

"I have just finished some of Jock's Posi Jack Herer and have one that keeps like the Eveready bunny. It just won't quit after 11 weeks, although harvesting two. Think you will like it. Nice profile, short internodes, average harvest from 9 weeks.....typical indica/sativa leaf, excellent calyx/leaf ratio, great high that you're good for the night. Doing a seed program and am coveting the seeds

"I have been expressing my opinion that I haven't been really impressed with Christ, me and the lady smoked some of the Posi Jack Herer last night and we finished a grow which was for seed production primarily, and have slowly but various strains over a period of a few months, and am still not finished, however

The Jack Herer is definitely Wacky Weed. I mean this stuff is like being in Alice's nice body stone, very potent head stuff which is psychedelic and just plain played head games until we settled in for the night.

I have never complained about the grow profile of the limited Dutch strains I plant had 1/2" internodes, huge thick colas (yeah, it's the one that went a little

Got 4 3/4" oz of sensi (minus the seeds buds) from a 27" plant. My journal on dark leaves, bushy, 11 leaves per leafset, hybrid, heavy profuse flowering."

Now....this is what's just plain fascinating....this lady leaves a distinct taste a very subtle menthol taste, somewhat piney and having a fresh earthy taste. like a fine wine would - very pleasant. Anyone else have this type of palate e

Strain: Princess 75**Strain Type:** Mostly Sativa **Origin:** Holland/USA **Breeder:** Mr Soul

Images: 1

Description:

none

Specifications:

none

Growers Comments:

“(Sk#1 x NL#5) x (Sk#1 x NL#5 x Haze)) x (Sk#1 x NL#5 x Haze)

6 seedlings are off to the races. Princess was obtained from growing out seeds that were purchased in Amsterdam at the "Sensi-Smile" coffee shop, an authorized grower. It is considered to be an f2 generation Jack Herer. The seeds were found only indicating that the father was an unusually early-maturing JH that the grower. Princess smells very much like pineapple both during flowering and when dried, too, like rotting meat, which has been linked with the most devastating weed from SSSC, years ago). The taste is connoisseur quality when it's cured; VERY intense for a lot of people. Dr. atomic actually refused to smoke any on our side rather "hazed and confused" on the first sampling we did together a couple of days. I try Shiva Skunk and found that more mellow and to his liking. Two hits of Princess tremble involuntarily and your heart to race and paranoid thoughts...very much intense. It also has a "creeper" quality that makes it easy to over-indulge...you'll be out of the first 10 minutes after smoking. Look at the May '98 issue of High Times' "Cub Cab"...that's EXACTLY what the finished Princess buds look like. The "frosting" on the flowers and smaller leaves gives them a "furry" appearance much like the original. Princess grows vigorously, and is rapidly maturing...6 to 7 weeks of 12/12. It is 50% stronger nutrient solution than an Indica does. It stays short, for a Sativa about 3 ft indoors. The yield from such a plant is about 20 grams.

Mr Soul has been "cubing" the clone of Princess so the seed line will be Princess. He is currently growing out Princess.75 to obtain males for the creation of Princess. The next generation will be ready by mid-July and should produce excellent plants, all nearly. He plans to back-cross once more after that to arrive at 0.94 Princess. Princess is a stable, true-breeding seed line with females "replicating" Princess reliably.

This strain is exactly what most people believe doesn't exist; a Sativa which is short, and matures as rapidly as an Indica (faster than many), and has the good yield. The yield is fine too. Mr Soul finds that the Indica strains are too leafy/stalky for him, whereas Princess has an extremely high flower/leaf ratio and therefore produces a high yield. "Current crop is Jack Herer x Unknown (Nickname - Jack's Heir): Seeds - I bought the buds (1996 Cannabis Cup winner) in Amsterdam at "Sensi Smile" coffee shop. The buds were supposed to be sinsemilla, but I was pleasantly surprised to find a high yield. I found the high to be cerebral and energetic, but not too long lasting; the buds have a thick resin coating. Of the 6 seeds I attempted to germinate, every one was successful. The male/female ratio. Seedlings - Very consistent and uniform in looks and growth. Princess is a three-way hybrid itself). Rapid growers. Typical internodal spacing signs of both Indica and Sativa heritage. Large, broad bladed leaves, but light green. It is an Indica. Somewhere in between stature.

Mother plants (J1 and J3) - Grow vigorously and bushy. J1 is the hardiest look
Father plants (J2 and J4) - Grow vigorously and bushy. J4 is the hardiest looking
this J4 grew from a seed I'd characterize as a "runt", about half the size of his
all clones of J4 were lost and I have only a "decent" supply of pollen from his
Clones - Very quick to root (10 - 14 days) with a success rate of 90 to 100%.
clones eventually came around and flowered nicely. Rooting occurs independent
cubes with pH 6 or 5.8, Rootone or not, seems to make little difference.
Flowering - Once rooted, the RW cube is buried up to it's top in a 6 inch round
Professional Soil Mix, fertilized initially with Miracle Grow 15-30-15 at 1/2 tsp
looking well at 12cm tall, flowering is begun with a 12hr light/dark cycle. Dur
30 to 50cm with large fan leaves but suddenly look over-fertilized (Miracle G
curling at the tips of the leaves. They respond virtually overnight to a good, f
then they take on a dark green color and start to "bud out" rather than get to
flowering, feeding is switched to Shultz's Bloom 10-60-10 at 1/2 tsp. per gal
and wait a couple days until they get lightweight before the next good soaking
extremely resinous, except that they continue to get progressively fatter and
the Jack Herer itself does. I would guess that the father of the seeds was a sl
calyx to leaf ratio is so high; the flowers just keep sprouting out in all directio
resin coated leaflets interspersed between flower clusters. The leaves, all bu
stalked resin glands from base to tip. Sample smoking of immature buds whi
them in RW cubes but they died) after two or three weeks of flowering prove
and produced a very "happy" high, not at all paranoia-inducing. The finished
Currently, I have several healthy, rapidly budding clones that are in their thir
well finish before their eighth week. The lowest four branches of one J1 clone
the J4 male's pollen and should yield roughly 50 seeds. My hope is that these
great variety of fine characteristics. The outstanding gene pool should ensure
Then I'll have a great breeding project: trying to select individuals for future
best characteristics of that diverse group." - Mr Soul

Strain: Rosetta Stone

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Mr Soul

Images:

Description:

Rosetta Stone is a fast-flowering plant with heavy resin production and average
and is generally an easy plant to work with. It was created by pollinating a u
Ale makes the densest nuggets we've ever seen) with a male we've tracked
resin-enhancing father. Rosetta Stone is a super potent, wonderfully sweet, f
Sativa/Indica hybrid. A definite keeper in any connoisseurs garden. - Bros. G

Specifications:

Flowering: 50-55 days ~ Height: 120 cm ~ Yield: 1-2 lbs per 1000W lamp.

Growers Comments:

"I like growing rapidly-maturing strains with very high flower/leaf ratios. I cho

dense buds frosted with resin glands.

I can't STAND leafy strains.

Princess has a sister I call "Cafe' Girl", which makes a GREAT production plant. She takes 7 weeks of 12/12. The colas are BIG and DENSE and RESINOUS. Her buds taste quite like the old Colombian Gold we used to smoke in the late 70's...very wacky and inducing.

She's an excellent yielding plant to boot; I could fill my 4'x8' flowering space and easily yield 60 ounces of Grade "A" since...that's an average of 1.5 ounces per square foot!

Cafe' Girl is the mother of "Rosetta Stone", a White Widow hybrid." -Soul

Strain: Willy Jack Jack Herer

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Sensi Seed Bank

Images:

Description:

none

Specifications:

none

Growers Comments:

"The Willy Jack Jack Herer is a domestically produced version of the Sensi original. It's pretty messy, in that there was a great deal of variation between the different clones. It went with has a relatively short flowering period (about 60-65 days) and big buds, but definitely worth the meager price and growing them out to find the best one. It's sativa, but you can still feel the indica. In my opinion, it's like a skunk that is more herbaceous on the side. If you flush it properly or grow organic, it should end up tasting sort of like Jack Herer. Jack Herer is a high light plant. For good bud density you'll need at least 30 watts per sq ft. It's such a bitch, probably the haze presence (Jack Herer = haze x nl #5 x skunk). It likes to stretch if you let it. Tie the girl down!!! All in all, it's a good one."

"Mine does have nutty flavor but with an undertone of catpiss.....good high...not too crazy but flower time is good....55-60 days. Definitely worth the price if you can get it from your momma." - Capn Howdy

Family: KC 33 Strains

Strain: KC 33

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** KC Brains

Images:

Description:

"Dutch variety, crossbred with a Thai and Brazilian weed, special for the outdoors. A favorite outdoors variety right through Europe.

Specifications:

~ Flower: 8 weeks, 8-10 outdoors ~ Harvest: Sept. " - Positronics seedbank

Growers Comments:

none

Strain: Leda Uno

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** KC Brains

Images:

Description:

"This variety is a sativa/indica cross (a hybrid of a KC 33 male and a Brazilian female) with a strong lemonlike aroma.

Specifications:

~ Flower: 6-9 weeks ~ Harvest: end of September"-Positronics catalog

Growers Comments:

"There are a few Dutch hybrids that might qualify that smoke up like a sativa, but of, nothing really grows like a sativa except a sativa. Some of those Dutchies are a high " high " and something that finishes in months not seasons. Search around the pages and zero in on any hybrid with 60% or more sativa in it e.g. kc33, Leda Uno, Trick. You can grow full-blooded sativas indoors but it takes forever and I mean on the thin sativa side, big fat indy type colas, finishes fast (for a sat. dominant) and is excellent for indoors or out and the high is like good champagne, an uppy, energetic, intelligent buzz. It's the type of smoke that makes you want to get up and do some chocolate and channel surf in a horizontal position. Everyone has his or her favorite way to grow, pretty as a pin-up and great for close, packed-in, SOG type growing, but women love it !!! etc. a real daytime smoke. It used to be available in Amsterdam station, but I've seen it at other seed resellers there. Recently (this year) I've seen it maybe they have it in now? But if you can get it, do so. If you are used to the low that some full blooded indys give you, you like it even more, sort of like a green sort of way."

"Originally bought at... Interpolm in Amsterdam in July '96, although I saw it at other seed sellers through out the city, a year and a half later. I thought I better get you get a bad lot and hate it; come fall, you wont hate me if your version is a good one. It serves me correctly (hmmmmmm!) its an indoor/outdoor variety (an easy grower) and is scented (then again I'm nasally challenged), doesn't seem to have any skunk

excellent for close together, one stalker growing if un-tipped and forced to flower one big cola (topping seems to reduce yield not increase it unless it is done ; get the same genes that I got, you'll be happy. try to do a seed crop (male L have lots of seeds to play with , give away and breed , I wish I did ! (I crossed local sativas trying to get something stronger, bigger and better), its got that and up high, indica growth pattern, sativa leaves and high ...there are lots of available ...silver pearl, NL x haze, early pearl, kc33 etc and most will give early growing lots of indica dominated varieties so you might not be so dazzled by time, I had only grown Thai and other south east Asian full blooded sativas, r flowering stage passes like a blink compared to those equatorial types, if I w buy strains like Cali orange and any of the pearls or any strain that is fast an

Strain: Leda Uno x Northern Lights

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Amsterdam Aloha

Images:

Description:

"Source: Amsterdam Aloha (I did the cross) Started flowering on 8/7 at 40* n harvested 9/15. Appearance: Outdoor plants (late start - June 21) were bushy Cultivation: Creek bed on edge of corn field. Only visited the patch 3 times. I release 14-14-14, visited once to cut back weeds and foliar feed, and then h

Specifications:

none

Growers Comments:

none

Strain: Mango

Strain Type: Indica **Origin:** Holland **Breeder:** KC Brains

Images:

Description:

"Mango is a 100% Indica variety, a F-1 hybrid of KC-33 and Afghani. High yield early.

Specifications:

Specifications: ~ Flower: 6-7 weeks ~ Harvest: end of Sept., 1st week of Oct

Growers Comments:

none

Family: Purple Strains

Strain: **Purple #1**

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Dutch Passion Seedbank

Images: 1

Description:

"A strong plant (50% Indica, 50% Sativa), easy to grow. Purple Afghan seeds with Indica and Sativa varieties since 1983. The plants are fully adapted to the climate and produce a respectable yield. This variety has calyxes that turn purple, starting at the buds. As the plants turn purple. Has rough, but subtle aroma and a very good high.

Specifications:

~ Flower: 8 weeks ~ Harvest: 2nd half of Sept., 1st week of Oct." - Dutch Passion

Growers Comments:

none

Strain: **Purple Haze**

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Positronics

Images:

Description:

"Produced from Mexican, Colombian, South Indian and Thai varieties. Incredible high, clear energetic high.

Specifications:

none

Growers Comments:

"This medium-grade outdoor Sativa is very, very dark purple, almost black, with brownish-red hairs, and lightly coated with crystals. When breaking it up, the trichomes are THAT dark! The stems taste like peppermint, and buds smell like chocolate (cut grass). When smoked, the bud tastes like a high grade outdoor Thai. Good as a campfire! The high creeps up on you, is spacey, and a bit uplifting. Much better than pipe. ***" - Homepage Amsterdam

Strain: **Purple High**

Strain Type: Indica **Origin:** Holland **Breeder:** Dutch Passion Seedbank

Images:**Description:**

"Original Dutch outdoor variety, strong plant. Almost all plants turn a rich purple, grow, early finish. 100% Indica, unusually fragrant smell. Tastes a little rough, high.

Specifications:

~ Flower: 6-7 weeks ~ Harvest: mid to late Sept." - Dutch Passion catalog.

Growers Comments:

none

Strain: Purple Skunk

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seedbank

Images:**Description:**

"This variety is a hybrid (F1) of Purple #1 and an early Skunk. About 50% of plants are in flower. The variety is 87.5% Sativa and 12.5% Indica.

Specifications:

~ Flower: 8-9 weeks ~ Harvest: 1st week of Oct." - Dutch Passion Seeds

Growers Comments:

none

Strain: Purple Star

Strain Type: Indica **Origin:** Holland **Breeder:** Dutch Passion Seedbank

Images: 1

Description:

Very strong and easy to grow purple variety (100% Indica). Very resinous, has a strong purple color. The aroma is a little rough, but the variety produces a very strong high. About 50% of plants are in flower.

Specifications:

~ Flower: 6-7 weeks ~ Harvest: 2nd half of Sept., 1st week of Oct." - Dutch Passion Seeds

Growers Comments:

none

Strain: Shaman**Strain Type:** Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seeds**Images:** 1**Description:**

This is the former variety Purple Skunk. This variety is a hybrid (F1) of Purple
50% of the plants turn purple during flowering. The variety is 87.5% Sativa a

Specifications:

~ Flower: 8-9 weeks ~ Harvest: 1st week of Oct." -Dutch Passion Seeds cata

Growers Comments:

none

Family: Trinity Strains**Strain: Buddha****Strain Type:** Mostly Indica **Origin:** Holland **Breeder:** Dutch Passion Seeds**Images:** 1**Description:**

"Another favorite from our collection, developed by our breeders in 1996. A
with a male Oasis/Shiva/Skunk. The talk of the town in Amsterdam in 1996.

Specifications:

~ Flower: 8 weeks ~ Harvest: end of Oct." -Dutch Passion Seeds catalog

Growers Comments:

"I grew DP Buddah on my last crop and you did not miss much. In fact I wish
could have moved on to a strain with more potential. Basically the problem w
and very little taste with most of the commercial bud in my area being super
that I can not be bothered to smoke." -Glaeken.

Strain: Hempstar**Strain Type:** Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seeds**Images:** 1**Description:**

“Developed as a tribute to all the Hempsters and the International Hemp Movement between Skunk, Oasis and Haze, it is the combination of the three major varieties with enormous potency and sticky Sativa high. The taste is very mild.

Specifications:

~ Flower: 9-12 weeks ~ Harvest: end of Nov.” – Dutch Passion Seeds catalog

Growers Comments:

none

Family: White Widow Strains

Strain: Great White Shark**Strain Type:** Mostly Indica **Origin:** Holland **Breeder:** Arjan, Green House Seeds**Images:****Description:**

“Taste: The fruitiness of the Indicas with a strong presence of the widow and the fragrance of flowers and fruits with the odour of a White Shark. Visuals: Orange buds that glistened in the crystal rain of its widow father origins. Touch: The buds are sticky and solid -just like the original parents. Stone: Seductive high feeling like the jaws of his namegiver. Family Heritage: A cross between a Super Skunk and a White Widow. Seed Co. catalog.

Specifications:

Vegetative Time: For indoors a suggested minimum of 2 - 4 weeks. For outdoors in spring. Flowering Time: For indoors a suggested time of 8 weeks. For outdoors a substantial yield will be expected. Achievements: 2nd - Place - BIO-Award 1997” – Green House Seed Co. catalog.

Growers Comments:

“There is something so enchanting about the way the buds have formed on top of the snow cones sitting delicately atop their verdant, leafy bases. Like the plants

something! And one thing I have noticed. The skunkiness that accompanied pretty much dissipated entirely at this point. The floral clusters now have a c like fresh wintergreen. And the resin crystals are starting to coat both the ca Yummy. I really like these plants, can you tell?

Someone was wondering about stretching with this cross. They are not small moderately big with significant but not unmanageable internode lengthening flowering. I know this is impressionistic, but they are too far along in their de retrospective percentage of the stretch to the original seedling size at the tir Cloning is super easy with GWS and the slips grow like wildfire. It is an ideal forward to sampling the final product which I understand ripens fully in about interesting to see how much more bud growth occurs in the final fifteen days

Strain: K2

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Homegrown Fantase

Images:

Description:

“It’s the little sister of the White Widow Bio, short plant ideal for people with decent high. Grown very much by local growers, a perfect compromise betw favored by Hydro growers. Very good yield.

Specifications:

~ Flower: 8 weeks” - Homegrown Fantaseeds catalog.

Growers Comments:

“This white crystal covered compact bud is mostly pale green with patches c clusters of orange-red hairs. It has a strong sweet green scent with just a hin when smoked, K2's flavor is mild green with a bio taste. The smoke is smoot high comes on quickly and is spacey and mellowing and just a bit visual. ***:

Strain: Lady Widow

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Undetermined

Images:

Description:

none

Specifications:

none

Growers Comments:

"Daughter of the White Widow plant. This bio is yet another example of Holland's generation of Neder-weed. These medium green, smallish buds are so covered in trichomes they appear much lighter than really are. Its red hairs are sparse and short. The buds are sweet--like a powdered lemon drink mix. The smoke is expansive in the lungs and the high is constant, mellow and pretty stony. ***1/4" - Homepage Amsterdam

Strain: Misty

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Homegrown Fantaseeds

Images:

Description:

"Sister of White Widow. Short, bushy plant yielding a high THC content." - Homegrown Fantaseeds

Specifications:

none

Growers Comments:

"Misty (a supposed sister of WW) is thought by many to be a just one of the incarnations of WW, It is said to be a much more stable variation of the WW

"Misty seeds are strong variety. Short leaves, light green, strong bud, big cluster, sweet, and grows very fast. 4 weeks until flowering, 8-9 weeks for full flower

"On a smoking excursion to Amsterdam last September I got a chance to sample and see both side by side. They look almost exactly the same, side by side, and I easily think they came from the same plant. I saw this in person at Positronic the Skunkmaster some White Widow as I was standing there, and he compared it to the one I had just purchased in the smoke room in back. The Misty is a *fairly* strong strain on a scale of 1-10. Equivalent to a good Northern Lights in potency. The White Widow, on the other hand, is great. This is just my opinion of course." -SonOfLights

"10 seeds were ordered from Jocks and all but one germinated using the old method. They were then planted in rockwool cubes and all 9 sprouted. Last week when I saw them under flouros with 2 lagging behind. (They looked healthy I just think they were still working on their 4th node. I forgot how old but I would guess around 12 days of them were showing good branching characteristics." -Ratchet

"Misty from Homegrown Fantaseeds. It was real easy to grow. Yielded over 20g of buds sweet like sugar. Connoisseur quality cannabis. Best I've had. Chronic from 5g is better than Misty.

"...The Misty is really sweet. Chunky thick bright green nuggets with little delicate trichomes in the Misty. The Nugs are really fucking green. They're very sticky, and VERY powerful. This shit knocks you on your ass, and it stinks. The kind of shit that when I've got a 1/4 in my backpack in the trunk. Yield is way better than average. I've seen half ounce single stalk 3-footers that were flowered at 6"-8". A joint

before you're half way into it. Split a modest one with a friend and you'll be i
or one mother load will put you on your back. If you want more info on Misty
Fantaseeds web site. Misty was the key ingredient in White Widow, and altho
WW family is probably unstable, of the 7 Misty seeds I started there were no
even size variations. Misty is definitely the better choice unless your #1 con
wrong yield for Misty is BIG. I don't have the link anymore for homegrown, b
find. Misty is definitely amongst my 3 favorites, but I haven't tried a lot of th
has been NL5xHaze, and number 2 is either misty or blueberry." -Skywalker

"...AK-47 from Serious Seeds, and Misty from Homegrown Fantaseeds were k
Misty have a great yield, and a knock you on your ass stoned to the bone. I l
power of the Misty the best personally." -KITSCY DUB

Strain: Original Misty

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Homegrown Fantaseeds

Images:

Description:

"A truly beautiful plant misted all over with bulging THC glands. A good prod
dick tops, combined with prize-winning quality, gourmet taste and a sweet a

Specifications:

~ Flower: 8-9 weeks" - Homegrown Fantaseeds catalog

Growers Comments:

"If you are looking for the best quality and yield combination I would recom
Homegrown Fantaseeds. Misty is a stabilized sister of white widow with a big
taste. I've heard that all of the white widow hybrids are very unstable, but I s
plant growth patterns in my experience with Misty. I got an even larger yield
but only a very little bit larger. It did however have a sweeter taste and an e
Chronic. Flowering period for Misty was 8-9 weeks, and I harvested a little m
planting. After 2 weeks rooting under flo's I veg for 2 weeks under MH and th
- Stoned Silly

Strain: White Rhino

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Green House Seed

Images:

Description:

"Afghan X Brazilian & So. Indian.` Somewhat a mystery strain. Suffice to say
ratios expressed with a definite freak in its family.

Specifications:

~ Flower: 10 weeks." - Green House Seed Co. catalog

Growers Comments:

"This crystallly, olive colored bud is sparsely covered in brownish red hairs and proud and bubbly. This bio has a pungent, green scent; some have even said Very fluffy somewhat dense buds break apart nicely and leave your fingers tastes a bit brown for such a green plant, depicting its Mexican heritage. The you coughing a bit. The high is not overly mellow; the head change isn't muc does very well through water, eliminating the need to cough all together. **]

"Flowering time is 8-10 weeks respectively. Although the flowers will appear extra two weeks is to allow THC to spew out of the glands leaving a coat of v patient with this strain unless your wasting your time. TO EVERYONE WHO G YOU ALL TO WAIT THE EXTRA TWO WEEKS THAT IS NEEDED FOR THC PRODU

"In the case of multiple sclerosis an indica is a good choice, but I don't think with using a strong indica to ease the pain is that it also fries your brain and incapacitated. I would suggest either a 60/40 cross between Sativa/Indica or Winds is an excellent pure Sativa and White Rhino is a great 60/40 cross bet

Strain: White Russian

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Serious Seeds

Images:**Description:**

"With the combined power of White Widow and AK-47, this potent plant became Cannabis Cup '96 organic pot award. Select best female for future cloning.

Specifications:

S~ Flower: 8 weeks" - Serious Seeds catalog

Growers Comments:

"Winner of the 1997 Cannabis Cup. This bud is mostly sea green (yellowish-green, and has clusters of reddish-tan hairs. Very light tan crystals coat the and bio with an undertone of skunk. When smoked, the bud tastes sweet and The high is spacey, stony, a bit forgetful and lasts strongly for 2 hrs or more! good hits and you're set for a while. ****3/4" - Homepage Amsterdam

"White Russian (Grey area) again very complex high, but tends a little more coffee." - Prince Caspian

"Very strong hash oil taste, I give it a 9.2. Both WW and White Russian are ir

and good yielders the Russian is my favorite. It's my fav. strain, 70-75 days 1
all your seeds to be sure you have the best cross section, taste = potent, yie
very good it's my fav. still after a year and 1 that I would recommend WW. x

"It is my best yielding strain, better than SK#1. There is some variability in t
squatty ones w/ the best yield for future clones. Definitely the best weed I ha
comment from a couple of 60's stoners who made the mistake of splitting 1/
much...I was tripping!" These are experienced smokers BTW. I find it to be v
(but not a knock-out indica type of stone) and, w/ 2 bong hits of (early) buds
up/trippy high. You won't be able to sleep, that's for sure. I would recommen
with the exception of Nevil's Nepali (which I can't find anymore) or his Haze.

Strain: White Widow

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Ingemar

Images: 1 2

Description:

"Taste: The major player is a freshness laced with many fruits, but because o
only real taste goes hand in hand with the expectorant effects of the THC. Yo
A strong pungency first hits you, then follows a sour sweetness with the final
could have a strong body odour then the White Widow needs a deodorant. V
green plant grown in a snowfall then that's it. It has a dense covering of the
for. Touch: If you manage to touch this plant without sticking to the leaves o
grow it properly. It has intense crystal formation that needs to be touched to
puff, that daunting warm feeling of impending stoniness comes over you. You
throughout your body in time. It is a serious heavy highness. Family Heritage
a Brazilian and an Indian - Suffice to say the combination is 60: 40 sativa to i
Co. catalog

Specifications:

Vegetative Time: At least 2 to 4 weeks if on Bio. On Hydro it is only recomme
Flowering Time: On both mediums it is suggested to flower (12 hour light) th
weeks will really give you the crystals you are after. We suggest the final 2 v
the lights off altogether - or at least down to 8 hours. This keeps the flowers
plant into giving up its last drop of goodness as crystal to protect the flower.
BIO - HTCC - Award 1995." - Green House Seed Co. catalog

Growers Comments:

"The most rewarded variety of recent years in Holland. The plants are white
of the fan leaves. A very soft smoke and great high. Very potent.
Specifications: ~ Flower: 8 weeks ~ Harvest: end of Oct." - Dutch Passion se

"It is a serious heavy high. Heritage: Originally the union came from a Brazili
the combination is 60% Sativa to 40% Indica. The most rewarded variety of i
are white of THC-glands, even on big parts of the fan leaves. A very soft smc

1st place winner 8th Cannabis Cup. 1st place winner 8th international Hydro height, Indica dominated variety with a sweet 'Skunky' high. Incredibly resinous flowering heads. Delicious odor and taste.

Specifications: Outside/Indoor/greenhouse

Flowering period 8-10 weeks for crystals (50-60 days), outside 10-14 weeks.

Height: Height: inside: 60-75 cm, outside 1.50-2.00m

Yield: up to 150 gr.

Harvest time under natural light: End of October.

Appearance: very strong plant with big leaves." - Sensi Seedbank catalog

"This fabled bio probably derives its name from its whitish appearance created covered with tiny white crystals. The bud is almost absent of hairs, save sparse bud. Its scent is mild and flat with the tiniest touch of green that tells droves parentage. Light, semi-sticky buds snap apart from yucky tasting stems, perfect. The smoke has a mild flowery full taste. The high is a little of everything--a bit stony. Nice trippy feeling but very mild. ***" - Homepage Amsterdam

"Arjan at the Greenhouse first introduced the White Widow strain in 1995. All it has a very complex lineage. In Amsterdam most every coffee shop now sells different "WW". One sample from the Green House Centrum, one from Homegrown from a small local's shop called coffee shop "Tops". All three were very different. My favorite of the lot came from the green house. It was a nice bud but it didn't stick. I remembered from previous trips to Adam. The Hydro from Homegrown fantastic. A resinous sample from "Tops." Other items that I have read state that WW is still the best you could get almost anything."

"The way Marc told it was like this: Arjan had a WW on display at some expo and a passion/aloha stole a clone and hybridized it. That is the plant we bought for our grow. Because of great variance we see in the plant, it's not just WW being unstable, we know that over generations- gene recombination produces various phenotypes representative as well as different genotypes. It's great if you're a breeder because you can be selective to your preferences. I have one f2 plant I believe to actually be a throwback to the original. It's larger and more indica than the rest." -LadyJ

"It's a very strong weed (which has unfortunately had the effect of spoiling me and not to get me high like they used to), but not too sedating. And extremely tasty, I've run across (makes NL seem weak, odorless). Strange that the widow was supposed to be VERY easy to grow in organics. A smallish medium yielding plant that is very tasty. I been smoking along time and I prefer a tasty herb that you can puff and it knocks you on your ass after one hit and tastes like pure thc almost narcotic. Most were like me."

"I heard that the mother was First Lady which parentage comes from Mullim strain down here in Aus. The father I heard was from a Dutch Shiva Skunk (Not a famous white crystal." - Delta9

"White Widow: This plant at 60 days did not have the advertised heavy resin (I had a good sample). smell was minty sweet. plant is fluffy and leafy. looks like NL. The high is a bit racy, and both I and my co-sampler found it made all the blood clotting. standing up. tendency to feel faint. Very easy to clone. buds fluffy. Plant is p

leaves. Not recommended.” - Splif Lipsit

“I'm also growing DP white widow. I have also found the fragrance to be very This stuff is stony, but the taste leaves much to be desired. There's not much mothers and can't decide which one is the keeper. Overall, I'm kind of disappointed all the hype about it. I too have not had the good fortune to get buds that are hey, I had to see for myself. I, too, have had the problem with the powder m on the leaves when it gets close to harvest. I have had to do lots of manicuri stash that I really want around. It doesn't get smoked.” - potattic

“I voted for the WW at the 8th Cann Cup. It was fantastic, Arjan at the award in 2-3 years. I returned and got these seeds from his shop and they are excellent short and dense, not very branchy, just over 7 wks. The rest were taller and had a consistent heavy crystal, great smell and great stupefying high. I have my first harvest of WW was A+++, I had to actually concentrate when driving profuse and on the big fan leaves. Taste is very good, def. KIND. Taller ones I assume the taller are dominant to the Sativa side and have the taste influence mothers. All females where KIND, but I couldn't keep all so I gave up only on they are very consistent except for the one Indica dominant plant. I want to the 3 sativa dom. ones. I suggest this strain (I got mine at the Greenhouse in for personal stash, one of the best tasting strains I ever had and one of the best strong, stupefying yet not sleepy. Should be best crossed with fast, heavy yield growers.”- Wood Duck.

“The WW-'s finished pretty tall, at about 15-18 inches and yielded about 21 g stalks that grew tight buds with a spicy smell. I didn't get that ultimate WW I the fan leaves like some say it does, but while budding the buds were pretty of the trim leaves. I am having a little trouble drying this strain as it seems to have been using Tupperware for the last 3 months to even out the drying process today for the first time and I liked it a lot. I wont classify it as anything spectacular me to the chair pretty hard!” - James Hetfield

Strain: White Widow X Northern Lights #5

Strain Type: Mostly Indica **Origin:** British Columbia/Holland **Breeder:** Unc

Images:

Description:

“White Widow gives Northern Lights #5 a powerful boost in this strain. Like a engine, this Indica will pack a lot of power.

Specifications:

~ Flower: 55-60 days ~ Height: 3-4'' -Marc Emery Seeds catalog

Growers Comments:

none

Family: Uncategorized Strains

Strain: **Amsterdam Flame**

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Paradise Seeds

Images: 1 2

Description:

"This outstanding plant of excellent quality with her sparkling looks is selected for her wonderful high and soft subtle taste carries us like a summer breeze, tell me it is worthy for the 'canna'seur. It is not saying too much, it is hard to wait for harvest."

Specifications:

~ Type: mostly indica, Flowering time: 50 - 56 days, Yield per m2: 400 - 500g

Growers Comments:

"Well here's my detailed report on my AMSTERDAM FLAME" (Paradise). Grown in different strengths. One being high Phos (for flowering) the other high Nitro (for vegetative flowering period.. Small staunch indica, purple/orange hairs, and nectarine smell like an Alaskan winter. In fact crystallizing so well that you can hardly see veins upon them. Looks like I put it in the freezer or something..." - Mirage

Strain: **Black Domina**

Strain Type: Indica **Origin:** Holland **Breeder:** Sensi Seed Bank

Images: 1

Description:

none

Specifications:

none

Growers Comments:

"Sensi Seed offers g13xhashplant and that was it. It is the same as the one sold by Sensi of Black Domina. I learned this at the Sensi Seed shop 1 day after I bought the hashplant from Dronkers hands at the Pax party house. I spoke to Tony about the Mantanuska and he said he smoked it and none is ready yet. I picked up 10 Mantanuska and 5 peak19 buds (from Stonehedge) for 300gilders (about \$175american). Adam from T.H. Seeds (The Bubbligum and Californian genetics) told me its "Sag's big bud" with "great high in potency" and that the Stonehedge was a "more rewarding high/plant to grow than the perfect compromise/partnership." - Damion

"Black Domina. It's a day ender, you wont do anything but slump there for q
hardest full indica I have ever grown, or smoked, and I have been to A-dam v
by a bro from a coffee shop. The coffee shop is a direct competitor of Sensi's
floor you, it did." -Greco Roman

"Greco, I know just what you mean. It's one of those breeds that you gotta si
got a taste like no other Indica (pure) out there! Not for those seeking "sweet
Hash Oil.
ps- it's good outdoors as well...very early." - Bdubs

"I purchased some Black Domina seeds from the Sensi Seed bank the last tir
too impressed with my final product. True it was very resinous and smelled l
that desirable. I also made the mistake of trying to grow a B.D. outside. Sinc
does very poorly under natural conditions. I ended up with some runny nugs
ok bud." - Bill Wonderful

Strain: Chitral

Strain Type: Mostly Indica **Origin:** India/Holland **Breeder:** Dutch Passion

Images: 1

Description:

This variety is a hybrid of Chitral and Skunk, Chitral being the variety of the 1
seventies. Hybridized with Skunk, the variety tends to be even stronger. Good
strong "physical high".

Specifications:

~ Flower: 8 weeks ~ Harvest: 3rd week of Oct.

Growers Comments:

"This bud has thick layers of orange-red hairs surrounding darker colored gre
very obvious, but are noticeable. It has a sweet green scent with skunky und
buds break up stickily and the stems taste more like mint or blueberry stems
tastes skunky with an undertone of citrus, like orange peel. It's thick and exp
you cough. The high comes on quick and is lazy and stony. Doesn't give the
Amsterdam

Strain: Chronic

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Serious Seeds

Images:

Description:

"Chronic is the plant to grow when yield and quality are top concerns. Mostly up to 600 grams per m² while not compromising quality. Chronic has a strong Smokers that know and grow choose this plant for both appearance and it's : hydro division in the 1994 High Times Cannabis Cup, this is chronically the best tired of losing quality when gaining yield. Indica/Sativa bred with powerful effect Quality without compromise, serious flower power!

Specifications:

~ Mostly Indica, Flowering time: 60-67 days, Yield: 400-600 grams/m²" - Seed

Growers Comments:

"I've grown Chronic. I've heard several different ideas about the genetic origin. The second was NL x Big Bud x Afghan. I am personally more prone to believe a certain mildly sweet aroma and taste that I didn't notice at all in Chronic. I have characteristics other than a giant fucking yield. Chronic has a very slightly spiced stone. If you are looking for the best quality and yield combination I would recommend Homegrown Fantaseeds. Misty is a stabilized sister of white widow with a big taste. I've heard that all of the white widow hybrids are very unstable, but I see plant growth patterns in my experience with Misty. I got an even larger yield but only a very little bit larger. It did however have a sweeter taste and an effect Chronic. Flowering period for Misty was 8-9 weeks, and I harvested a little more planting. After 2 weeks rooting under flo's I veg for 2 weeks under MH and then - Stoned Silly

"Chronic is a strain developed by Cerebral Seeds. After this company split up Cerebral Seeds, both parties kept the strain. Serious sells it under the Chronic name and name Slyder. Actually Sagarmatha ran into some problems with the germination seeds. They have stopped carrying it FOR NOW until they get a few new batches personally that the Slyder would return very soon. The origins of this classic strain crossed with an Afghani ". Very, Very Heavy/ sleepy buzz. Tons of resin, relative structure. Very well suited for SOG application."

"As for the Chronic, I'm extremely impressed. All the claims of high yield and haven't got the total weight of my grow yet cause the MONSTER colas (two for drying, but the first three plants (which weren't the biggest) gave over 100 g last three look like they'll weigh in even more. There is a bit of variance in the phylotaxies/growth patterns indicative of the Sativa/Indica mix: thick, luscious slightly fluffy buds on stretchy tall plants. Nevertheless the result was excellent mental and will lock you to your couch for a long time. I'd give it a 7.5 or 8 out

"All 10 started with germinated and sprouted. The seed gave up 7 females with plants were similar in appearance but differed somewhat in growth rate under long leaf stems with leaf blades somewhere between an indica and sativa as was a darker green with a nice shine.

1 and 2- These two were practically identical in all aspects so what the heck. cut down around 10 weeks and could have gone on longer. All of the chronic weeksù68 days. Some were probably ready a few days earlier though. Braided

describe the bud structure. Buzz was good and yield was decent but both the the long flower time. These plants also had the city skyline look to the buds : branches were just about all horizontal.

3- Got shaded bad and after a test smoke was chopped since it wasn't as good been a decent plant but we'll never know.

4- This one here was the winner as far as yield goes but since they were all s its the real champ. This will be a nice plant to grow since it grows like a sativa hard times than indicas. This plant placed well in the buzz department too, 2 with smaller calyxes than 1 and 2. They were fairly tight buds considering th grow.

5 and 6- Yep these two were practically identical as well. Heck they even yie completely different in bud structure than all the others. They have small cal they are much more compact than the others are. Buzz place was a close 3r

8- Don't know how this one yielded since it was the buzz champ and got cho was a ginzu.

This buzz is nice and the yield won't be too bad either. This was the prettiest braided look with smaller calyxes than 1 and 2 with a nice orange color for fl one does from clone is information that's highly anticipated because of the b flowers prior to induction and what was left on the plant on the 58th day was definitely the earliest finisher.

Aroma: This had possibly the most pleasing smell for weed, ever smelled in t light perfume or garden flowers, very nice.

Buzz: The buzz from 8 is about the same for all of them except for potency.) it had a definite sativa feel to it and it was even reported that someone had when tired. Once the thing matured the buzz turned more into and indica typ folks down but really isn't couch lock at all, its just that the potency causes k But mostly the weed has the sativa edge. Since little was smoked when the p

let's leave this until the final report from clone, it's better than average right Taste: The taste was pleasant and tasted somewhat like it smelled. More on attention was paid to this characteristic.

Yield: Because these plants were flowered for 2 weeks under flouros before i were somewhat crowded, and because they yielded as much or more than a cc jr." - flick

Strain: Domino

Strain Type: Indica **Origin:** British Columbia **Breeder:** Breeder Steve

Images: 1

Description:

"Tangy indica, wicked crystal.

Specifications:

Height: short, will grow wide with veg Flowering: 6 Weeks Harvest Outside: e Life Seeds catalog

Growers Comments:

none

Strain: Durga Mata

Strain Type: Indica **Origin:** Holland **Breeder:** Paradise Seeds

Images: 1 2

Description:

“This cross of two super Shivas, selected for their resin content is mind blowing she is easy to grow. A plant to get familiar with the world of cannabis.

Specifications:

Type: indica, Flowering time: 50 - 55 days, Yield per m2: 350 - 450 grams” -

Growers Comments:

none

Strain: Dutch Dragon ®

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Paradise Seeds

Images: 1 2

Description:

“This dragon of Dutch descent is a spectacular plant for indoor growing. High Superb quality along with long sticky colas. Its sweet taste and strong potency many regular smokers.

Specifications:

Type: Sativa indica, Flowering time: 50 - 55 days, Yield per m2: 400 - 450.” -

Growers Comments:

none

Strain: Early Riser

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Sagarmatha Seeds

Images:

Description:

“Early Riser is our first variety especially developed for outdoor production. Selected breeding -choosing individuals with the shortest flowering period combined with

cannabinoidal resin - have produced a wonderful example of botanical wizardry supporting the same high quality standard of exceptional cannabis that Sagarmatha scrutinizing clientele. The aroma and flavor of Early Riser is sweet with a mirage and motivational, releasing the sun's natural energy with every bowl, so let t

Specifications:

~ Type: Indica-Sativa, outdoor. Flower period ends: Mid. September. Average Yield: 400-600 grams/plant” - Sagarmatha seedbank catalog

Growers Comments:

none

Strain: Eclipse

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Dutch Passion Seedbank

Images:

Description:

A new variety, mostly Indica with a sweet taste. Somewhat a version of the kush by American clients. This is one for the young and the young at heart.

Specifications:

~ Flower: 8-10 weeks” -Dutch Passion Seeds catalog

Growers Comments:

none

Strain: El Nino

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Green House Seed Co

Images:

Description:

Haze X Super Skunk Brazilian X So. Indian. 25% Sativa/75% Indica

Specifications:

Vegetative Time: For indoors a suggested minimum of two weeks. For outdoors of spring. Flowering Time: For indoors a suggested time of 9 weeks. For outdoors substantial yield will be expected.” - Green House Seed Co. catalog

Growers Comments:

“El Nino is Haze xSuper Skunkx Brazilianx South Indian. Tastes very earthy w

resinous buds, but a low yielder. The high could have and should have been parents. Tried it at last years Cup, didn't even finish the spliff." -Geronimo

Strain: Five-in-One

Strain Type: Sativa/Indica/Ruderalis mix **Origin:** Holland **Breeder:** Undete

Images:

Description:

none

Specifications:

none

Growers Comments:

"The strain called "5 in one" was my favorite. Very high calyx to leaf ratio. Tl on these awesome buds!!! It was all bud I swear to ya!!! They reached matu plant had many medium size nug. The stems on these babies were strangel growing up I thought they were going to suck. I used shiskabob sticks to hold closer they were held to the light, the denser and bigger the bud was. The sr something fruity. The taste was great too, actually the first time I can say I a taste of this awesome strain. These babies yielded almost a Z a piece so need them." -James Hetfield

Strain: Fourway #1

Strain Type: Sativa/Indica/Ruderalis mix **Origin:** Holland **Breeder:** Sensi S

Images:

Description:

"Four Way #1 is a hybrid of 4 different strains, 25% Indica, 25% Ruderalis, 2 Skunk #1. As a whole the Four Way #1 cross has the Indica appearance. The grow. Some of the plants give very high yields, so select a clone. The plants leaves and grow well developed buds. A very good smoke in taste and high. Sensi Seed Bank

Specifications:

none

Growers Comments:

none

Strain: Hollands Hope

Strain Type: Sativa/Indica mix **Origin:** California/Holland **Breeder:** Dutch

Images: 1

Description:

"One of the first Dutch Outdoor strains, grown in Holland since the early eighties. Very mold resistant. Highly recommended.

Specifications:

~ Flower: 8 weeks ~ Harvest: end of Sept., 1st week of Oct." - Dutch Passion

Growers Comments:

none

Strain: Hollandsch Hoop

Strain Type: Sativa/Indica mix **Origin:** California/Holland **Breeder:** Positronics

Images:

Description:

"Developed: inbred 10 plus years Stabilised hybrid Sativa/Indica: California Sativa
Appearance: big long clusters, green to goldish at harvest Smell/taste: sweet

Specifications:

Type high/strength: good taste and strong Height: 3-4m Yield: very high Harv
photoperiod): begin Sept. 12hr day exposure harvest (# of weeks): 7-9 indoor
Positronics seedbank catalog

Growers Comments:

none

Strain: KC36

Strain Type: Indica **Origin:** Holland **Breeder:** KC Brains

Images:

Description:

none

Specifications:

none

Growers Comments:

"I grew KC 36 from KC Brains, it is a very unstable strain, out of 30 seeds I g
"varieties" one has very fluffy Buds and small calyxes, this one you can forge
calyxes but very few. The "real one" has big calyxes and extremely big buds
the good plants tends to get Bud rot cause of the massive Buds, the other is
immediately after you turn the lights to 12/12 (about 5 Days). Flowering time

mothers do not start flowering, give them 20 hours light, my most promising 16 hrs light. Resin production is only strong in some plants. The real one should think of anything else right now.

I am not sure myself if I should keep them, I got the seeds as a present. I was unstable like this myself- cause I might even have been lucky that I got the 2 Seeds and it is all crap, and you don't catch the "hybrid vigor" super plant. I got some of the good ones that they might be Jack Herer stolen from Sensi and being F1 F1 Seeds they are more unstable than Jack Herer, and J.H. is very unstable. F1 is good - High is good. If you decide to try this strain out look out for a mother with large growths where each flower or calyx is really fat, and the Colas are fat. Leave it alone as with other varieties like NL or WW. Look for resin production and big calyxes. It is a stable strain-but yield is mediocre. The KC 36 high is between Indica and Sativa "in circles". few things are nice very fast start of flowering, explosive bud formation yield." -Baron

Strain: Nebula

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Paradise Seeds

Images: 1 2

Description:

"Like the name suggests this plant is covered with twinkling shiny THC glands. The taste is marvelously sweet is a delight to even the most experienced smoker. She is out of space. Her buzz is typically transcendental and it is known she takes you to another world. If you want to join the worlds of nebula, she is waiting to give you universal depth.

Specifications:

Type: indica/sativa, Flowering time: 56 - 62 days Yield per m2: 350 - 450 grams

Growers Comments:

none

Strain: Night Queen

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Dutch Passion Seeds

Images: 1

Description:

"A 1997 upgraded strain. Very early flowering, very productive, a Sativa/Indica hybrid. It is sweet, Sativa high.

Specifications:

~ Flower: 6-8 weeks ~ Harvest: end of Sept., 1st week of Oct." - Dutch Passion

Growers Comments:

none

Strain: Peak 19

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Sagarmatha Seeds

Images:**Description:**

"Peak 19 was the original western name for Mt. Everest. With similar magnitude mountain herself inspires, F1 hybrid Peak 19 will fulfill your cannabis desires take you soaring high above the rigours of daily existence. Thought provoking highs associated with Peak 19 are somewhat trippy in their nature. This sure-footed high altitude experienced Sherpas or persons with a high sense of Stonehedge and Matanuska Tundra is one of Sagarmatha's most prized and a palatial delight and a celestial height for every high mountain trekker.

Specifications:

Type: mostly Indica, indoor and outdoor. Start vegetate: shortly after roots set time: 60 days. Average height: 1 meter. Yield: 350-375 grams / m2 (dried)." catalog

Growers Comments:

"Well let me tell ya the most impressive strain since afoaf's first strain which along nicely, its Peak19, and in both of its phenotypes its a real sight, it comes Tundra expression, they both start frosting with trichomes early (2 weeks), that's great when you need a really short plant, the spec at Sag says they are a/b . that afoaf has is 18", after 4 weeks 12/12, they stretch so little, it was forced branches are starting to form one whole plant connected cola, It would be great for grows that need short style plants, or any grow where height is a factor. Also Ingmar is a great strain also, the odor is unmistakably "Orange" at 4 weeks 1 as fat in diameter as any of the 5 strains in the grow, Ingmar must select again "Ingmars Punch"(WWxSkunk) was the same really fat colas, I guess 17 years attributes in strains, that's a lot of time to grow out lots of generations, and backcrossing." - Budm

"About the Peak 19s, they were great the F1s have 3 types one that sticks to phenotype, however in this strain its not tall, lanky, and skimpy, it reaches a that are frostier then many indicas. The next expression sticks to the Matanuska short and stocky, at maturity, after stretching the gal was just 18", and she v and stony smoke, Then there is a homogenized phenotype, that is between t "its like getting three strains in one pack" Now the F2s my friend made are t the F1s, the male used in the pollination, was very impressive, nodes were u stocky, lush, and stinky at maturity, he pollinated one Stonehedge type gal, My friend harvested his first Peak 19 F2, and its every bit as good as its mon

taste is great with out curing, it will be real nice when cured. So far two out of three Stonehedge type, they have a great up "wake and bake" soaring high, and one more Indica like, from the Mat T parent." -Budm

Strain: Pluton 2

Strain Type: Indica **Origin:** Holland **Breeder:** Super Sativa Seed Club (SSC)

Images:

Description:

"M45 Indica type, strong, bushy plants. Very suitable for outdoor growing in cold climates. Very resistant. Success guaranteed. Early flowering. Yields vary from 500-1000 gr per m2. Harvest second week of September. Very good for indoor plantlet growing as well. - S.S.S.C. catalog 1987-88

Specifications:

none

Growers Comments:

none

Strain: Sensi Star

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Paradise Seeds

Images: 1 2

Description:

"This hybrid is a great indoor plant. She produces powerful, resinous and very sweet aroma speaks for itself. One of world's best stuff for heavy smokers. It's stoned to the bone.

Specifications:

Type: mostly indica, Flowering time: 55 - 60 days, Yield per m2: 350 - 450 gr

Growers Comments:

"I harvested the SS in early October. 4 plants, each with a 1oz. cola (big and fat buds. This weed is probably about as potent as Northern lights, although the taste are very lemony, fruity. Nice, smooth powerful weed. I'm quite happy with it. I keep trying to tell myself its not as good as the NL#9 I grew with it, every time I smoke at the potency." - KGB

"It is a very good cross for its potency. Yep, the high is more complex than Northern lights, but the potency is fairly low, matures from 50-60 days. There's much variation in this strain, so select your favorite. Be glad to answer any specific questions." -stix

"Received Sensi Star through HS, 10:10 for germination. All very uniform looking females, all short, very vigorous and dense in growth. I put them into bud after they were about 12-14". All had minimal stretching under my 1000w hps and range. Out of my 4 females, one had a mold problem at 6 weeks and the other tall and ready to harvest any day. They have huge, very dense, THC covered buds. A great indoor plant that seems to have great commercial value." -Brends

Strain: Silver Pearl

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Sensi Seed Bank

Images: 1

Description:

"This 3 way hybrid contains Early Pearl®, Skunk #1® and Northern Lights®. Plants exhibit characteristics of the Northern Lights #5® and the sweetness and calyx-to-leaf ratio of the Skunk #1®. One of our favourites and in 1994 the winner of the mixed Indica/Sativa category." - Sensi Seed Bank

Specifications:

Flowering: 45-50 days. Height: 100-125 cm. Yield: up to 100 gr. Finishing date: 10-15 days. Yield in greenhouse: up to 500 gr." - Sensi Seed Bank catalog

Growers Comments:

"My Silver Pearl is beyond wonderful! VERY HALLUCINOGENIC tastes sweet like candy but a great accomplishment. I sent away for silver pearl seeds from mike 12 days ago the way so I'm hoping for Friday, then greenthumb at my friends house!" - Damion

"Silver Pearl hallucinogenic? You bet it is! Never grew it (but have the golders had it last year grown by a friend (he purchased seed in Adam himself) I'm a bong hits to be high as a kite, 6 or more and you'll start seeing what I mean. enjoy an even better ride!" - Damion

"You said that the taste of the silver pearl had no noticeable Skunk taste in it. I'm a target with the silver I've smoked and the Early Skunk (EPXSK#1) that I have (sweet with almost minty undertones) seems to be the dominant trait carried by the pearl. The High of the EP X SK #1 is kind of heady and very functional. One of my friends for the morning are a couple of hits at lunch." - D

"Silver Pearl is a taller plant the stone is more up, while Super Skunk is short stone -haven't grown either since 90 so may have changed but both were nice." - D

"Old timer described the 2 perfectly: Super Skunk will give you that couch potato more energetic/hallucinatory. I'd go with the pearl unless your growing for yield." - D

"I just finished super skunk and have Silver Pearl coming right behind it. the

but nothing all that special. IMHO the silver pearl will be the better strain.” -

“If I was given the choice, I would choose Silver Pearl over Super Skunk any NL (after 2.5 weeks flowering the buds are so resinous they stick together), 1 (never goes hermy), and the delicate class of the sativa Early Pearl. This has smokes -the smoke is sweet, orangy-incense, and the high is a full-on trippy anything to skunky- its all a bit the same, I think its best to mix it with other

“For the other side of the coin, I've grown Super Skunk (Sensi '95) and it per since the price was like 60 guilders or so). It would make a great commercial buds, though not the densest. Good deep smell, I don't like it but many people covers both sides... it will put you to sleep if you smoke too much. I would say be better if the weed is just for you, or the SSkunk if it is more commercial.”

"This plant has the power of NL (after 2.5 weeks flowering the buds are so release of growth of skunk (never goes hermy), and the delicate class of the sativa one of my favorite smokes- the smoke is sweet, orangy-incense, and the high -retro13

“We didn't grow out enough SP to make a decision on variability, but this I can are looser than NL, with slightly lower yield. Its taste is thick, warm, sweet- s very vigorous. The high is not bad. At first, it can be quite shocking (giving a but after you get used to it, the 'power' hit lasts about an hour, is slightly sativa/indica cross type high. Its not couch lock, nor is it get up and go speed As far as variability is concerned, I've worked a bit with early pearl (one of the that this strain is much more variable than I previously assumed. There are the bred against other things, I've seen quite a few different groupings of character As far as I'm concerned, SP is likely to be kept, just because it's a regular, not it being too indica, and without having all the hassles of the harder sativas to was you, I'd plant as many seeds as you've got and see what comes out. It can pattern- early and advanced branching, but looser nodes than NL. The leaves: trait) which makes manicuring as easy as a walk in the park.” -retro13

Northern Lights x Silver Pearl: “These dark green buds are completely coated buds at first seem a lighter green. The buds are evenly covered in light orange almost flesh colored. Their structure is highly compact as small buds break up super-sweet green bio scent (quite expected from this lineage!). The taste is and fruity and expands slightly in the lungs. The high is spacey and visual are forgetful and a bit lazy, a nice rainy-day-got-nothing-else-to-do bud. ****1/2”

Power Pearl: “This is the daughter of the Silver Pearl. These buds are a bright with even lighter crystals and covered in short orange-red hairs. They are very and leave your fingers tacky and sticky. The stems taste very piney, while the pungent. The smoke is full bodied, skunky, and unbelievably smooth! The high and takes just a few minutes wait to some on. ****” - Homepage Amsterdam

Strain: Stonehedge

Strain Type: Sativa/Indica mix **Origin:** Holland **Breeder:** Sagarmatha See

Images: 1 2

Description:

"Stonehedge is a marijuana of megalithic proportions. This plant has vigorous structure. By far the largest and densest sativa we have. Her lineage consist plant with a slight Western Winds influence that enhances the sativa strengt possesses is soaring and overwhelming, providing the smoker with a lithogra the evening or after work her magic is well received. Not recommended for c "unless it's you." Second Place Winner 1998 Cannabis Cup

Specifications:

Type: Indica-Sativa, indoor and outdoor. Flowering time: 55 - 60 days. Average meter. Yield: 350 grams / m2 (dried)" - Sagarmatha catalog

Growers Comments:

"Tony, an American and owner of the Sagarmatha seed shop in Amsterdam, been given to him by some Vietnam vets (so much for the "breeding" efforts they were the result of their breeding a local (Californian) strain with a Camb The Sag site in the last months has added a reference to Special K in Stoneh they re-bred it with Special K. In any case, it is supposed to be a "manageab decent yield and remarkable good taste (even when some reports state it ha well). Special K, which may or may not be in there, is Sags (corrupted) versio Serious are spin-offs from a previous company called Cerebral Seeds, and it keep the two true stocks, the ones that make up AK-47 as a F1 hybrid).

I believe that indeed most of Sag strains are not bred or developed by them, stock given to them by their network of American friends, as it is the case wi (Rosa, co-owner of Sag, said that this one was a Cali Orange selection given Matanuska is most likely totally unrelated to the real deal from Alaska (peop number of local strains, adding to the confusion) but rather related to an NC(involving a NL with some alleged G-13 in it) dating back to the time they (Sa They just appropriated the Matanuska name, as it had a mystique, and appli be surprised if they registered it as a trademark, which they can in Holland.

Sag are very liberal with seed names --their "NL#9" has no Northern Lights a of Jack Herer, White Widow and Durban (yeah, nice mix). As you see, its all v only way to ascertain quality is to grow the stuff. I even suspect that Sag per strains, as several of them where out of stock for more than a year (rip-offs a operation) and suddenly (suspiciously) resurfaced... perhaps today's Stonehe female clone crossed with a male Special K to get a seed line going (that wo Special K in the description).

More ramble than you bargained for, eh? Sorry... got carried away, the story Hope this helps though." -Adam Tripper

"I grew out ten seeds earlier this year. The plants were quite robust and larg indica influence in the leaves, Stonehedge grows like a sativa with internode spectrum. It needs a lot of light and even then the yield is somewhat exiguou clusters and begin to put on some weight after fifty days of flowering. The ar earthy grapefruit bouquet if I were pressed for a description. There is excell

up markedly after fifty days of flowering. The high is intense and long-lasting tastes and makes me feel but I am not happy about the yield. Ten seeds were get a mother of truly outstanding character. Perhaps another female would know." -Moose

"Don't know too much about Stonehedge's parents. It was indica dominant, a "stony" party killer-type herb. Pretty average when compared to some of the others." -Geronimo

Strain: Swiss Miss

Strain Type: Mostly Sativa with Ruderalis **Origin:** Switzerland **Breeder:** P

Images:

Description:

Imported: Switzerland Pure breeding Sativa/Indica: looks pure Sativa Appearance

Specifications:

Type high/strength: lightweight smoke Height: 2m Yield: med Harvest date (with photoperiod): end Sept 12hr day exposure harvest (# of weeks): 8-10 indoor flowering (good breeding stock for earliness), good for the Dutch Alps

Growers Comments:

none

Strain: Top 44

Strain Type: Mostly Indica **Origin:** Holland **Breeder:** Interpolm Growshop

Images:

Description:

none

Specifications:

none

Growers Comments:

"The top44 is a cannabis strain developed in Holland some years ago, it's mostly indica and something else, there are a lot of speculations what this 'else' might be. The top44 is an impressive fast flowering plant, I never heard of a strain that can finish the time from only 6 weeks (44 days), but gives big resinous buds in this short time. At first the Top44 was popular under cash growers in Holland, later on the high yield and ability of the strain too, it's able to switch between vegetative and flowering stages. It mostly stop after one week you put it in flowering. It will go inside and also outside. As a growing plant, it is easy to get in one of the many cannabis growshops, this is because the law is getting harder for the bigger clone producers. Because it is a compact

SOG setup, it gives one long cola if you grow 4 plants the sq./feet like in the there are growing 49 plants on soil, used are 4 liter containers and a 600 wa used in this case is 9 sq./feet, in this setup we normally grow only one week to get up to 6 crops a year. At the growshow (sample setup in a growshop) I see that the top44 is doing very well if it gets more space and time. On the p big plant that they did grow three months vegetative (18/6), they used a 600 plant was in a 50 liter container, if you plan to grow bigger plants rule one is did give 350 grams off the finest buds. The high is really great, strong and e off this plant gives a relaxed feeling overall, smoke it and let flo your mind. I sweet, the buds are very smelly and sticky, it has red hairs after 6 weeks. So flowering a bit longer to get an ultimate effect, the top44 adds a lot off resin manicure because of the good leaf/bud ratio." - Jock

"There are a few around here (Flick?) that have the real Top44 from Holland Jock. The seeds available from him are not the same as the cuttings he has. company without much reputation yet.. But they're getting around the net si But its not a very popular strain except in Holland / the rest of Europe as a c

"50+ grams/s.f. Spacing at only 2 per square foot in 48 days isn't too bad. I s better when I play with it just a little more. I'll agree that the 44 days is push buzzing 4 or 5 days later but you can harvest at 44 and be satisfied with the yield. It's a great buzzing social indica that grows fast and heavy." -flick

"I've grown it from seed and from cuttings that were supposed to have been didn't mature in 44 days (under lots of light) and it didn't yield enough. I hav in the past 2 years and it was the most disappointing." - Muir!

"I would stay away from anything with Top 44 in it. I got my Top 44 seeds in Homegrown Fantaseeds. The Top 44 buds look great and do mature in 44 da was sorry I put all the time and effort into growing Top 44 when I could have with just one week longer to wait. I ended up giving 3 Zs of Top 44 buds awa consume them."

"Grew Top 44 from seeds through Jock (I think they're Nirvana's). Not shwag any stretch. First of all, it didn't finish in 44 days. It took 54 days to reach 90 of mixed MH/HPS light. They were less than 10% withered at 44 days. Visible 50% of what you'd expect from a top-grade strain (no sugar frosting). Secondly, like most strains whose main claim to fame is earliness, Top 44 is before changing to a 12/12 photoperiod began flowering at about 6 biological Ruderalis genes to me. It was cloneable, however, and the clones did veg ou flowering. Potency was overall a disappointment, but better than expected considering Indica stone, about a 6 out of 10, 10 being that yet-to-be-smoked perfect bu On the plus side, it has textbook "mini-baseball bat" buds with virtually no bu grow straight up with no branching, making the strain ideal for SOG, less so t These traits no doubt are behind its Dutch rep as a good commercial crop st Will I grow it again? Probably not." -B420

Flick's TOP 44 REPORT:

Bank- This strain did not come from a known bank but rather an unknown (to

Holland. Supplier: Jock

Because this strain was sent as a cutting rather than seed I can't say that you have the Top 44 seed from any bank that offers them. I do know that Jock is working very hard and is looking for something with the same quality as the clone material that was sent. The plant I will be talking about. Here are a few things you should know before considering the info presented.

Notes

Plant was approx. 2 months from the day it rooted when put to flower. I think it is genetically stable. Plant had approx. 20 cuts taken at 3 different times prior to induction (63w hps per sq. ft for 10 hours, light balancer, CO2?, GH notes)(The question is whether the tank ran out at some point and I can't be sure exactly when it happened or how long off.) Plant was grown using a wick system that turned into a water culture deep pot.

Plant was grown using the Screen of Green method (ScrOG-for those in the dark) for training rather than wires making for easier and better training strategies. Plant suffered a dry out of the reservoir which hurt the root system some (it was corrected but yellowing started. I believe it was due to some root damage but it could have been the growth rate required more N than I was feeding it. I'll find out next go round. I was overcompensating with N too long into the flowering stage and ended up with

Days Till Harvest

The first bud was snipped at 37 days with approx. 50% of flowers having turned on day 42, 43 and 44.

Growth Characteristics

This sucker is fast! I've never seen a plant flower this fast. It sounds just like what the raves about. NOW I know why he loves the Shiska and why I will love one soon. At the start of flowering and the condition of the plant when put to flower I failed miserably on the screen. The plant stopped growing after only 6 days! It's not only fast but it grows at a pace as well. The plant does well under low light levels. Found this out by letting it grow during veg to help keep tight nodes for future cuts. Add this to the fact that it grows very well when compared with those towards the middle of the grow and I do not need any light and this plant.

Just to give an idea how fast this plant flowers. I still have my NL#5 and put it out of the way (Remember I'm looking to kill this thing off soon because of the Top 44). The Top 44 was put to flower about 19 days after the NL5. The Top 44 caught up as flower growth goes and passed it in 4. It was amazing to watch especially with mostly sativa bag seed.

Yield

Because of my failure with the screen it's impossible to give an accurate gram yield. The plant stopped growing 6 days after induction I ended up with a circle of buds in the middle. (I didn't start the plant in a corner since I put an NxS plant there to take up space in a flowering area). Best guess on area covered is somewhere between 1 and 2 sq. ft. that said.. 84 grams, dry was the total harvest weight for quality bud. The snipped buds were not counted in this figure. (There wouldn't have been much cooking bud at a time as the buds were shading smaller ones due to the poor training).

Bud Condition

Buds were nice and tight with orange to red rust colored hairs when done. Remember I see with the N x S the T44 has small resin glands. While the N x S looks like the resin glands look like a coat of light snow or heavy dust. Many areas of the buds look like white ;-) Note: This plant piles on the resin in the last few days, I don't record

know I won't do it again.

Aroma

It was nice to get something that smelled good in the grow to compensate for the N x S when it is growing. It smells of citrus, fruity, with the skunk lurking way I can describe it. It isn't over powering but did require more than a bag brought an ounce to someone.

Buzz

When I cut the bud at 37 days with the 50% withered flowers I test smoked it doesn't smoke as much as I do but he isn't a lightweight by any means, he's a guess. He missed 6 turns on a familiar ride in 1 hour and 15 minutes. He likes it for driving since he was spacing out so much. I thought the whole thing I'm sure you know I was all over him on every missed turn. (Little did he know all either ;-). I didn't like the buzz from this early bud at first, it was too speedy after a while. The other thing that wasn't too impressive from it was the stay. Now the buds harvested later were a completely different story. Mature buds are definitely not couch lock weed but you can find comfort in your big buddy if you soar, then quickly settles into a body and mind buzz conducive to thought and verbalize those thoughts without difficulty ;-). This is a social indica.

The buzz lasts quite a while and slowly turns into a couch lock thing if you do line-. As a head grower I would keep the plant just for the buzz I like the buzz is to life, I guess ;-). If I were still growing for dough I would love this plant and into the game someday.

Yo money tree folks... people like the looks and smell of this weed. I don't have buzz yet but will include them in the additional T44 info that will be given in

Strain: **Twilight**

Strain Type: Indica **Origin:** Holland **Breeder:** Dutch Passion Seedbank

Images: 1

Description:

"A beautiful purple variety with high yields and Afghan taste. Heavy buds and

Specifications:

~ Flower: 7-8 weeks ~ Harvest: end of Sept., 1st week of Oct." - Dutch Passion

Growers Comments:

none

Strain: **Valley Girl**

Strain Type: Mostly Indica **Origin:** Holland/USA **Breeder:** Sagarmatha Seeds

Images:

Description:

“This variety is a Cheyenne Indica with a skunky influence, for lovers of fragrant. Take this girl just before bed and have a seductively sedative session. Her numbing stupefying qualities. Gag me with a bud.

Specifications:

Type: Indica-Sativa. Start vegetate: 1-1.5 weeks after roots show. Flowering height: 1 m. Yield: 275-350 grams / m2”- Sagarmatha catalog

Growers Comments:

none

Region: Indo-Asian Strains - Afghanistan, India, Nepal, and Sri Lanka

Family: Afghani Strains

Strain: Afghani

Strain Type: Indica **Origin:** Afghanistan **Breeder:** Dutch Passion Seedbank

Images:

Description:

“A pure variety, never hybridized, imported from Afghanistan, grown in Holland. Indica. Heavy buds with lots of resin. Some plants turn purple at harvest time. Aroma and flavor are heavy, almost medicinal. Very strong, physical, practical.”

Specifications:

~ Flower: 8-9 weeks ~ Harvest: 1st week of Nov.” - Dutch Passion catalog

Growers Comments:

none

Strain: Afghani #1

Strain Type: Indica **Origin:** Afghanistan **Breeder:** Sensi Seed Bank

Images: 1 2 3

Description:

"The Afghani part is a very short Christmas tree-like plant, 100% Indica, very F1-cross with Skunk #1 gives the variety a bigger yield and better taste. Ver

Specifications:

~ Flower: 8-9 weeks ~ Harvest: 1st week Nov." -Sensi Seed Bank catalog

Growers Comments:

"Afghani #1 is basically selected Afghanis back crossed with themselves to get lots'o resin."

"I'm not sure who's is best, but I can tell you what Sensi's Afghan #1 grows I grew was given to me as seed. Those plants grew to about 3-foot bushes and looked like little florescent green golf balls. The Sensi, however, is completely and rounded, but they aren't dark the way Sensi describes them in their catalog. Hindu Kush is a lot darker. The Afghan #1 is tall and thin and hasn't filled out. I know it has nothing to do with ferts because everything I used is organic. Baked and bone meal and fed every 2 weeks with a mild mix of fish emulsions, 5-1-1 into flowering and not nearly as vigorous as the Hindu Kush. In my opinion, that might be due for a genetic boost."-Pauly

Strain: Californian Dream

Strain Type: Indica **Origin:** California/Holland **Breeder:** Nevil

Images:

Description:

"Californian Dream (Afghan #1 x Californian Buddha) is a cross of two adapted strains which create a fast growing, hardy, 5 foot bush which produces chunky potent buds. Beautiful colour and excellent cast. A favourite. In middle Europe they mature September 1. Indoors copious buds mature in 8 weeks. -Legends Seeds catalog

Specifications:

indoor

Growers Comments:

none

Strain: Mazar

Strain Type: Indica **Origin:** Afghanistan **Breeder:** Dutch Passion Seedbank

Images: 1

Description:

"This is an upgraded selection of the former valued Afghan Skunk. A 1997 in The taste is softer than before. The Afghani (Mazar-i-Shariff) part is a very sh 100% Indica and very resinous. The F1-cross with Skunk #1 gives the variety Very good "up" high. As both parents are very consistent, the offspring is ve

Specifications:

~ Flower: 8-9 weeks ~ Harvest: 1st week of Nov." - Dutch Passion Seedbank

Growers Comments:

"Started with 10 seeds and all germinated and sprouted. Two sprouts didn't push out real leaves, it wanted to, but couldn't get it done... chop went the b behind.... chop went the blade. Of the 8 that were left 3 were female and 5 v of hermies with the Mazar was heard but none were seen.

This is unquestionably indica in appearance and smell. Wide dull dark green the blade serrations. Two of the 3 females were somewhat similar in appear doing it's own thing. They looked pretty much identical during veg growth. D The oddball had the braided city skyline look. I'll explain later. The other two smaller calyxes.

2- First let me tell ya bout some weirdness. The plant grew leaves from some anyway.

This plant suffered from shading of taller plants but did OK considering. It wa through the shading since curiosity was peaked by its performance. This plan accident and wasn't smoked by anyone that knew they were smoking it. It's clone.

3- This bad boy girl grew a fat top bud and may have been the heaviest of th some overcrowding vs. the top producer. This bad girl also had the heaviest potential to be a producer except for the long flower period, which would nee speed.

Note: All of the plants were harvested in approximately 10 weeks but it coul probably should have been. So just figure a 9 weeker for now.

5- Yep this is the braided one and this is what was meant. The plant was trai horizontal. Looking at the big bud from eye level gave you a city skyline look braided hair with the big calyxes. This plant also had a nice covering of resin were smoked. It was also the heaviest plant. The one possible problem with male flower or two early in flowering but that was it. An eye was kept on it a male flowers until a few days before harvest. The late start of a male flower due to leaving them to flower too long before chopping day.

Aroma: An earthy spicy thing with a skunk background. Not overpowering wo packaging.

Buzz Above average. NL x Shiva hates this plant in this neck of the woods ar and comer that could become the next couch lock champ when it's old enou This was stoner weed period but...

It was harvested much too late which could have caused this type of buzz. Th buzz lurking so we shall see. If it wasn't because of the late harvest there wi smoke this chit.

Taste Distorted by feeding. It had a spicy taste to it that isn't bad and could right feeding schedule.

Yield Slightly above average with 5 better than that.

Comments: This is looking like one of those plants no one likes to smoke because surprising that it took as long to finish with this strain, we'll see what happens improve with age and better growing conditions.

Curiosity is peaked about the type of buzz that will be had when the plant is shading was a problem for this strain so yield is really up in the smoke right since the buzz is making up for the long flower time." – Flick

Family: Kush Strains

Strain: **Hindu Kush**

Strain Type: Indica **Origin:** Northern India, Pakistan **Breeder:** Sensi Seed

Images: 1

Description:

"Pure Indica, one of the most constant kind. Best start for anyone who wants like taste, large firm buds, above average yield.

Specifications:

~ Flower: 8 weeks" – Sensi Seed Bank catalog

Growers Comments:

"I've grown Hindu Kush 3 times and it's a beautiful but extremely stinky plant really like the smell, but the odor of the Kush is difficult to control even with paranoia has banished it from my garden. Great yielder ... more than average working on the garden I'd always have to take a shower to get all the resin off plants etc. Hindu Kush is a great way to earn the nickname 'skunky' ... Kush skunk than Skunk#1 (smells sweet to me)." – shiva

"The Hindu-Kush from Sensi averages about 2.5 to 3 oz's of sticky, sweet, green starts flowering the first week of August and is ready by the third week of September

Strain: **Kush**

Strain Type: Indica **Origin:** Northern India, Pakistan **Breeder:** Dutch Passion

Images:

Description:

"A heavy budding plant that produces crystals galore. Good rich smoke, excellent
Clones very easily.

Specifications:

(indoors) ~ Flower: 60-70 days ~ Height: 110-150 cm ~ Yield: 300-325 gr/sc
Plant: Jun. 1st ~ Finish: Oct. 1st ~ Height: 5-6' ~ Yield: 2-4 oz ~" - Dutch Pa

Growers Comments:

none

Strain: Masterkush

Strain Type: Indica **Origin:** India/Holland **Breeder:** Dutch Passion Seedbank

Images: 1

Description:

"A F1 cross between two different Hindu-kush strains. Yield is high. Excellent
favourites." - Dutch Passion seedbank catalog

Specifications:

none

Growers Comments:

"This light-green colored bud has dark forest-green leaves protruding and is
color from bright orange to almost white (mostly strawberry-blonde). The sc
bio-y undertones. The taste, however, is surprisingly mild for this fairly stron
even have a taste besides the general burnt bud (brown) taste. It is also non
is mildly visual with a light head-change. ***" - Homepage Amsterdam

"My personal experience with MasterKush, grown naturally under mostly-con
rather long finish time (mid-late October) and can grow very tall, even in a 5
grounded. I live in the desert so mold has never been a prob for me but thes
long so I would expect mold probs in a more humid climate. (but that's just a
toooo intense but definitely longer lasting than most and IMHO, well worth th
by the potential mold prob). Very smooth and mellow flavor too. Not a major
either." -Mohave Green

"The only strain that I have that I can for sure say came from the breeders a
from Dutch Passion and the seeds were given to me by a friend who purchas
all were female (lucky eh?) and all grew very uniformly, I kept the best 2 and
months and every clone set has gotten stronger in potency as now the plant
pictures of master Kush I've been able to locate on the web.... the high unifor
as it will knock me down if I take 2 hits, like I tried to go a couple rounds with
prefer the high of a sativa dominant or a 50/50 hybrid...I know, I guess I'm ju
be able to walk and talk when I'm buzzed."

"It turns out that the Master Kush from Aloha is a very potent strain. Its chemistry is different from yours! It grows real well and the floral clusters have a grape flavour, maybe. Of the ten seeds I grew out, there was a lot of variation of the plants. Several were very sativa-dominant. The one I kept as a mother produced many small, hard buds. I still cultivate it because I love the hash its effect upon me is mostly a narcotic one in nature." -Moose

Strain: **Smokey Bear**

Strain Type: Mostly Indica **Origin:** India/Holland **Breeder:** Dutch Passion

Images: 1

Description:

"Produced by Dutch Passion, a cross between the famous Masterkush and K...

Specifications:

~ Flower: 8 weeks ~ Harvest: 3rd week of Sept.

Growers Comments:

none

Family: Ruderalis Strains

Strain: **Ruderalis**

Strain Type: Ruderalis **Origin:** Russia **Breeder:** Native Strain

Images:

Description:

none

Specifications:

none

Growers Comments:

"Pure Ruderalis, despite flowering automatically, finishes in no less than 10 weeks absolutely no use for the plant other than setting flower in equatorial varieties and my own experience." - Lady J

"Ruderalis: real Ruderalis is a single stem plant like a willow whip and x num

will begin flowering irrespective of light hours. Once this is in a strain it never flowerers are weeded out, it will reappear after a generation or two when the dominant form is like sickle cell anemia except you can't tell the carriers who have large colas either. In the early days of wild strain collection, indicas from Ruderalis they were early flowering with large colas. They flower early, but can be reveged. The difference is that with real Ruderalis once flowered you can root cuttings with just a few flowers under 24 hr lighting not a thing to pass on to future generations.

You can't tell if the (Ruderalis) gene is in a plant by the look. A friend of ours white widow from a Canadian source extremely potent and resinous after she turned up so they destroyed the whole line seed stock and all. Why do you tell your strain it seems pretty unlikely to me. A couple of Canadian seed banks in Holland it's hardly been used at all, Nevil experimented with it and dropped it it is in Swiss Miss / Myst but that's about it." - Ot1.

Strain: Ruderalis Indica

Strain Type: Indica/Ruderalis mix **Origin:** Russia, Central Asia **Breeder:** Sensi

Images:

Description:

"Flowers automatically Outdoor. Ready 3 * months start to finish. Good for Northern
- Sensi Seed Bank catalog

Specifications:

none

Growers Comments:

"The main advantage of the Ruderalis line is that they flower automatically v light vs. darkness. It's a good strain if you want to grow outdoors and live up a relatively short growing period. You could cross it further with quality strain auto-flowering feature of the Ruderalis." -BK_Greenthumb

"I've grown Sensi's Rud. Skunk. The Indica was (apparently) originally a result in mid 80's. The HUGE and in-surmountable problem with this variety is mold (it): Ruderalis is NOT mold resistant, nor is Northern lights, and nor is skunk. I for a very specialist environment: northern latitudes, low rainfall (were I come nothing in early Sept., well before it matured). On top of that, it doesn't taste that with auto flowering, you get no chance to filter for sex, so you've got to the seed planted will be early flowering female (75% of your plants will either any good!)" -retro13

"The ones I grew (from Sensi) flowered at 24/0, but only some of the plants (excellent male and a nice but low-potency female. The male produced a nice Made some F2 seeds for further breeding. About 100 days from seed to harvest -Epikur

Family: Shiva Strains

Strain: **Shiva**

Strain Type: Indica **Origin:** India/Holland **Breeder:** Undetermined

Images:

Description:

"Pungent Afghan smell with Indica. Short bushy plant. Heavy good quality cro

Specifications:

none

Growers Comments:

none

Strain: **Shiva Shanti I and II**

Strain Type: Mostly Indica **Origin:** India/Holland **Breeder:** Sensi Seed Bar

Images: 1 2 3

Description:

"This Afghani with its penetrating Indica aroma is one of the better yielders i
taste and above average potency make this an attractive variety for beginne

Specifications:

none

Growers Comments:

"The Shiva Shanti I is a 3 way hybrid which consists mostly of an Afghani stra
of its aroma characteristic. The Shiva Shanti II contains a smaller part of this
skunk and another Afghani. It is a less stable 4-way hybrid but quality wise v
be somewhere between 45 and 55 days. It is also an F1."- Alan Dronkers, Se

"Shiva 2 is a quick, crystallly below average yielder. It has a very up quality t

Family: Southeast Asian

Strain: Cambodian

Strain Type: Sativa **Origin:** **Breeder:** Native Strain

Images:

Description:

Specifications:

Growers Comments:

"Smoked some Cambodian in 67. It was the best we had ever seen at that time. Thai sticks but it was one bud, the length of a fold lock bag, light gold, \$15.00 [\$10.00 for 4 fingers at that time] till it kicked our ass. Haven't seen any since."

Family: Uncategorized Strains

Strain: AK-47

Strain Type: Sativa/Indica mix **Origin:** Afghanistan/Holland **Breeder:** Seri

Images:

Description:

"A 1995 Cannabis Cup winner. This is a very popular sweet plant. 3rd place winner. A potent 50% Indica/50% Sativa cross nicknamed The Killer! Aromatic, sweet to the point of being debilitating high. Excellent indoor and hydroponic results. This is a truly militarily damaging strain. Takes no prisoners! Highly recommended. An absolute must! AK-47 will take you away. Peaceful people that we are, we wanted to convey in a sentence that it was a real hit wonder". AK-47 shot us into 2nd place as a seed company in the 1995 Cannabis Cup. Judges and took 2nd place in the hydro competition along with 3rd place in the indoor competition. Short flowering time and hard compact buds that ooze glistening trichomes and a sweet smell. An Indica/Sativa bred with powerful effect and sweet smell in mind.

Specifications:

Mostly Sativa, Flower: 50-57 days, Yield: 250-350 grams/m2, Height: 100-150cm

Growers Comments:

"Nevil went to great expense to obtain seeds, a commitment that is best illustrated by the fact that he traveled to Mazar-i-Sharif in northern Afghanistan. According to the Moslem legend, one of the prophets, Ali, was buried in Mazar-i-Sharif. Consequently, it is a very holy city. It is also known for high quality cannabis. From the area had been readily available in the late 70's, the Soviet invasion of Afghanistan destroyed the cannabis exports. In 1985, an Afghan refugee told Nevil the (cannabis) fields around Mazar-i-Sharif had been destroyed. "That was what I needed to hear" says Nevil, " I caught the next day and I found the strain"

"After being smuggled into a refugee camp in Peshawar while lying on the floor with a 30-year old Muslim fanatic who had a throbbing vein that ran from between his eyes to his forehead. The man took a lump of black hash out of his pocket and told Nevil

his uncle, a man known as Mister Hashish. Surrounded by four men pointing about negotiating with Mr. Hashish, a Mujahedin commander, and finally per his men 280 miles into Soviet occupied territory and come back with two kilo Nevil added " He thought I was ridiculous because I didn't want to buy hashish come out to buy seeds, and at first he had no idea what I was talking about. genetics to this tribal hash leader in sign language. When he finally figured c much money. I took a zero off his price and gave him 10% up front. He called seeds four days later." - Nevil Schoenbottom, High Times Magazine, March 1

"If you got the real stuff from serious, the trick will be remaining patient while seeds produced two outstanding mothers, each of which are about the best I have ever had (plus a few other very interesting plants).

My seedlings didn't show a lot of vigor, but that may have been from overwatering completely new at the whole thing. They tend to be pretty sativa in appearance slightly indica types. They show preflowers at about six weeks, and do best to They grow a lot, and stretch if you're not careful with them. My best smoking but they were tall. Just not great branching. Best to grow them SOG with tight mother that branched like crazy, but the buds were stringy and stemmy and I never had any problems with infestations or nutrients. You can give them high fine. Flowering time tends to be long, between 56-70 days, depending on the short, but it hurts the yield. Yields in general were not great, but then neither experience. Others report pretty good yields from what I hear.

The high is just plain supreme. Very up, cerebral, but smooth and completely musician friends completely love the stuff. Very compatible with activity, especially for parties also. Very social." - Castanza

"AK47 (Blue Bird Coffee shop): "Nice & complex high. Flavorful taste. Elemental spectrum are clearly pronounced." - Prince Caspian

"These dark green buds are very resin-y and have bunches of short, red hair less green with more hairs. This hydro has a very pungent, sweet, skunky green mouth water and will put a smile on your face. One or two small, crystalline non-smokables you get. The fluffy, compact buds break up nicely and will leave your fingers. The smooth, skunky smoke tastes sweet and flowery, though it has a bit of a cougher. Overall, the taste is outstanding. Not overly visual, a strong conducive to listening to music, watching a movie or maybe hanging out at a you to open your bag of Oreos or order 'patat' on your way home." - Dankmaster

"If a sledge hammer to the head is what your looking for then AK is your girl depends on which side of sativa/indica spectrum is more dominant indica on large fluffy semi dense buds at 50 days very crystalline with a spicy smell and strong and lasting but not like the sativa. The sativa is longer but is the better pine cone shaped buds at 70 days super crystalline (not like G13xNL that's the leaf a very nice spicy smell and woody taste that would take your lungs inside really strong more up but still slammin hard lasting high I got a headache from one:)... that's all I know..Hope this helps your choice." - Dankmaster

"How it grows and yields depends on which side of spectrum is more dominant indica and shorter nodes large nuggs with a fat top it built buds much different usual way sorta stacked single blade leaves it didn't decrease in blade number

gland production and a killer spicy wood-like smell. It flowered for about 50 c
The mostly sativa grew a bit larger and longer nodes but flowered much better
large nuggs covered in twice as much glands as the other. It flowered for 75
best; the smoke will tear your lungs apart and will smash ya within minutes.
of this one I would get a headache. Guess its very strong but not strong enough
breeding my AK indica with G13xNL pollen that was I given its already been
that helps ya out its 2nd best in my book and nothing beats the G13-NL." - D

"This type of question is always difficult to answer... Northern Lights is a real
it gets me really mellow without blowing my brains out. NL5 x Haze is a similar
potent, and after a few tokes leaves me happily floppy! AK47 is not my type
function without making a super human effort, and I am not super human." -

"NL is a great plant: taste, high, potency, yield, and growth wise. AK is strong
to repeat you probably wouldn't want to smoke the AK all day if you're a chr
will give you a headache/non-functioning state of bliss. NL is a more function
a trademark taste and growing ease, short stature. NL has sidebranching als
picking a general winner, but enough to pinpoint a personal winner for you. A
where a single bud can fill a room but it still smells [at least serious seeds ve
should keep the house sweet! I'm not that impressed with AK a big initial hit
another." - Oldtimer1

I've grown the AK-47 and in my opinion its a better high and much easier to
from Greenhouse in Amsterdam. I believe it was by Serious Seeds. It grows r
7 weeks from 12/12. It tends to flower on its own but not so much as to be a
out were fairly uniform but there was some variation. The smell was good an
-Greenman.

"Seriously, IMHO, skunk X big Bud or AK-47 are excellent strains for the exper
are stable, pure strains and very predictable when purchased from reliable s
hybrid with excellent yield when grown well, with a world class high." - Koha

"This one is hard to say since its a strain that reflects both sides of spectrum
short to leggy nodes will grow sativa like fans or more indica style. This all d
indica style had big fat nuggs, a bit airy though with a different budding struc
and clusters, not usual way of decreasing fans blades...Very nice strong spici
white, strong wood-like taste...and strong heavy high...A Sativa will grow a b
better side of the spectrum....it produces hard fat nuggies, not really big but
than the indica. It also had much stronger smell of spice and woody taste...a
sledge hammer to your head!! That by far is the best one and you don't need
be very happy with both" -sloppy seconds

"A Sativa-Indica hybrid that produces a quick stone with a long lasting cereb
and giant calyxes. The aroma is spicy with a slight sandalwood taste. This gi
taste. So wake and bake with a bud of AK." - seedbank catalog

"These dark green buds are very resin-y and have bunches of short, red hair
less green with more hairs. This hydro has a very pungent, sweet, skunky gr
mouth water and will put a smile on your face. One or two small, crystalline
non-smokables you get. The fluffy, compact buds break up nicely and will lea
your fingers. The smooth, skunky smoke tastes sweet and flowery, though it

bit of a cougher. Overall, the taste is outstanding. Not overly visual, a strong conducive to listening to music, watching a movie or maybe hanging out at a you to open your bag of Oreos or order 'patat' on your way home. **** ” - H

Strain: Himalayan Gold

Strain Type: Mostly Indica **Origin:** India **Breeder:** Arjan, Green House Se

Images:

Description:

“Taste: Fruity freshness that feels light, with a tang. Smell: A blend oh Hima the tropics. Visuals: Strong yellow hairs that are long and flat. Misty crystal : Compact form with great size colas. Touch: Small sticky crystals fill this plan sweetness. Stone: A very creative high. Great for a happy day. Strike the flo way. Family Heritage: Nepalese & No. Indian. An interesting blend of Indicas Co. catalog

Specifications:

Vegetative Time: For indoors a suggested minimum of 2 - 4 weeks. For out of spring. Flowering Time: For indoors a suggested time of 8 - 10 weeks. For autumn. A substantial yield will be expected. Achievements: Special for Out the "glasshouse-grower".” - Green House Seed Co. catalog

Growers Comments:

“I sampled Himalayan Gold while in 'Dam last year. It's an extremely cerebr can't control your thoughts well enough to formulate a sentence to explain I me of Colombian, kind of tawny and light, it was pale green/gold with yellow the sativa high you could guess that it would also have the sativa growth tra

Strain: Kerala Skunk

Strain Type: Mostly Sativa **Origin:** India/Holland **Breeder:** Dutch Passion

Images:

Description:

“This Southern Indian variety is crossed with Skunk #1 (F1 hybrid). As a who appearance (87.5% Sativa, 12.5% Indica). The buds have a sweet exotic sme medium strong high.

Specifications:

Specifications: ~ Flower: 10-11 weeks ~ Harvest: 1st week of Oct.” -Dutch P

Growers Comments:

none

Strain: Mangolian Indica

Strain Type: Indica **Origin:** India/Holland **Breeder:** Sagarmatha Seeds

Images: 1 2

Description:

"This variety produces an almost pure Indica with fantastic mango bouquet a slight skunk influence and is delightfully fragrant. The stone is long lasting an non-motivational daze.

Specifications:

~ Type: Indica, indoor and outdoor. Start vegetate: 1 week after roots show. Flowering time: 55-60 days. Average height: 1 m. Yield: 300-325 grams / m2 seedbank catalog

Growers Comments:

none

Strain: Mullimbimby Madness

Strain Type: Mostly Sativa **Origin:** Australia **Breeder:** Undetermined

Images:

Description:

none

Specifications:

none

Growers Comments:

"I have crossed a Mullimbimby Madness female to a almost pure indica male outdoors and took 13 weeks to finish budding and was huge, to big. Lucky for neighbors. The buds were sticky long colas with a strange smell, very fruity and real lady fingers and it had a extremely high calyx to leaf ratio. The father started 5 days and the female of the variety finishes in 50 days. Hopefully when I grow earlier producing type like the mother suitable 4 indoors. Maybe after a few I tried the mum indoors but is too uncontrollable like an octopus. The Madness grower put it in straight on 12 hrs but hopefully crossed with an indica might bring it in

I've heard many conflicting reports as to what actually is the parent makeup sure that there is Thai, Colombian, Mexican, Hawaiian, New Guinean, Indian and early seventies many a hippy and surfer traveled to those wonderful areas of personal stash. From what I gather after talking to a few of the older guys to get the finished product. They kept adding strains after guys came back a

they had a plant that was near perfect they stopped and started to let it poll very Sativa apart from the Lebanese but I think 4 the wait it is well worth it."

Strain: Slyder

Strain Type: Indica **Origin:** Afghanistan/Holland **Breeder:** Sagarmatha Seed Bank

Images:

Description:

"This Indica plant produces dense, crystallized buds with a strong aroma. Origin obtained in Afghanistan. The strain was crossed with a potent Northern Light 1 and cultivated indoors. This variety is superb for indoor production because of low THC content. She produces a strong lethargic stone that induces an imagined paralysis or what is often called "slide" where users often will "slide" their feet instead of lifting them, usually from the television to the couch. Hence the name Slyder. Best enjoyed around the house on lazy Sundaze. So sit back and relax into another reality.

Specifications:

~ Type: almost pure Indica. Start vegetate: 1 week after roots show. Clip cent time: 55-60 days. Average height: 1 meter. Yield: 300-325 grams / m2 (dried)

Growers Comments:

none

Strain: South Indian x Skunk #1

Strain Type: Mostly Sativa **Origin:** Kerala, India **Breeder:** Positronics

Images:

Description:

"F-1 hybrid Sativa/Indica: 87.5/12.5 Appearance: like Skunk #1, but more Sativa smell and taste. - Positronics seedbank catalog

Specifications:

Height: 2m Yield: med. Harvest date (Netherlands natural photoperiod): begin harvest (# of weeks): 10-12 indoor / greenhouse" - Positronics seedbank catalog

Growers Comments:

none

Strain: Special K

Strain Type: Sativa/Indica mix **Origin:** Afghanistan/Holland **Breeder:** Sagarmatha Seed Bank

Images: 1 2

Description:

Same heritage as AK-47. ``“A Sativa-Indica hybrid that produces a quick stone high. She is tall with large girth and giant calyxes. The aroma is spicy with a s can satisfy any connoisseurs' taste. So wake and bake with a bud of Special k catalog

Specifications:

Specifications ~ Type: Indica-Sativa, indoor. Start vegetate: flower shortly aft 65-75 days. Average height: 1.2-1.5 m. Yield: 325-425 grams / m2 (dried).” -

Growers Comments:

"Nevil went to great expense to obtain seeds, a commitment that is best illus Mazar-i-Sharif in northern Afghanistan. According to the Moslem legend, one Mazar-i-Sharif. Consequently, it is a very holy city. It is also known for high qu from the area had been readily available in the late 70's, the Soviet invasion exports. In 1985, an Afghan refugee told Nevil the (cannabis) fields around M destroyed. "That was what I needed to hear" says Nevil, " I caught the next p strain"

"After being smuggled into a refugee camp in Peshawar while lying on the flo with a 30-year old Muslim fanatic who had a throbbing vein that ran from bet forehead. The man took a lump of black hash out of his pocket and told Nevil his uncle, a man known as Mister Hashish. Surrounded by four men pointing r about negotiating with Mr. Hashish, a Mujahedin commander, and finally pers his men 280 miles into Soviet occupied territory and come back with two kilo Nevil added " He thought I was ridiculous because I didn't want to buy hashis come out to buy seeds, and at first he had no idea what I was talking about. I genetics to this tribal hash leader in sign language. When he finally figured o much money. I took a zero off his price and gave him 10% up front. He called seeds four days later." - Nevil Schoenbottom, High Times Magazine, March 19

“If you got the real stuff from serious, the trick will be remaining patient while seeds produced two outstanding mothers, each of which are about the best s ever had (plus a few other very interesting plants).

My seedlings didn't show a lot of vigor, but that may have been from overwat completely new at the whole thing. They tend to be pretty sativa in appeara slightly indica types. They show preflowers at about six weeks, and do best to grow a lot, and stretch if you're not careful with them. My best smoking moth they were tall. Just not great branching. Best to grow them SOG with tight sp mother that branched like crazy, but the buds were stringy and stemmy and I never had any problems with infestations or nutrients. You can give them hi fine. Flowering time tends to be long, between 56-70 days, depending on the short, but it hurts the yield. Yields in general were not great, but then neither experience. Others report pretty good yields from what I hear.

The high is just plain supreme. Very up, cerebral, but smooth and completely musician friends completely love the stuff. Very compatible with activity, esp parties also. Very social.” - Castanza

"AK47 (Blue Bird Coffee shop): "Nice & complex high. Flavorful taste. Elements of the indica spectrum are clearly pronounced." - Prince Caspian

"These dark green buds are very resin-y and have bunches of short, red hairs. The green with more hairs. This hydro has a very pungent, sweet, skunky green smell. In water and will put a smile on your face. One or two small, crystalline stems to choose from you get. The fluffy, compact buds break up nicely and will leave plenty of pollen. The smooth, skunky smoke tastes sweet and flowery, though it is expansive in the chest. Overall, the taste is outstanding. Not overly visual, a strongly mellowing high. Perfect for listening to music, watching a movie or maybe hanging out at a Coffeeshop. Try it with your bag of Oreos or order 'patat' on your way home." - Dankmaster

"If a sledge hammer to the head is what you're looking for then AK is your girl. It depends on which side of sativa/indica spectrum is more dominant. Indica one has large fluffy semi-dense buds at 50 days, very crystalline with a spicy smell and a strong and lasting but not like the sativa. The sativa is longer but is the better. Cone-shaped buds at 70 days, super crystalline (not like G13xNL that's the queen). Very nice spicy smell and woody taste that would take your lungs inside out and a strong more up but still slammin' hard, lasting high. I got a headache from smoking that's all I know.. Hope this helps your choice." - Dankmaster

"How it grows and yields depends on which side of spectrum is more dominant. Indica and shorter nodes, large nuggets with a fat top. Indica buds much different than usual way, sorta stacked, single blade leaves. It didn't decrease in blade number, gland production and a killer spicy wood-like smell. It flowered for about 50 days. The mostly sativa grew a bit larger and longer nodes but flowered much better. Large nuggets covered in twice as much glands as the other. It flowered for 75 days. Best; the smoke will tear your lungs apart and will smash ya within minutes. I don't think of this one I would get a headache. Guess it's very strong but not strong enough. Breeding my AK indica with G13xNL pollen that was I given it's already been good. That helps ya out. It's 2nd best in my book and nothing beats the G13-NL." - Dankmaster

"This type of question is always difficult to answer... Northern Lights is a real one. It gets me really mellow without blowing my brains out. NL5 x Haze is a similar. Potent, and after a few tokes leaves me happily floppy! AK47 is not my type of high. It functions without making a super human effort, and I am not super human." - Dankmaster

"NL is a great plant: taste, high, potency, yield, and growth wise. AK is strong. I can't repeat you probably wouldn't want to smoke the AK all day if you're a chronic smoker. It gives you a headache/non-functioning state of bliss. NL is a more functional high. It has the trademark taste and growing ease, short stature. NL has sidebranching also. It's a good pick for picking a general winner, but enough to pinpoint a personal winner for you. A single bud can fill a room but it still smells [at least serious seeds version]. It should keep the house sweet! I'm not that impressed with AK, a big initial hit but it's not another." - Oldtimer1

I've grown the AK-47 and in my opinion it's a better high and much easier to grow than from Greenhouse in Amsterdam. I believe it was by Serious Seeds. It grows really well in 12/12. It tends to flower on its own but not so much as to be a bit messy. The buds were fairly uniform but there was some variation. The smell was good and the

guess it really does go to show, that cup winners mean nothing, the samples sold to the public another. Don't get me wrong, no conspiracy theories or col very variable outcomes. I'm sure allowed to grow out enough seeds, one car plants that generated the samples to win the CCup, but they were not in this

Strain: Thai

Strain Type: Sativa **Origin:** Thailand **Breeder:** Dutch Passion Seedbank

Images:

Description:

"This variety grown in Holland is a pure Sativa, selected for short size and ea resin, with typical Thai flavor and aroma. Very strong and energetic "up" hig cultivate.

Specifications:

~ Flower: 10-14 weeks ~ Harvest: end of Nov." - Dutch Passion seedbank ca

Growers Comments:

"This dry, compact, seedy bud is dark brown with some dark green spots. Th and runny and also lightly resinous. It has a spicy, earthy scent and an earthy, energetic. ***1/2" - Homepage Amsterdam

"If its a Thai indica, its not really a true Thai, but probably will be great anyw unique in many ways and is at the far opposite side of the cannabis family co growers cross Thais with their wonderful high with to faster finishing Indies t will finish under two months. Thais grow fast, tall and are similar to a willow long thin floppy branches, but matures slow (indoors they need lots of light v buds, 25 or 30 just wont be enough, try for at least 50 watts/sq.ft. or more, c leaves towards the end of flowering, they don't mind higher than average gr 90F/30C) and expect to wait forever to harvest, 100 days is normal under ide nobody grows pure Thai indoors although reducing the flowering stage " ligh from the time you turn the lights to flower them , go from 12.5/11.5 graduall expected 3 month flowering time will speed up the harvest date by a week c about 3 hermies , 4 males and 3 females out of ten seedlings would be norm small, without markings or lines and readily drop to the ground when fully fo makes them a bastard to find!). Most Thai crosses have seeds with dark line: Thais tend to have long thin leaves, be mold resilient due to the very thin wi as much as indicas, drop most of their multi fingered leaves as it approaches be on the look out for the odd male flower which tend to appear at any time late stages of flowering. If you discover a male flower on a " female " (they a pick it off, but if you see 3 then 4 then more pull the whole plant otherwise y an acre next summer! dry it and try it out or if the weather permits plant it o dead one. Try to very lightly pollinate some branches on your young females developing although I do it sometimes, I'm not sure if it actually works. The (

and bud sizes vary greatly with Thais I have seen, I guess, due to cross breeding for a quicker turnover (make that the bent Cambodian army generals and Thai generals). Some Thais have a Xmas tree shape with 2-ft long continuous buds and a more of a willow tree with knotty dreadlocks at harvest time. The high can vary greatly with Thai/hybrids going from a hard instant knockout punch to a spacey speedy high. The average Thai is strong, a bit druggy and a bit spacey. If you manage to get a high will be better than most Thai commercial, probably more on the spacey side. full potential and pick it just right hmmm although I've tasted some home grown heavy and others that were almost trippy, nothing beats a good home sub-tribe ride, beats the hell out of those tasty 49 day Dutch weeds." - bone-tired

Strain: **Voodoo**

Strain Type: Mostly Sativa **Origin:** Thailand/Holland **Breeder:** Dutch Passion

Images: 1

Description:

"A green strain, developed from Thai parents in 1997. The Thai parents have been available already. A very strong plant with long thick buds. Has a Thai aroma and a clean taste. Very productive.

Specifications:

Specifications: ~ Flower: 7 weeks ~ Harvest: 1st week of Oct." Dutch Passion

Growers Comments:

none

Region: African Strains

Family: Durban Strains

Strain: **Durban**

Strain Type: Mostly Sativa **Origin:** South Africa **Breeder:** Sensi Seed Bank

Images:

Description:

"A very early strain from South Africa. Durban is a compact Sativa with a sweet taste. As one of the most reliable early outdoor varieties, it will produce chunky, solid buds early in the season.

haven't tried Durban, you are missing out on one of the easiest-to-grow, high world.

Durban Poison
- Outdoor / Indoor

"This strain is famous throughout the world. Non hybridized sativa. Not only across South Africa leading to variable quality. Our seeds selected only from consistent 'kick ass' plants loaded with resin. Height 6 - 9 ft, flowering period indoors." -African Seeds catalog

Durban Poison - Native
- Outdoors / Indoors

"Specially selected seeds from crops grown in the wild, these seeds will give high yields and large buds. Nice herbal taste and strong 'physical high'. Flowering indoors results." -African Seeds catalog

Specifications:

Finishing: end of Sept. Height: 1.5 - 2.5 m. Yield: up to 400 gr." - Sensi Seeds

Growers Comments:

"I grew Sensi's Durban this year and it has the anise flavor (dry toke) and it gets a relaxed body high with a mild mind high. It is worthy grow for personal commercial purposes, low yield. Many of my friends who are indica smokers said they could still function, but felt high." -Mota

"2 many males+2 little potency+2 small a yield = on sale baby"-toker2

"The West Coast variety never finished outdoors in time in Seattle. I grew it mold both times. I'm guessing it would have taken until mid to late October. Don't know." - SCW

"Same with the Dutch version- mid to late October." - danny

Strain: Durban Poison

Strain Type: Mostly Sativa **Origin:** South Africa **Breeder:** Dutch Passion Seeds

Images: 1 2

Description:

"Imported from South Africa, produced in Holland. Exclusively inbred, never long bud leaves, buds are also large and long with lots of resin. A sweet licorice similar to Thai. High yields. Well suited for out crossing with late bloomers to does very well under artificial light.

Specifications:

~ Flower: 8-9 weeks ~ Harvest: end of Sept." - Dutch Passion catalog

Growers Comments:

"South African (called Durban Poison by some) is the most inconsistent or, more strikingly different varieties of all marijuana originating from a single country called South African or Durban Poison in the US, quite probably it originated in the 1970's by breeders in the San Francisco Bay area....The unnamed breeder had high potency and early flowering-and he succeeded wonderfully with both goals. It's a great gardener no matter what the growing conditions. This Durban Poison strain has characteristics of Afghani but long internodes like sativas. Stigmas may be pure white, red, purple or black. It can grow with differing lengths like Thai, and the profile may be from an eight foot bush. This Durban is fast-growing, hardy, very early to mature, very potent and very fragrant. What more could a grower ask?"-Mel Frank

"M3 Pinetown Durban South Africa Sativa. Known also as Durban Poison. A great choice for the earliest maturing original Sativa's. Very suitable for making hybrid crosses. Harvest second or third week of September (Outdoors). Taste is sweet. \$45 for 15. (Sativa) -From the Super Sativa Seed Club Catalog 1987/1989

"I was reading that a certain durban sold from a breeder is superior to the others. No, Sensi is not the superior Durban (I think). Ask around, and make sure you know what you're getting. It is renowned for its early flowering characteristic, it can go outdoors or indoors and stay high in a fast flowerer. It is also very stable, so you can easily breed your own.

"I bought some HBC durban (dutch passion) last winter and grew a very nice bush and finished outdoor by mid-spring. a friend gave me 6 of his S.S.B. durban and I grew it this summer and harvested about 4 weeks ago. both company's durban grew very well. wayyyy better. better taste and buzz anyway. even the aroma during growth was better with Dutch Passion's version and stay away from Sensi's on this one. I have read that Sensi Bank but I don't know and others who have sampled both ssb's version and dutch passion's version much much better. both were grown in the same soil (except for the partial indoor grow with 500k mh with the d.p. durban.) and all other possible grow conditions differed.they grew under very similar conditions. s.s.b. is still at or near the top of the list. I'm kinda missed with this one. this, of course, is mostly just MHO but others agree. I know what i'm talking about and hang here will put in their 2 cents worth but I'm not unhappy a few months down the road." -durban grower

"The trick is to not allow too much upward growth- on node 7 or 8, pinch out the main stem. You should be left with about 6 branches which will rapidly bush out to form a crown. These will, in turn, produce branches growing into centre of plant. These secondary branches will form about 3 or 4 nodes on the same day that flowering is started. Durban starts to flower. I can see signs within a week. After about 10- 14 days, pinch main branch-tips off. This will form a crown that will now fill out into colas. Final plant should be just over 2 feet tall at cutting. High is totally unbelievable- its like the first time you got stoned, but cerebral and euphoric. Yield is average, nothing a cash-cropper would be impressed with."-Norwegian Wood

"Mel Frank says that he knows the breeder in California that developed Durban Poison. He says 2 females out of 16 grown from 1 variety out of six that came from South Africa.

worth a damn. What he doesn't say is that there must have been some other... He notes that genetics among growers in SA were already all jumbled up from... on, so the claims that Durban is a pure sativa have to be taken with a grain of...

"I'm trying some Durban from Aloha out right now in SOG. I've harvested a... and it was good quality so I have a little sea of her going now.. 4 per foot in... stretched more than I wanted or expected under the 1K Agrosun MH, I was a... will probably hit 2.5. You can train and prune and tie her all over but it won't... makes for the lankiness. Budding them around 6 to 8 inches, or 5 days of ve... time. The yield should be good, not great.. it won't be huge like a good indica... with flowering times and amount of resin (how many cycles per year can you... have no idea if these plants are even distant relatives of the seeds you might...

"I messed around with Durban in a 24" sog setup, and it just wouldn't work, I... stayed fairly short, so I cloned it for a mother and put it aside for some mont... and thought of the Durban, so I cloned it up and ran 5 of them under the scr... HPS conversion bulb. The Durban wanted to run a bit, but that was OK with t... now is a number of 4-8" flower spikes about the size of large cigars, and the... for a couple of weeks. I think it will mature nicely, which is good, as Durban i... bit spindly, yes, but I can live with that; this is not for production, just person... that Durban can work in some inside environments, or maybe just the right I... good.

It's 1 foot to the scrog screen and that gives me another foot until the tops a... raise the screen a bit next time, as the longest Durban bud is 8 inches. I let t... filled up the scrog screen (not exactly a scientific process), and that took abo... clones. Sorry, I don't keep a log book or anything like that, so I'm guessing to... From the time the lights went to 12 hours, the Durban looks to finish about 8... thought, and I'm basing it on the proportion of white to brown hairs, never a... way. Outside I had to harvest it early due to mold. I think I'll let it go two mo... vacation, to see if it puts on some weight, which will be about 9 weeks from... grown in the same air chamber is already dead ripe.

One thing about Durban; it's very prone to mold. I recommend denuding all t... and using a fan to provide air flow to that area. I lost several stalks to mold b... space.

Oh, and one last thing. Remember, I tried Durban sog last year, and it sucke... start over. It was just this one Durban that seemed to have the potential to s... turns out to be ideally suited to scrog. I can't promise other Durbans will wor...

"I grew out sensi durban. Potency on a 1 to 10 a solid four. Very pretty plant... too many males. No soaring sativa high."-seedydive

"I`ve just grown out the durban from sensi....this seed came in original sensi... when sensi had the buy 1 get 1 free sale going on....I`ve never grown any ot... compare...potency is the biggest disappointment from what I`ve had. early r... Sept 20th....the high did not pick me "up"...a mild sativa high..."-straydog

"I grew Dutch Passion's version. It's not worth paying for. From what I hear, t... is if you're looking for a pure sativa with an anise flavour. My plants looked li... that the plants were absolute crap, just that they were not worth the \$11 a s... blueberry seeds had more value. They were good enough and uniform enoug...

hermie plants to create backup seed before I dump the lot.
I think the wild bank in Africa would be the best source. With any luck, I'll have it by the end of the day. I saw some pics of traditional durban leaves at Lyceum. Dutch Passion's

"Today I tasted some Durban Poison for the first time. The plant was not mature yet, day 60 of 12/12. Durban has a very clear energetic high for me with almost no or less body. The aroma is sweet, like tai. It looks a bit like tai also, but much more dense calyxes. It is fun to talk on, go out in public, and energetic. I can see now why it is so popular. Personally it is a nightmare in ScrOG/indoors and I would not recommend it for those who stretch like crazy, and the buds are very fluffy and airy. the colas also fall apart. It continues to stretch well into the 2nd month of bloom. I do not know why it is so popular, but the head is great, but I think a cross to Skunk to increase density and resin is in order."

Strain: Durban Poison X Mighty Might

Strain Type: Sativa/Indica mix **Origin:** British Columbia **Breeder:** Federal

Images:

Description:

"Better outdoors than Durban alone, yet a better yield than Mighty Might alone."

Specifications:

(indoors) ~ Flower: 60-65 days ~ Height: 110-140 cm ~ Yield: 300-325 gr/sq ft
Plant: Jun. 1st ~ Finish: Sept. 8-15th ~ Height: 5-6' ~ Yield: 3-4 oz" - Heavens

Growers Comments:

none

Strain: Durban X Skunk

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Positronics

Images:

Description:

"Origin: South Africa and California Type: F1 hybrid Composition: 12.5 % indica
seedbank"

Specifications:

Flowering-Time: 8-10 weeks Environment: Fit for inside, outside, and greenhouse
plant has long, sticky buds and many branches Smell/Taste: High, soft taste
200-500 gr. Harvest-Time: ± 10 October" - Positronics seedbank catalog

Growers Comments:

"Very simple pedigree: its an F1 cross of two stable strains: durban poison and not the most potent strain ever, but it is nice. Durban gives a good flavour to taste of aniseed, coffee or liquorice), which grows slightly larger than average (under 2ft easily), plant tends towards a bush (no single stem shit here), buds pungent. Yield is lower than many indicas, but quite respectable compared to cross was that durban is considered by many to be a bitch to grow, with a re some of D's worst traits (height, yield, variation in high, hermaphrodite tendency moderated by crossing to skunk. I wouldn't grow it outside. If I liked skunky taste), then this would be a plant I would grow first off, along with Kerala skunk india, slightly more trippy). I think on the hole, a good plant." - durban

Strain: Durban/Thai

Strain Type: Mostly Sativa **Origin:** South Africa/Thailand **Breeder:** Super

Images:

Description:

Durban-Thai Highflyer/ S.S.S.C. "M8 A Thai strain inbred for 4 generations crossed with Africa sativa. Very sweet resinous buds. The high is very strong and up. One outdoors: the second week of Oct. Suitable for indoor growing as well. \$55 for catalog 1980s

Specifications:

none

Growers Comments:

"I recently got my hands on seeds from my FAVOURITE SSSC strain - Durban seedlings going as we speak (5/7 germed from 11-year-old seeds). I grew a v about ten years ago and they were SO KILLER, with the kind of SICKLY-SWEET makes your mouth water...so resinous that the joint would be BROWN by the had this "evil" scent like rotten meat when you broke up a bud. I'm going to Haze hybrid I'm developing over the course of 1999. I'm really excited about

"The original SSSC Durban/Thai cross is one of my personal favourites that I that the mother was the Thai and she came from the fourth generation of selected indoor cultivation. This Thai mama was SWEET, I'm sure it's the Thai y a head-trip high? I now have a SUPERB female D/T that I flower clones from. see/smoke this plant! In 8-9 weeks of 12/12 she's ripe...a really FAST Sativa influence, the ripening buds smell like foot perspiration...really FUNKY. Thank delicious licorice scent/flavour and is wickedly cerebral. DTC99 resulted from best C99 male." - soul

Durban Thai Home Hybrid

"Those are hybrids of Durban/Thai crossed to NL#5/Sk#1 x Hawaiian...the best Home Hybrid, or DTHH. I had 50 from this generous friend & he even gave me seeds (11 years old), which is how I got my special D/T lady." - soul

Family: Uncategorized Strains

Strain: Malawi

Strain Type: Sativa **Origin:** Lake Malawi, Tanzania **Breeder:** Undetermined

Images: 1

Description:

none

Specifications:

none

Growers Comments:

"Malawi is the spiciest smoke I've ever had. I used to have this thing that had a teenager where I'd get some killer smoke from AFOAF that would literally make you fall asleep in half hour within 10 minutes of smoking it, a little too much too quick. Malawi is still there but vision changes to lights and shadows and sounds become muffled and things in your peripheral vision will catch your eyes. The high was full of sensations of the indicas. Darkest leaves I've ever seen, almost look black. I had to take a 20-30% could have went another month to round out the buzz. Yield was similar to the indica worth the wait if that's what you like. For me it's the kind of smoke you'd take if you're stoned will vary, it's too much if overdone." - Frank

"AFOAF grew hers out when Greenthumb first brought them out last year. Leaves were the darkest green(looked black) I've ever seen. Took em unfinished at 85 days(2 weeks) for personal head stash and one to take out for special occasion. The high was like a indica effects and somewhat short lived. I made the mistake of smoking an indica instead of the Malawi and I couldn't move for a couple of hours. Can be a typical unruly high that needs attention. Worth the effort if that's what you're looking for, I prefer a more relaxed buzz." - Frank

Strain: Malawi Gold

Strain Type: Mostly Sativa **Origin:** Lake Malawi, Tanzania **Breeder:** High Level Genetics

Images: 1

Description:

none

Specifications:

none

Growers Comments:

"Outdoors Summer Report: This baby definitely has Sativa in its genes. 6 feet tall before its done. Big Christmas tree type plant. Buds are bursting out from the leaves." - Frank

lower branches are putting on bud weight! Awesome....only wish I had a Trop

Strain: Power Plant

Strain Type: Mostly Sativa **Origin:** South Africa **Breeder:** Dutch Passion

Images: 1 2 3 4 5 6

Description:

Power Plant (mostly Sativa) was developed in 1997 from new South African inbred only, never hybridized. Very rich in THC. It is a strain with an enormous yield in a greenhouse the plants have an enormous yield. Indoors flowering starts back the light cycle to 12 hours. Outdoor flowering starts late, but the plants are uniform. Strong "up high", very soft smoke.

Specifications:

~ Flower: 8 weeks ~ Harvest: 2nd week of Oct." - Dutch Passion catalog

Growers Comments:

"I grew one Power Plant outdoors at the 39th. The seed was germinated on a paper towel at 15 inches tall. I was quite happy with both the potency and yield. If it had a higher yield probably would have been enormous. The plant grew more like an indica than a sativa, good, long lasting sativa up high to it. Unfortunately, I lost all the other seeds from the mother after harvest. I did, however, get a few seeds from crossing her with another strain to grow outdoors in my area. It seemed to me that power plant was exactly like an indica except the plant finished 2 weeks earlier, and looked about half indica. I wish I had more seeds."

"Let me preface this by stating I have 8 yrs of gardening experience. I found it difficult to start the seedlings. Of the 6 of ten that survived = 1 tall male, 1 short male (with controllable hermie traits) 1 short total female and 2 very hermie "females" as a indoor/ greenhouse stock it can become a big plant very quickly with some sativa structure. The 1 short female looks like it will produce well even though it was a trial run."

The harvest is about 2 weeks away so more detailed info at that time. It is a good strain well in a ScrOG set up. If the result is of high quality, I will devote a hydro farm to see how the totals compare to the much more indica stock that is most of the stash. Now I will not say that I am beyond mistakes but I had very bad survival rates with pellets and much better results the second germination round using oasis cubes. The seeds are very small and produce very small seedlings that need a little more care. Of course there are always new things to learn when working with new strains."

"Hermies tendency, not rich in resin, medium in power and shit to grow." - c

"I had a good experience growing power plant outdoors. I only grew one female and it was very uniform. I was surprised that it appeared mostly indica, but for me, the high was very good."

soaring too. Also, it finished two weeks before(Sept 23) the description said

"Power plant was very hermy and might do for outside or green house but it was good and uppy but not "soaring". I have dropped it from this next go round

Strain: Swazi

Strain Type: Sativa **Origin:** Swaziland, Africa **Breeder:** Positronics

Images: 1

Description:

"Imported: Swaziland, Africa Pure breeding: never outcrossed Sativa/Indica: large resin covered bracts, seeded or not; long slender buds, very low leaf-to-taste, nice smell – Positronics seedbank catalog

Specifications:

Type high/strength: strong, fairly clear Height: 2-3m Yield: very high Harvest photoperiod): end Nov 12hr day exposure harvest (# of weeks): 9-14 Indoor more mold resistant than other varieties." – Positronics seedbank catalog

Growers Comments:

"Swazi: For outdoor growers we now have the famous Swazi, know for early finish, sweet sativa taste and high. A truly unique variety from Swaziland South Africa. Outdoor height: 7-9 ft. Outdoor yield average: 1 lb. Finish date: Sept. 15 at 4 weeks. Quality Seeds catalog

"I looked in both of my SSSC catalogs (1987-88, 1989-90) and they did not list a South African strain that they listed was a PineTown Durban Poison (M3). As I checked out my Original Seed Bank catalogs from the same time period. Never the first time in Nov. of 1987. It is listed again in his 1988 catalog. By 1989, I offered. (One Swazi hybrid that was introduced in 1988, is still listed in his 89 SWAZI)." – Prince Caspian

Strain: Swazi X Skunk

Strain Type: Mostly Sativa **Origin:** Holland **Breeder:** Dutch Passion Seed Bank

Images:

Description:

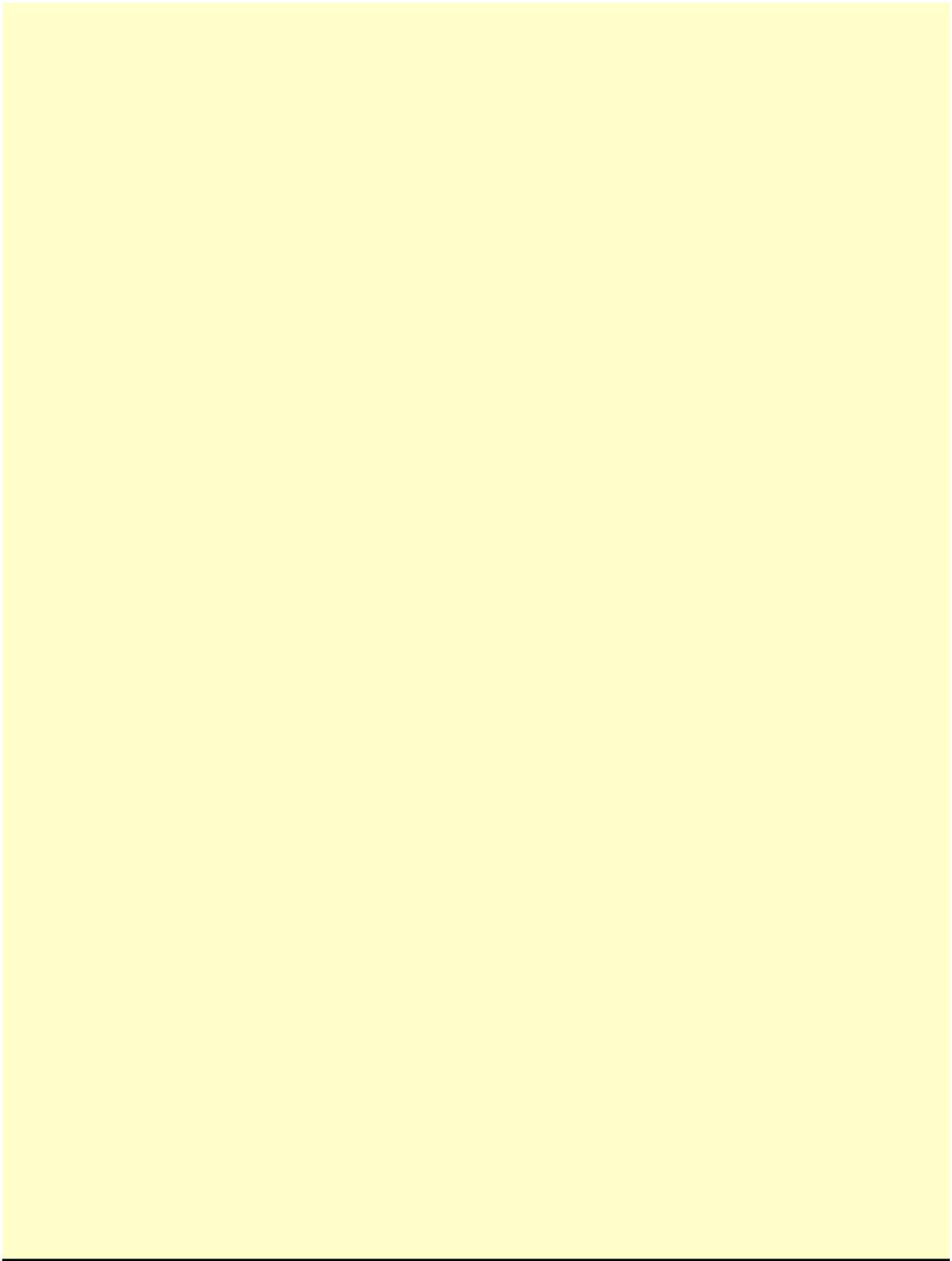
100% Sativa crossbred with a Dutch Skunk. This is a real bargain, slow but with a strong high.

Specifications:

Specifications: ~ Flower: 9-14 weeks

Growers Comments:

none



Region: **Templates** - For Incoming Data

[Hyperte](#)

Family:

Strain: **Blue Mountain Jamaican**

Strain Type: Sativa **Origin:** Jamaica **Breeder:** Wild Rose Seeds

Images:

Description:

Sweet, earthy taste, rare to find. Resinous large buds with few sucker leaves.

Specifications: Cuttings of this strain can be brought to maturity in 65-75 rooting. Seedlings need to veg for 35-40 days. Flowering time 65-75 days

Growers Comments:

none

Strain:

Strain Type:

Images:

Description:

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Specifications:

Growers Comments:

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Region)

phabetical Order)

« Use either hypertext list to access
Ganja Strain Database
(Lots of info/pics)

(Neal Smith)

The War On Drugs (Damuzi)

Glen Boire, Esq)

Glen Boire, Esq)

s (Richard Glen Boire, Esq)

Rosenthal)

t Connell Clarke)

Indo-Asian Strains -
India, Nepal, and Southeast Asia

ains

[Dream](#)

s

l

l

[ear](#)

ains

[ndica](#)

is

[iti I and II](#)

Asian

l

ed Strains

[Gold](#)

[nk](#)

[Indica](#)

[oy Madness](#)

[n x Skunk #1](#)

[stal](#)

Region: African Strains

Durban Strains

[Durban](#)

[Durban Poison](#)

[Durban Poison X Mighty Might](#)

[Durban X Skunk](#)

[Durban/Thai](#)

Uncategorized Strains

[Malawi](#)

[Malawi Gold](#)

[Power Plant](#)

[Swazi](#)

[Swazi X Skunk](#)

[»Back To Index](#)

[»Back To Index](#)

[»Back To Index](#)

bean

determined

) is all indica. BC Big Bud has
#18 (Steve Kubby header), and a
the female in those Romulan x BC
V/\$40 US for 10 seeds. Giant seeds,

ance despite what mythology
elder like BC Big Bud but the high is
more sativa like." - Marc Emery

k

eed high yields, 25% has
it of the buds. Cash cropper's



rain just doesn't do it for me. They
rown this strain 2 times before
ny first crops, but even this latest
as far as potency goes. This will be

al as many people seem to think.
ey are big, but not significantly
ff your feet good. There is huge
egends, but the majority are just
ject miracles. I just finished a

the BB from Sensi I grew and
t. Much greener, tastier, more
cial". So I'd advise germinating the
! Good luck dude. If you never
/ what your doing (selection wise)."



nsi BB, and I'm glad I didn't
nd didn't score that hard to find
They were big in circumference, with
ke Holland/Canada Big Treat than

about 43-45 days and it yields real
stating buzz, however it has a
me." Its just an all-around good
big consideration." -Budm

Undetermined

o of butter, that turned out way too
e was a complete runt, I don't
m for 3 weeks under a 1000MH with
ant was topped twice. Flowering was
A second identical light was added
allized plants of this variety that
o paper bags, then into mason jars.
hat I'd like. This crop just floors
f bong hits it just hits you like a
But it lets your mind stay
d with this harvest. I had a couple
end the cold started to set in a bit.
pical Big Bud problem of slightly
all the other plants, I ended up
yielded almost 4 ounces alone." -

eedbank

Big Bud itself is not a very
ing Big Bud and Skunk #1, Green
and strong high. The plants have





Passion seedbank catalog

real bomb taste. The only
efathers."-Mcgee

standing trichomes. This produces a
tout kush plants that produce

rway catalog

ily in its glandular resin coating.
my personal gene pool collection."

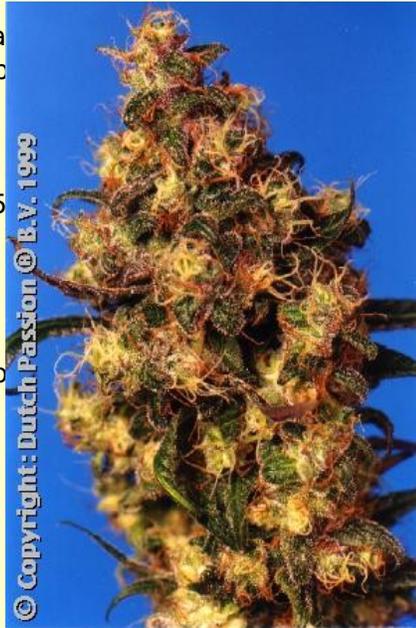
my best NL female and so far,
s a strain out there with that

ou want your ass kicked (it isn't
it. Yield pretty good; nugs too
o busy to get terribly scientific
(I doubt anyone shares them.)
o change my mind, which I may.
have an opinion on all others.
irting every bean in my
y opinion better then.
n superstoked to have it." -stonerg

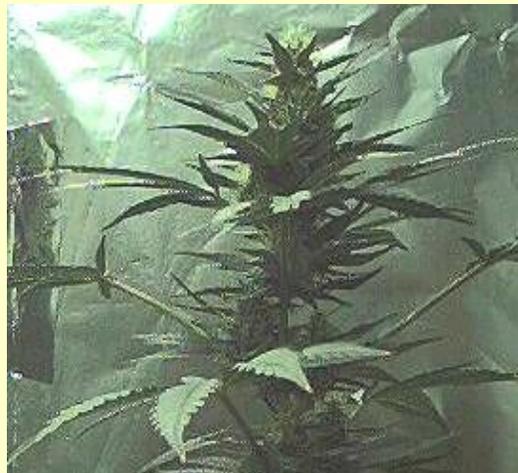
ur most pure and oldest sativa
ra lovers. Wrap these velvety b

roots show. Flowering time: 65
atha seedbank catalog

The buds, and yield are a bit lo
ld say it does MUCH better



ARANCE: Very short plant -up to 80
s forming a bush almost as wide as
nsistent -height, nodes and density
nge hairs forming thick, rock-solid
lue hue to the tops. Good side
n small thick leaves. TASTE / SMELL:
sty, with a sweet hashy berry flavor
g, floaty, very visual buzz. It is
idow, but is not very heavy. YIELD:
odes with thick solid clusters with
plant indoors but the BlueWidow



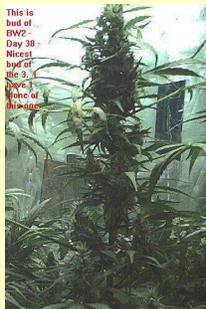
**Final Lady
(BW3) is fairly
full top bud,
not as good
BW2, but
much better
than BW1.**

talk but rather many stems
e slender when flowering. Very

Widow (hands down the best so



but start it indoors under natural
light from seed it tends to make a
plant the same 6 ft but yields about four
times you can go to the 3rd or 4th its just



the keeper in my grow. It has the
same as itself. It matures in 45-50 days
to grow with BlueWidow and C99. 2
times the size and Buzz are the most

type about how great Sensi,
just very good commercial pot. The
others they have lost their original zip.
Widow is more powerful and has
a blue hue absolutely destroys the original
purple buds that still have distinct
purple color. Not to mention their price

is not a great yield, but worth it. The
difference with the Widow-- that the smell is
stronger just starting to flower it so the
plants grow close together for a while and

is preferred. I don't think it will be more
preferred from this is as strong as our

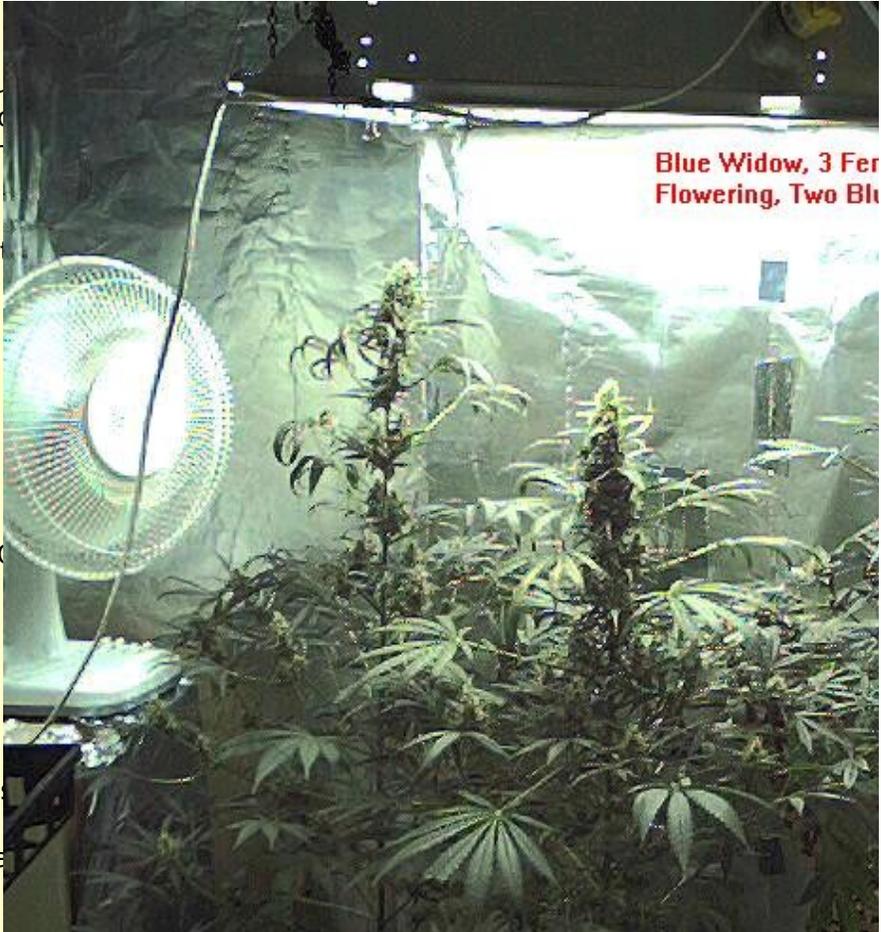
or this strain to cross with a very
sativa: will go more sativa as it enters
winter: ice thick solid clusters with orange
hues: strong the nose and strong hashy
smell."

clear and focused...I would go with
a very nice yielder of solid buds the Kali
description says. It gotta a very nice
AK is heavy slammin high but very
minimal buzz then you would want

appy hunting."

vers after 4-6 weeks of continuous
g and J.H. mix; these plants do not
from thick indica to more slender
id nuggs BlueWidow and it is a
e a little less yield on this 1, but
er lost his sense of smell and taste
strong sample on occasion...I
st as long as the others (keep in
density are all the same with

n short nodes thick dark green
iller than that when u flower her
ost hurts the eyes to look at it
explodes the lungs VERY STRONG
rt, good side branching buds will
tween small thick leaves has a
s:). I tried some leaf from it 10
ale leaf after sexing the plants. I
of its own. can't wait to try the
our purposes. I too have noticed
ants don't have any center stalk
hat's beside the point), but he
are uniform and almost as wide a
avor and aroma that leaves me
than makes up for that."



g a main stem like most plants,
into flowering, so I am curious
nd this leaf "kicks ass"!

ken blueberry and crossed it with
StoneBlue which is a cross of
idow is almost as good sacrificing

th week of 12/12, both stand
f resin. They are also kinda bushy
the clones had to rejuvenate. My
r 7th node, still parallel
that to having more room root

ave yet to sample any... but I can
march planting. They are all very
be the fastest (well, the MCW is a
arden, though. If it smokes like it
re this fall." - m.g.

. I always wind up harvesting about
turned a robust purple, kind of
such a low yeilder. Her big sister is
t....

ones with 3 weeks left.
ured 18" plant w/ 4 colas). Smooth
ne wonders if they are still high

is and 2 smallish ones. For all the
ll it was a fun project and I've got
e BW around for a while." - D.

lant to develop sexually before
own it and several of my patients
: results have been zero hermies.
ermy. Now that it is only

louros (24/7) then cut back to
nt really stretched at that point for
powering off, and then coming
g. At this point the buds took off,
leaves around the buds frosted

ough to get pollen and seeded
calyxes on all the buds (maybe

ne bottom 10 for clones. Even a
me breaking out of bud mode

e pink coloring on the buds is
top of the plant got turned off
ating its top buds (all that's left
and more like hashish and is

utgrowing their space in the veg

ing high or wait for them to finish
ing the small frosted bud leaves

.ft. room gave me 10 oz of
This batch was very fast. Buds are
e from the BLB Mom but they

he late 1970's. A large producer
lly blue hues that usually cure to a
e berry. It produces a notable and
um to large calyxes."Blueberry"
ion catalog

uces large, crystallized buds with
surable on the palate. A favored
appy, healthy harvest." -

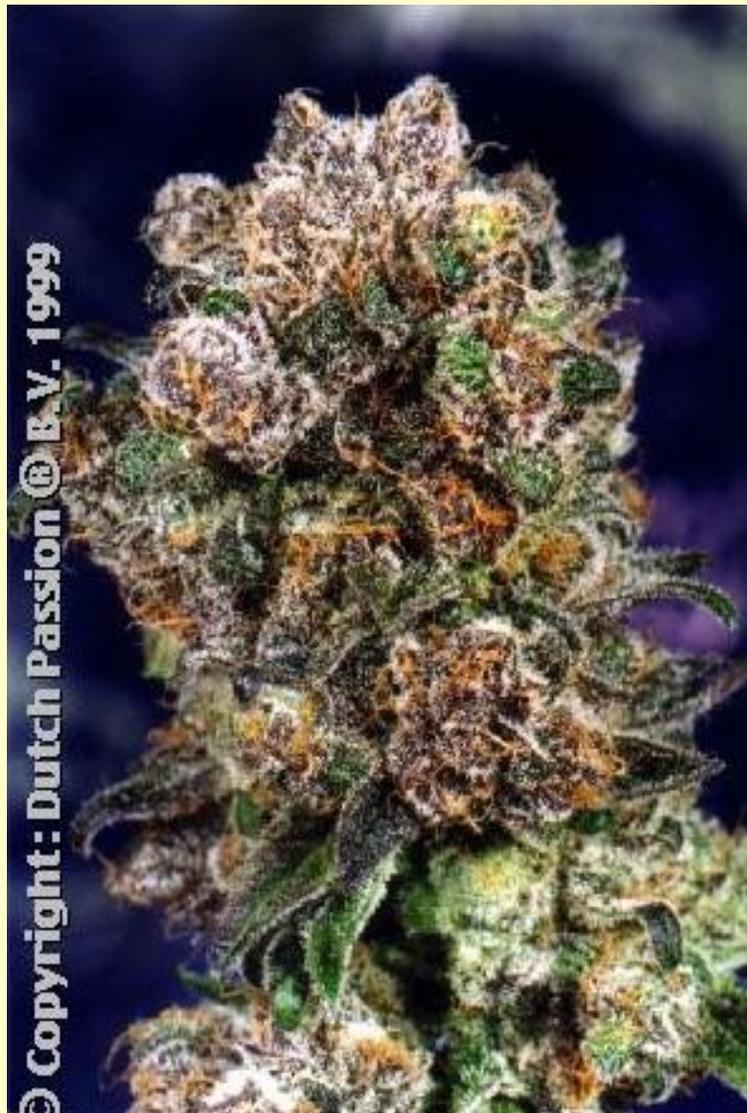
of Oct.; Height: 0.7-1 metres (2-3

-2 weeks after roots show. Clip
325 grams / m2 (dried)." -

he late 1970's. A large producer
lly blue hues that usually cure to a
e berry. It produces a notable and
um to large calyxes."Blueberry"

e was not the first to create it. I
fruity Kush. And I think I
give that uplifting high." -Vic High

at came to me one generation
l to the plants grown from this
that developed from the f2 (and



Chocolate Thai-Oaxacaan
uniform hybrids. The f2's, f3's and
to be known as "Hindu Kush",

etween the two. Both grew short
n had slightly shorter stems and
shorter stemmed Afghan leaves
side branching, especially from
earthen" odor and a lighter green

op more downward, exposing the
it during later maturity. Also, the
r" than the basic Afghan. The Kush
stemmed leaves, many of which
h large swollen bracts and flowers).
ma, some with aroma like
rowed from) Robert Connell

et, berry, or otherwise from my own
(the original P1 stock). Technically,
tan/Northwest Frontier north of
trains. I hope this has helped to

eberry from new genetics" was
an market. I simply authorized the
ould re-do these descriptions.
f my own varieties. I am only
gion of origin. Until more of these
rk with. Look for new varieties in

seed trade.
natha release, and all subsequent.
nd phenotype is more vigorous,
. I've found the first phenotype
l who bought the first batch direct

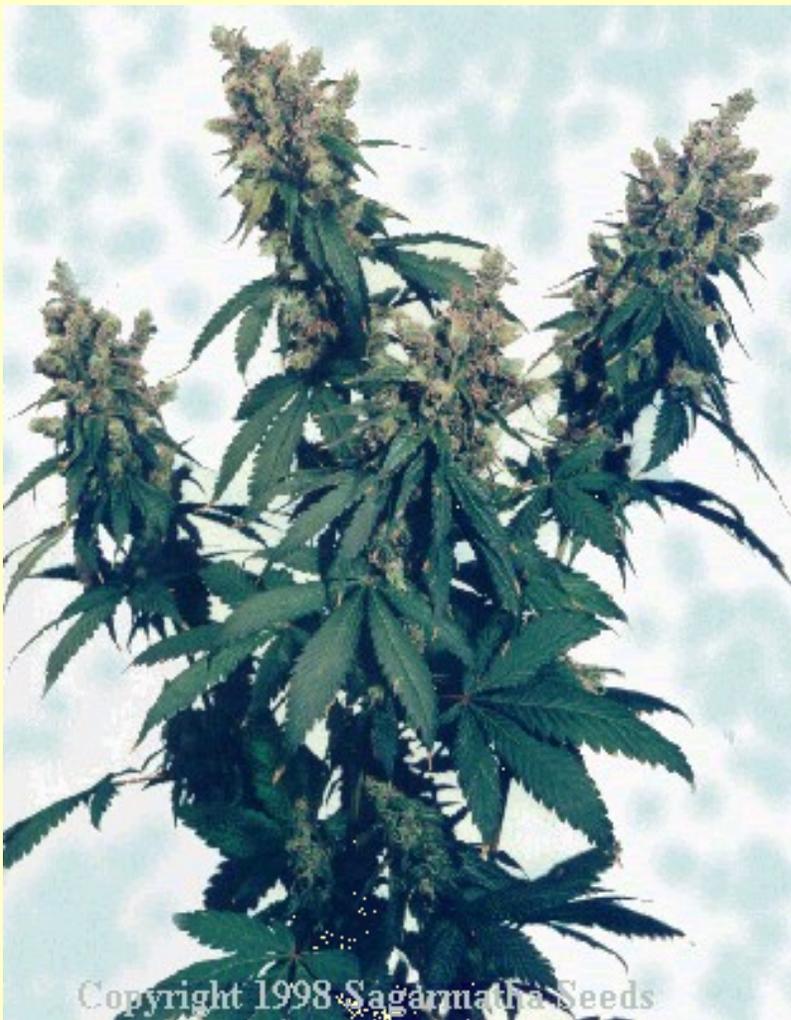
w of the second (wider leaf)

e now of the second (wider leaf)

again, these are now of the second
nery seeds and the Amsterdam

e difference is that it is a knockoff

nt, tended to grow a bit taller than
as, but potency and flavor good.
g to top only once or not at all in



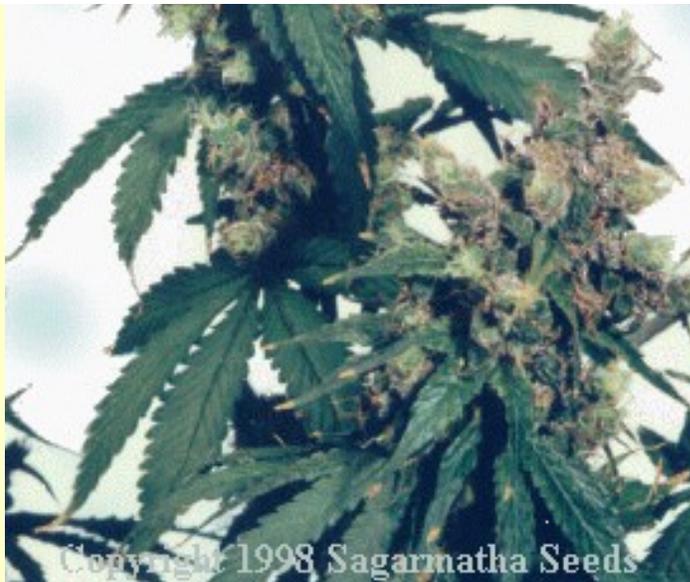
ic trait. I used 'feminized' seeds
nusiastic about this variation. For
." - Tokko

stone 1 quite zippy and 3 quite up
breeding."-Oldtimer

ost potent. The smoke is soo clean
our. When being transported, it

ed grower quickly. Blueberry,
nt in my garden to tell me that
ch as NL5?" - Vic High

s, WOW. I used to grow with stash
, with 55 watts per s.f., vented
5."



have been supplied by
es in 45 - 55 days. Reported to
mistakable berry taste and aroma.

ery deformed with wrinkled leaves
found out that the strain was
ould not stop flowering regardless of
shed pollen (they would flower but
was by far the most robust and
ne females produced great buds
d then discarded. The final 2
oduced the sweetest berry like
as the father.

nities have disappeared in mature
e about 12" long with tight
on. They have a high calyx to leaf
ey are not my most potent strain
is uplifting and pleasant.

l, and finished at about 36 inches,
v bags containing the super soil
cted.

ow bags containing the super soil
ile the remaining 22 were pruned
ere placed into flower (Group B).
when they reached 20".

000w HPS and 1 1000w MH on a
l reflector and the MH was in a

so that the lower buds would fill

1.61oz per sq ft. by growing

so that the lower buds would fill

ing the tops, I yielded 1.28 oz per

32oz (11.5 lbs) would be
7 week flower period. Pretty

were manicured but wet and still on
and removing the stalks they

7.75 oz and an average of .64

ing the tops twice, I yielded .43 oz

1 and 2, still germinated but
e sprouts started a little on the

ng with the exception of one that
naped leaves, wider and rounded
e seen. Oh yeah. These plants had

to show a weakness to mold its
; weak, and weak is a kind word.
d and it produced the most bud.
spectable plant though. Plant was
for this age.

verage in buzz.

eld wasn't impressive but... the
ng. That's the best that can be
ed very early, approx. 38 days.
:'s likely to take longer when
go round.

1. The plants grow small buds at
grow. More veg time under white
far as all the colors DP advertises

lat green right now. But if you look
blue tinge? it's due to the

er it'll start showing its psychedelic
er that lighting angle is achieved

show colors.
cked when the time came to
ly had zero resin. Because the
g its maker.
riddance.
ng, rooting and flowering. The
half the same grow filled with

o the sweet skunky indica odor
of you that have friends that are
g time attention to odor control in
g but the lawn.
me unknown reason -
or this age. Both were definitely
thing going on. More later when
everything else worth keeping

there that is different. There is

on who stays and who goes then.
mature. If it shows an early
for surprises." - flick

f happened. It turned out to be a

ded up using clones from two
relatively slow growing, and formed
is started right off turning
bark from a distance. The fan
ey stood out straight from the plant

ogger a couple of times, not for
l. I'll do it again next year.
: did develop a couple of grey
before full maturity. Good thing,
d at us with a late Indian summer

ith small lime-green hairs. The
eaves. What a beauty! The smell
e. It's safe for backyard growing.
as suppose to (September). There
; my fault or just the plants
most years. But I call it stalwart,
rly October that would have melted

red 9 dry ounces (very closely

s (after being cut back a couple of
piss poor in anyone's book.

). I didn't weigh the skuff, maybe
coated leaves).

I've smoked, but it gets the job
ed. It doesn't last very long,
ca homey for instance. You can
. Maybe these particular plants
a downer before. It has an nice
and deliver it to your vocal cords in

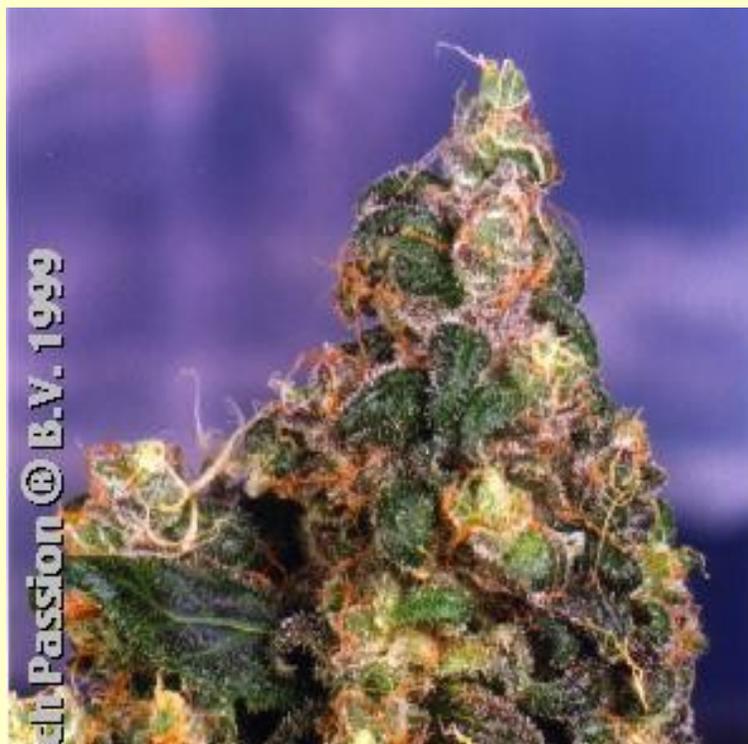
are greatly washed out in gland
h as any of my other pots. It
o be a sleep pot. It does taste
ing plant, which is just wonderful, I

va phenotypic characteristics that
small, densely packed purple
ly mature by the end of their
er a period of time. The first buds
t, new buds form and can be
ong. Therefore, "Flo" is ideal for
ite unique, the flavor is like

Sagarmatha seedbank catalog

icy/high: Not much "body stone" at
ie), kinda "up" y'know -- makes
Not real visual/hallucinogenic, and
(an hour off 2 medium bong hits),
really like this one, although the
sh as I do.

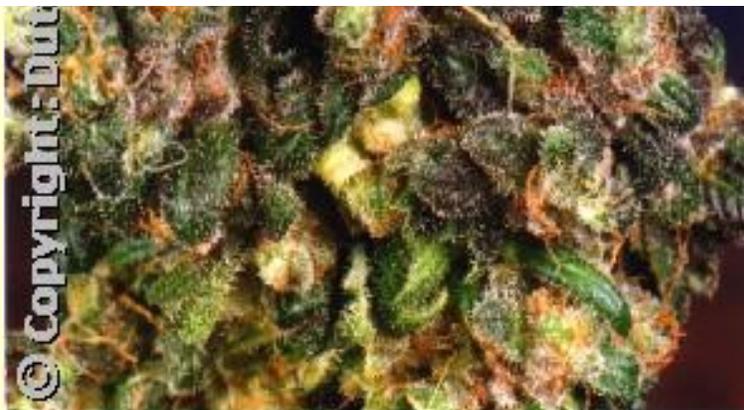
his because she yields pretty low:
ng strain. But also the most
look at, dark maroon-colored
very sweet floral kind of scent.
heard varying reports: 60% sativa,



eed, you know, you can wake n
n the morning (sometimes), and
ost thought I wasn't high -- the
ppy, slightly visual, cerebral

finishes (in my room) at 2' or
re the two. To repeat myself, I
mper crop (she won't). I'd guess
- 1/2 oz per 2' plant."-Zachary

ail about 7-10 days for the
ste like Royal Nepal. High was like
strain. I grew both Blueberry and



t breeder's strains came from
supposed to be related--probably
ng

le that do not like blueberry. Its
: kid of leafy. Lots of resin on the
eaves. grows long, Superskunk
etty big buds. I have been pleased
n like blueberry. Unfortunately , one
ore intense. There's a peppery
eek or two earlier than Blueberry.
rtial to the oranges, and sweet

ip is unknown but 1 puff told me
y fast . it also has a noticeable
azy about the blueberry taste but
f puts you in a daze, a dreamy
ding. I like Cinderella in the

others. One was an indica dominate
/ up...the weed tastes real
r after this one you are going to
ant to do that,...so roll another and
izz will relax ya so you can
n on my face and deep perception
especially when you want to talk
e definitely more potent...but I

body, 10% head high. Matures
n in color. Difficult to clone, gets
e high is very physically relaxing

se 40% of the clones, and just lost
ns survived without any harm, but
e only reason I keep growing it is
truly an exceptional strain in this
ht explain why yours does not have

high from it. something that is a
eberry and taste similar. your

ask because one female was
s on. but she still wants to
wth...and they have resin glands." -

ds never got very frosty, and the
ay. The bud appearance looks
is the Flo got a thumbs down." -

nd could think of.

0 gr/sqM" - Marc Emery Seeds

mix of NL power with Blueberry
at they don't exhibit Blueberry

erry male. The hybrid retained the
uity aroma and taste from the
ids seen in Aug. 98 High Times.

alog

The high is up, for an indica, and
.5 Taste--9 or higher! This is what
e best way I know how to describe
es to have a rich well drained soil,
weeks 18-6 from seed, 10- 12

nice taste but I would still pick

otal of 50days 24/0 400mh, in 2gal
plication. Flowered under 400hps
uds. Nice 75-80% brow hairs, 50%
30% of the bud material was left
2oz's each. Being the first grow, It
fantastic yielder. I really thought
would surely take a 1000watt
are awesome! The Romberry
dense, stalked trichome frosty
: amount of light to produce
t Expect Centerfold Colas on Your
t of help from the great people
ms that I think are worthy of a

nt colas with as little as 35 watts
tage and original breeding
en flouros were popular, and
does well under low light

I thought I had 3 Roms, but one
with prolific pre-flowering. Also,
them go 72 days. Actually, I
everything worked out in the end.
to set me up for MONTHS!

your face. The flavor's coming out



glistening Blueberry Male, for added
other backcross.

ht)" - Spice of Life Seeds catalog

ay that shishke is a better yielder
ode it got bigger than I wanted it.
/ft with almost all extraneous
uning the lower branches in my
after you start 12/12 and you'll have

good(could have been better but
ays and not 6 weeks as advertised.
n me out indica stone. Not too

. Had 3 sizes but all eventually put
ighest leaf-calyx ratio while the
anicured bud with the smallest one
once pinched plant) and the
h buds" along with a nice main
uzz and taste but there's better
o other strains and lots of
grow and minimal care. I did a few
ality of the outdoor grow...also
(if that makes any difference) but
I purchased mine last winter from

buds are fat and sticky with a
ry Blueberry look to them, based
. The only problem I have with the
shable for what it is, it is enough to
erb

in it, if anyone is interested. A
v are only from one of the



Shiska mum.

sample. But kaka has yet to
are drying and I can't smell

ne me. Today it has whipped me
inmotivated. This evening a friend
visual distortion, lots of laughs
below the NL x shiva in power
with the nlxshiva toward the

ind left with a hint of
on the mild side. I'll have to see

o heavy yielders. Plants were
been killer. 3 mothers had the
bove average, especially
aberry's buds are larger than the

airs are orange and few leaves that
sity is definitely above average.
ure, not that I'm complaining.
sibility. Lots of sticky fingers. The
of a good mother. As soon as
1 2'(runts) to 3'(fatties)." - kaka

ld say top after the 5th or 6th
de branches too, as they will
rs. If you train the plant right you
3 feet tall. My current grow I tried
ushy/big leaf I would try to grow no

n bb (sort of) flavor. very smelly
y other and clones easy. but very
bly tall...maybe 6-8'... but I
a prob. most excellent long and
em with all branches
of the bed... btw, I'm at 36
f Sept to mid-Oct, if I recall



a dominant expressed in two
ial glands are smaller but more
oma gene has been fixed quite
effect (on me at least) with typical
eaves will turn yellow - this
sual comparison to bb and nc5a
al branching. 5 seeds were
ore than 6 weeks veg for full
Lady J

Flowers look similar but plants
ut not bushy enough - eh, 1 is
anch of the latter to cop some
, as an F2 hybrid, has lots of

Colombian. The Colombian female
has dense buds and stickiness. It is a
well branched. The result is a well
branched and bud extensively and are
great for weaving its numerous
buds bulk at about week 6. 8-10 for
then train the plants and you

Thai Seeds

to stabilize its traits favoring indoor
particularly sweet Thai female from this
has quite a reputation among
its heritage, maturing early and
it is sickly sweet, but when crossed
with Grimm decided to cross a
female. A limited quantity of seeds is
available for indoor cultivation." - Bros. Grimm

very green colored that seem
is a little brown (dirty), a little
since, its appearance could be
compactness is certainly a result of
in both green and brown flavors.
have been overly dried in transit.
if it were nicer aesthetically it may

on Seeds

g and fluffy to start but
dense resin production, this plant has a
are light green at first, becoming almost
ne".

loor Oct 14

ed Bank

t BC Seed Co strain, NL x
immer day, dreamy. The big buds,
the pistils are often tinged red,
and larger than moderate potential
n't handle stress well, so an already
ou feel you have evolved to in grow
ould like to see White Widow
ences). Hawaiian indicas, in my

e Hawaiian outdoor available
on Program of the USDEA, Hawaiian
ys." -Marc Emery

soil with organic ferts mixed into the
oz. cups for approximately 4
e vegged for another 4 weeks,
most were transplanted into 5
sed through Ubino.
or this strain was a perfect 40/40.
ranching than the Californian.
ed for a SOG set up. Several of
12 inches for the smallest, 64
e as follows: min. 36g, max. 65g,
definite "lemon pledge" flavor to
other bud to get the effect that I
s among the female pistils, but

eaves, lots of resin on flowers
..5m Yield: medium plus Harvest
(# of weeks): 9-12 indoor /

riod): end Oct 12hr day exposure

n Seedbank

eaves as well as flowers, with a
rt rounded plants.

ion Seeds catalog

rmined

he NL#5xHawaiian would definitely
at are easily manipulated (not

ing in my sock drawer for about 2
d room to start them). Also
all new growth coming out of the
out killed it. My sister is flowering

ding female (mother) was topped
now. The secondary budding is
s has all grown back now.

re frosted with crystal (not as dense

nd pulled it at 5 weeks. I thought
outstanding female but left it. It

nothing else). It was some of the
/ and tropical. Even the leaves
lasted for about an hour (5 weeks
ct. I would highly recommend this
t them from Richies."- Scotty

layer of tannish resin crystals. It
istens like its Northern Lights
ery brown, like a Colombian.

ined

white crystals. The cannabis
nly but lightly covering the bud. It
taste much like incense--a quite
doesn't cloud your head, allowing

s

atics of Positronics fame. Current
eville at the Seed Bank, so I

almost lettuce green, three

e #19 lineage "lightly" crossed with
t: small leaves, up to five
g. Very sensitive plant to minor

an unusual smell... in between
vering a new audio CD and Welch's
urt-racing, but not overwhelming

es easily), buds very oily, not
nbling BCGA "supersoil" mix.

dling is known under, its "Haze
artijn) was super-strong but in order
day has 13% indica in it.

ise (looks indica), but on the other
le green, has no skunk odor at all
its feeding regimen (it immediately

rt in height and flowering time, and
breeding material, good structure

bank

ginally Haze is a pure Sativa
horter flowering period. Truly
rite strain from our collection. Very
Harvest time under natural light:
log

Really tasty strong plant, indoor, 8

skunk from Dutch Passion. What I
each different, from sativa type
Best plants were sativa type, small
the females that was impressive,
s plant wasn't too intense though. I

to about 2-3 feet. They would work.
could be problematic." -Chemo

sweet smoking (lots like Skunk1
10 seeds had 1 male, 4 hermies and
very rough on the lungs but I enjoy it
low yield. I wouldn't recommend it

some HazexSkunk from Dutch
4 real females, each different,
up, very potent. Best plants were
e. I had one of the females that
the high from this plant wasn't too
r." - Stix

likely have one from them called
bred from better breeders can
like bag seed at all, just do

harding smoke (that is, when you
report is supposed to be "up" but
others or us smokers. I've had
Haze x Haze. The Haze x Skunk on
very potent but not debilitating like
burns my lungs after smoking lots
at four hours, the Haze x Skunk
safety along with it for "daytime"
Stix.

about 1 m high, 1,25 in diameter and
compact and plentiful (every
it will taste like haze, there
regime. After 4 days of 12 hrs the

pot in the world. Very popular in
sier varieties. We managed to
: used them to produce some
iness. The fragrance is complex
nes. When used in a hybrid it add
ddition to the high. While not for
Seed Bank catalog, 1988

rators' Choice in California in the

s also. Haze takes a long time, in
Yow! In fact, Haze seeds are very
eds. The high is pulse racing, I
faze, because I have seen
and cannot be used casually,
makes a difficult cross because
it not its intense & dominating
my opinion Haze does not cross
er Silver Haze) or another. I pref
k (not a replica of any Dutch
he has crossed Haze with Black
maybe others I've forgot in order
esirable quickening of flowering

seeds from Positronics through
the 3, one turned to be a
m green medium wide leaves,
e, one very hermie which unloaded
showing weird misshapen male
ll as the underneath of the small,
one.

ze with some of my babes. Fro
pure. You don't know what yo

. Read another post that the h



d also that Positronics, Dutch
banks and they all had the
ices based on the awards won
A lot of their stuff is prone to
fits rather than breeding out
t, with no misrepresentation f

" - Uncle Ben Dejo

ad no potency what so ever. It
I have a bunch of seeds from
version of Haze." - RedDevil

of indica bred into it. I'm not s
les reasons. It grew well, clone
was not there at all Sativa/inc



ey introduced Haze X NL #5. Today
first in the "Name" as opposed to
nulation of this cross. I do know

reliable haze hybrid so far and is

searching for a superb Sativa/
iva qualities in the high. The Haz
s have been known to occur amo
s may include nausea, dizziness
or is considered normal"

introduced a Haze X NL #1 hybr
#5 X Haze. I do not know if the
st in the "Name" has any real
e 89 version were indeed



had from pot. The pistils must
them to come but I never regreted



available in Holland the last people
are selling a version of haze
ry up boys. Original haze takes at

Passion, Homegrown Fantaseeds
(, regardless of source), since all
s explain why all three seed

that kicks out bud with a distinct
es. This may be of interest to
€19 from TAC and had 80% of the
lanation for this but I talked to
riable. We are still getting 14 hours
e potency but you need to be fairly
being that it grows very tall and

strain. The resin it produces is
ants were harvested in about 55
w, I didn't locate a plant worthy of
with my new indica strains now. I've
led closed eye visuals while
ou can find a good yielder, it'd be
nale to try and make a worthy

males with this variety all but one
d they grew well. No males were

prise with yield and especially

eg and flowering. They had leaves
ch blades. The one loner plant
g most of the stem this one grew

m clones. They were all worthy
p from plants grown out in Jr. as of
cause of the uniformity. NL x Shiva

e plants that were killed off. Not a
a actually has production potential

uzz. It also finished in

able during veg but this plant
vn the stem while this one grew
h it since this plant has the best
stable right now even while still a
lead to head with the current

thing overpowering, but fairly

, not sativa intense but it has an
g ya know. You're not grinning
der plants in the stable Top 44
older.

wards a sativa side more than the
etter in the sun. I guess it's
ill works out to a good thing, very

ood but not great.

i the others was at least average.
and there is a possibility of all
ScrOG potential with this strain.
e. Also curious to see how the yield
department with age this will be
g off the belt for transfer." - flick

enbottom, Green House Seed Co.

ngth: The most potent variety of
too trippy - too profound.

riest will finish in 14 weeks
actical. Outdoors: should be
urprisingly good - the longer
tdoors. Not for the novice smoker

OW HPS on a 14 hour light/10 hour
at which time, they were put on
I forget) the damned old hps bulb
m outside during the afternoon,
armed up enough to leave outside
ure haze phenotype, and
ely long, slender leaves. One
fully pollinate the females for
ust now slowing down. I'm
n so soon as the tallest is only 2
ould stretch to about 5 ft. once
o indication of NL! Some of the
traits, and apparently, for hidden
ield is very poor at this point! The
it's hard to judge what the final
ot plant would have a fair yield.
ous yield, but indoors-no! It is
le of the best there is, than a lot

tom, Sensi Seed Bank

result: an extremely potent plant
head of its competitors. The high
vides for lush growth, heavy bud

- Sensi Seed Bank catalog

Will produce 4-6 ounces per plant.
weeks Yield: up to 100 grams" -

potato. Needs lots of lights.
crystals, put into the nation's water
probably not the best for a newbie,
- no shit, this happened to a friend
- be sure you've got plenty of
water, and you'll be better
I lots of fuel !! But be careful ... if
they before you know it. I would
be a little longer (70 days) but worth

experienced smokers do strange
of Sensi Seeds version of it and
are great." - Stix

10-12 weeks to finish and worth
yield too. Haze must be VERY
under 16 weeks more than
with 6" overnight! No lie. That Haze
that strain he was the only one with

that are growing like wildfire in my
- going to be worth the trouble they
on me. Has to be the Haze.
with NLxHaze from the bc seed co.
- when it became apparent that they
- then, I revegged all three and after
- the plants and their offspring have
- to find out if it was environmental or
- growing conditions could have
- prevented and a good laster. Taste
- is not stuff but I have had stronger in
- they may have gotten better results had
- been going to refine my growing
- method it yes but maybe not on limited
- resources!" - Turbo

what small as a result, but the bud
rain so into flowering they

waiting for the chance to grow out
- never had the pleasure of growin.

worth it, with tight, large, crystalline buds in any way. Its mostly sativa, LOOSE buds have been budding, and 90% of this order will be worth keeping, to so many people. Perhaps the 40 watts ft/sq. or else it was my gift to anyone again. I know time and The Seed Bank were much more vibrant vigor of the crosses from that

It breaks up very easily and emits a very strong smell, much denser than they seem. It only leaves you coughing. The taste is mild and relaxing, and even a

trays with much less light, about 400W. Most plants in strain outgrew table and were more potent with a high yield. It would have been a big plus and I bought every minute in both grows. I'm sure my samples weren't too potent at all, but well in the smoke and that's always

the product produced. Fat tight buds, gained height of around 5 and a high yield." - Mirage

are bought in Sensi for USD 150.- per plant. I let the plants grow upwards towards the ceiling. They were bending branches over, and were just about mature after

the best mother afterwards for regen.

So far I have had a really good experience. Although I bought a bud which flattens me. Sensi say to whom exactly? I'm a joint-a-day smoker. It's a really potent strain to have for

My experience tells me that I'm not sure about its potency. I use a small amount of one of these plants had this and mostly cured (about another 3

5

ates from Nepal and contains a
ne water. This excellent quality
ne world. 100% Sativa, a hard plant
sults for those who do not mind to
y Jamaica. Pure Sativa with light
ight / 8 weeks 12 hours of light
h long buds.

ation : Inside, outside and
- 1.75 m Yield : 400 - 500 gram

Tony at Sagarmatha. They are
e to the Kali but not quite the
lly kicks in. Some what
smokers only. It could really fr

steady smoking) is Haze. It's
IS CLOSE TO HAZE." -Mr Soul

ativas; Colombian, Mexican, T
from BC Seeds catalog). Mine
s are so limp that the large n
ativa strain. toke it easy on
er. did our haze have long skin
ek into flowering green tips gi
am outside into a longer light
of the bunch when mature."





roduce 5-10% special plants and be
n the others. The leaves are a tad
ker2

I got a handle on the general
aze reputation?" -Uncle Ben

no avail we were using cool white
100w per sq ft the selected ladies
are still growing at 18w and would
l in Holland can be the same
isses with short time indicas the
anoid, some people reported
ensive and difficult to grow but it
a memory. The shortest we got the
f = 9w at 12hrs." -Oldtimer1

q'.the clones were taken from
aste than the indoors had at 12
x. 2 oz/plant. Unfortunately, it
r more lumens." - toker2

nbian and Thai in varying
sent me. Some of the extreme
ened right after the induction of

uth Indian. It was created by "the

o tends to be quicker. Bio (in soil)
a hydro base. Of course there is
ain. Haze is one of our most
ns." - Homegrown Fantasy

18 weeks, Homegrown Fantasy
o 13 because that's not what
oss between original haze and
o grow original haze well indoors
." - Oldtimer1

eds

A classic Sativa high. Good results
standard for all Sativa's. Was one of
'97.

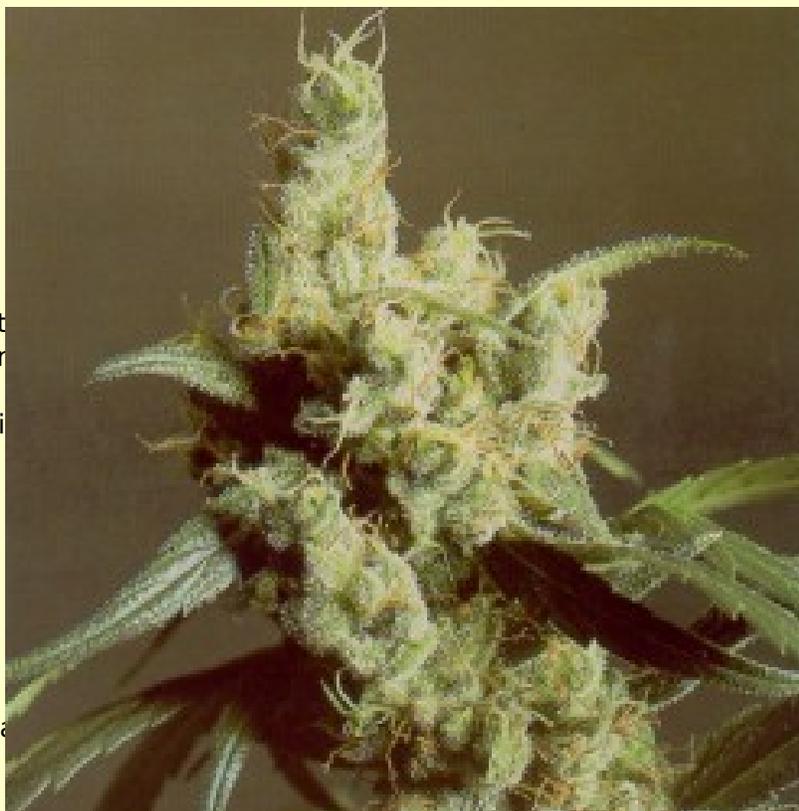
ers aren't too fond of this type:
i. We have spent years searching
haze, the most powerful Sativa in
ering time of the plant down to an
results: the Silver Haze, winner of
hat will excite the true connoisseur.

d Bank catalog

neath the crystal layering are
bud. These buds are fairly difficult
ngers. The stems taste like flower
e high hits you right away with a
vondering which way your hotel i

planted them around half may.
t 1 m high, 1,25 in diameter and
compact and plentiful (every
it will taste like haze, there
egime. After 4 days of 12 hrs the

arser leave. I topped it when it wa
t is also about 1 m in height and
s) but they are leafier and more



skunk x haze and much "hazier"
!")" -Smurf



bank

1992. Formerly this strain was
al Haze is a pure Sativa strain. It
owering period. Truly superior
from our collection. Very high yield

ber. They got through customs
d and unfortunately 5 turned out
/ broad, medium degree leaf
n veg under my 250w HPS with
ain took too long to finish. Took
e hairs take more time to turn than
much better in high light -
the 250 light and the floras I got
ld produce. I accidentally
t the fan...whoops...oh well, now I
ght to rename it Redwood bud.
: Grower

E/SKUNK cross which won the
ze that won the Cup is by
d many of his own, so he must be
arc Emery

er Haze is Skunk/Haze/NL. I was
eir seeds printed right on the seed



o.

world - Skunk, Northern Lights +
the High Times Hydro Cup '97, '98,
Indica + Sativa Highs. It leaves
s, heavy resin
of May/June in the southern
Is designed to astound both the
talog

breeding rooms (Cannabis
Jack Herer, but with one
d took the strain with him,

rain to the SuperSilverHaze which
much the same way Arjan screwed

everything available in Amsterdam
re because it was the nicest
opinion. But the Super Silver Haze
ed on.

but I bend then over almost in half
us size buds that are pointy on
you could call a spread-out cola.
created 4 main colas with only 4
t bent at all) and very compact
manage). For SOG, you would need
could get (4) four cola Super Silver
nicured bud.
omponent. It is supposed to be

h the best, but not the strongest,
. This is not MY very favorite.
ark and Mantanuska Tundra and
White Widow, the buds were fully
deep with cutting shears and get
Super Silver Haze, but probably
earch for the plant of my dreams.”

trait(s) you are trying to obtain

gland production. The only

a Super Skunk female, thus
because a little while back quite a
So the Greenhouse breeders
tendency. Plus, I'm sure they needed

male in the original cross of SSH,
Jack has a tendency to show a bit
an Indica growth pattern due to

SK#1 taste and stone, lots of resin

ed

ash alone. Smooth smoke and

atalog

CGA

I suppose that MCW is fairly mold
mold inside of the buds, but MCW
ave 2 mcw females, both are very
te. The mcw with more flavor
inated anything, I have had these

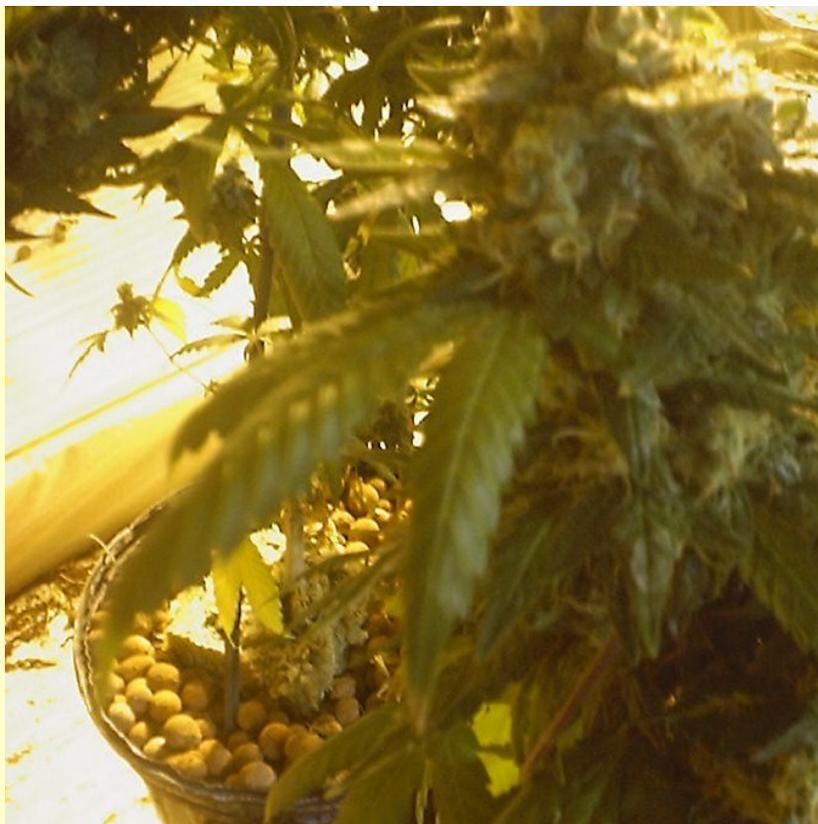


anther, even though the other mcw

avorite of this years crop and
ave Green

it a doubt, try to keep that strain
ergy rush that is truly incredible! If
that..."

dec. 15. all grew normally except
for the males. kept the tallest
an it has 100's of developing seed
th are pretty avg. to what was
. was harvest for the outdoor). #1
ery easy to clean too). Two main
ch early in growth. I expect an
n than most plants, very frosty with
and works well for the med. users
me too (failed back from 6



rms premium potting soil" cut by a
H conversion and 2 1000W
. Tried Mylar this year for the 1st
lar is a real pain to keep clean and

etermined

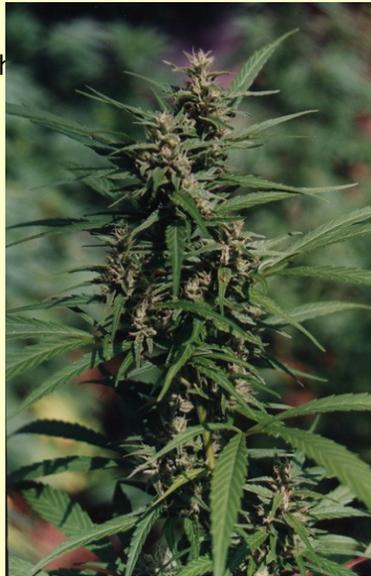
l2 - 15 years here. It is uniquely
is feature a dominant main cola

nk catalog

ola!
lected to produce a definitive 90
ial grade bud development. Yield:
outdoors, the strain can be started
can even be started as late as
harvest is 90 days. They can be
ning.

er: Dr. Greenthumb

ncy: 3* out of 5. Bouquet: Earth



catalog

er: Dr. Greenthumb

to leaf ratio, soaring high and

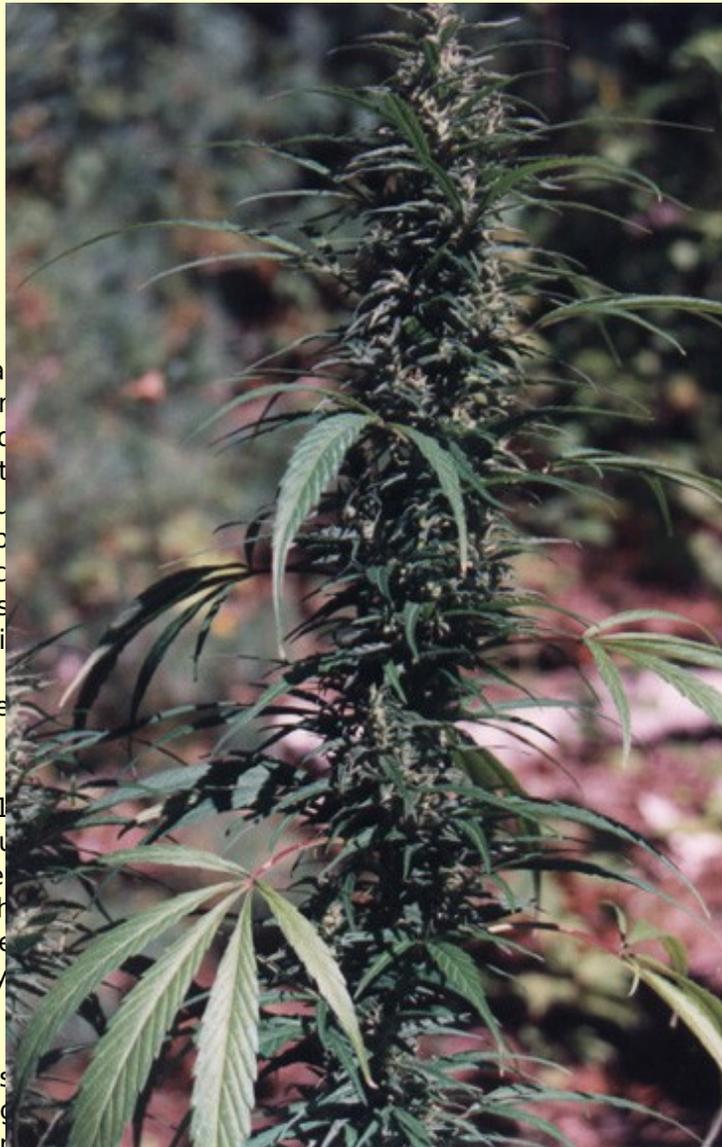
catalog

ds 18 sprouts. Out of the Nia
n from each and rooted later
ch types threatened to outgro
yield on both looks good, but
grams a square yard. The bu
I have not seen a less leafy p
about taste yet but the quick
rown before, what a head rus
ething. The Niagara x shiva i
otent than any of the strains
nb, but some may not like ge

numb. The plants look good I
sprouted. Plants have been u
ales and 4 males. One of the
on't pollinate the females. Th
never had this happen before
ess the photoperiod. Has any

HAIR. All normal color. :(Finis
ie pink hairs , I wonder did I g
der 24 hrs light. That I have never
lites, at least 8. Some of the
10 hours a day to finish them
mp!!!! Or maybe straight
Or maybe I was sent different
ought that the traits would not

t started off pretty fast; it was a
G method. However, it does flower
re flowers and it was pretty
ger and fill out some, which is
nto flowering. I use soil, and
ave my own soil mix that works
which is excellent. Make sure you



ge plant you may not wanted that
with clones instead of buds." -

e it was a really good-looking plant.

Shiva goes hermy. 6 other of same

Smells minty. Good crystal
grape smell in some mint in

rs of light within three weeks. Only
t of the 4 bad yielders 1 was fairly
e (at best) in potency. The taste
many of the popular Dutch strains
t is not for indoor growers. All in all
ever grown, this did not take the
at you're going to be growing. I
ok for someone who is just
!" - angelface

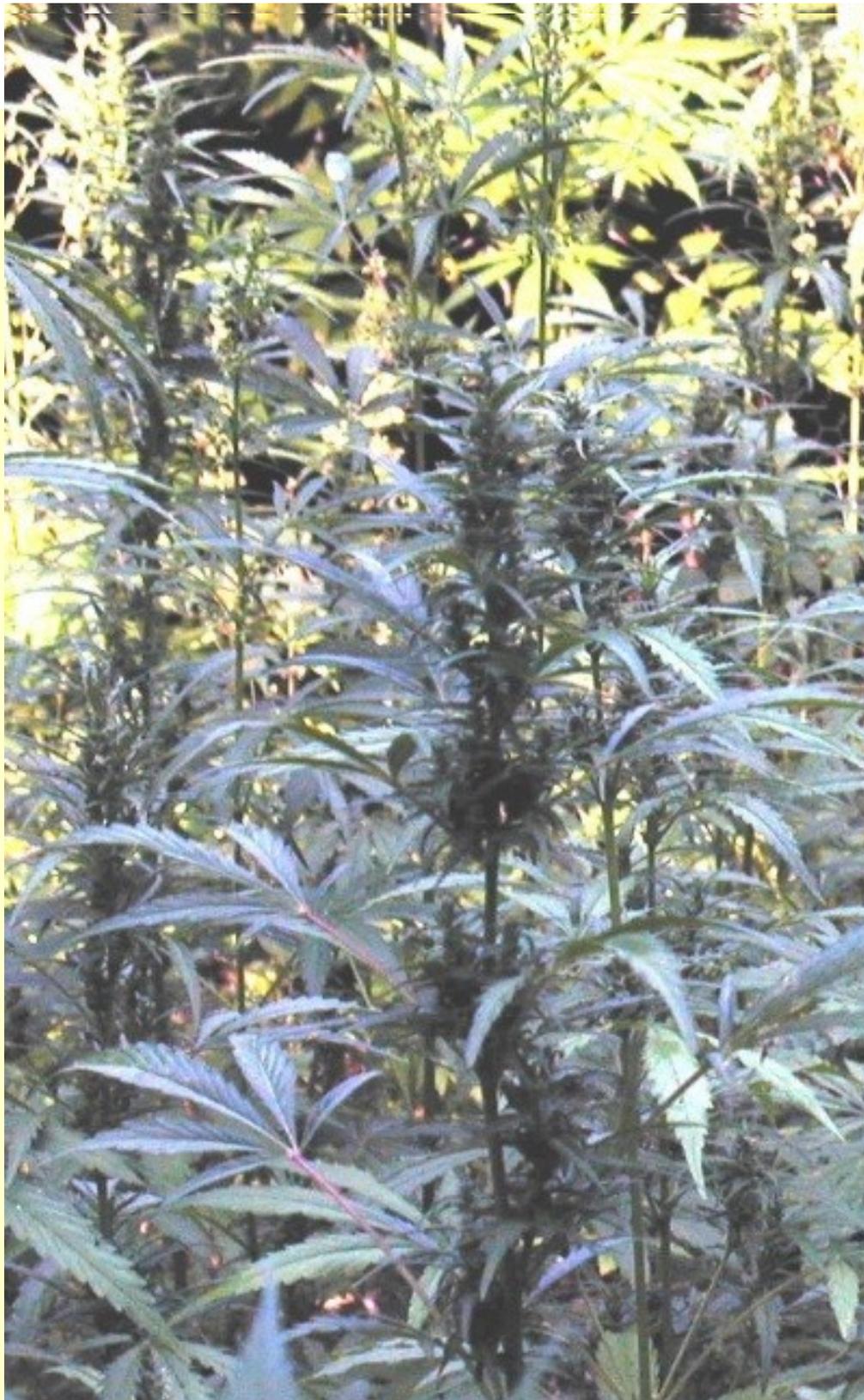
ower under 430W HPS. One female
shed males. Started flower at 14"
e fingered and HUGE. Topped once.
be great with 1 plant under 430W).
as advertised in type, production,
advertised." - Al Phadog

, and an early Afghanistan, both of
it finish in Canada, but he crossed
hybrid that flowered early like it's
67ed

three of the other four have
is the tallest of the bunch as well
ut very slow growing about 10"-12"
orous looks much like a

n under a Sunmaster 1k cool
worm castings. I had no problem
er filled out. The Niagara was a

o flowering the Niagara's had very
opped at 12 inches tall but the 5
growth that was a hassle to control.



ished due to space constraints." -

n and Oaxacan strains. There was
owering under 24/0 after 8 weeks

ght was odd but counted my lucky
g pretty crowded. Well at 8 weeks,
ra at Doc's site compared this plant
appy Camper

NiagaraVE growing indoors right
agara is an indoor/outdoor plant,
I will say that all plants are very
uite large internode spacing, and
ese plants will be enormous when

e female, one male. Both were late
y sparse spike of flowers, each
s about 1/3 the size of her sister,
as sparse spikes of flowers,

unt female this morning. I didn't
ntment to see how variable (with

ine that will grow outdoors in
cause I had planned to produce
s seeds stock is so variable, it
omething like a F1 of one type,
indica.

erate covering of trichomes on the
ne of the plants were stinky,
ative stage and first few weeks of

ick-dried pot--not as harsh as
(different days). Both gave
asn't the one-puff-and-I'm-flying

n day 63. Can't wait to cure and
rag about." - T. Aich See

way this is a stable strain. I have
teristic Kush look to the leaves. I
e with that Mexican/Colombian look
fat overlapping leaves. This is a

good, and they seem to be
nicely on the Kush-like plant, and

the faster they get there, the

much, I can simply choose the
Kush-like plant that is growing so

er, but the other 2 are very

18/6 straight to 12/12. They don't
les did this to me. One was way
f resin, good branching, clones
ough." - Red Devil

it's at it's 3rd clone generation.
the bud size, resin output and
8 weeks). I really like the Niagara
It hasn't got the immediate
e 1st smoke of the day. It's a

(47W/sf in a flood/drain table).
ough. Of the 4 females I had only
HC department." - RedDevil

from the Doc, but from Heaven's
two were female--one was robust
other was a runt, with very few
, few trichomes, and no gloss to
ts on my grow results), but the
ut I'd never waste space on
:he high--my current, ill state is
d my best female with the three
ore Niagara from seeds for more

ny of the short, bushy ones are

' strain--I bought three other
ture use; and 2) cross with each
y original plan of using Haze,
, I think this my be the most
ind of high. I have two clones of
1 week away from 12/12 (that way
e among the 4 is to cross these

t) and am 2.5 weeks from
) like this plant).... Niagara is good,
orny. Niagara is too subtle and

seedlings; both males and
is a worthless runt with very little
:le body) that was not especially
to their high (I'm not talking
producer--the buds are on the
as easily (I've only cloned after 4
art growing). It seems to be
ow, including the Niagara, but the

) with indica-dominated strains,
n produce more indoors. The only
m I don't want to tip off that I'm

st have been the soil because I
really found out what my problem
eir harvest time and I wanted to ask
strain.

th were done outdoors and have
er to leaf ratio is very high and
n they are still developing pistils as
arge and thick colas. If you look
mber color of the resin inside the
er colored resin than darker amber
ys ago. The temperature is very
t 7:30.

uzz...we sampled a bud last night
its that survived MY environment
t it is worth every penny." - Eric

amber; and right up to and
and trichomes, and density in the

given time; then allowing the
o further develop and pile on the

age...it's a waste of time in my
humb

er: Dr. Greenthumb

large yield. Recommended for
Sweet

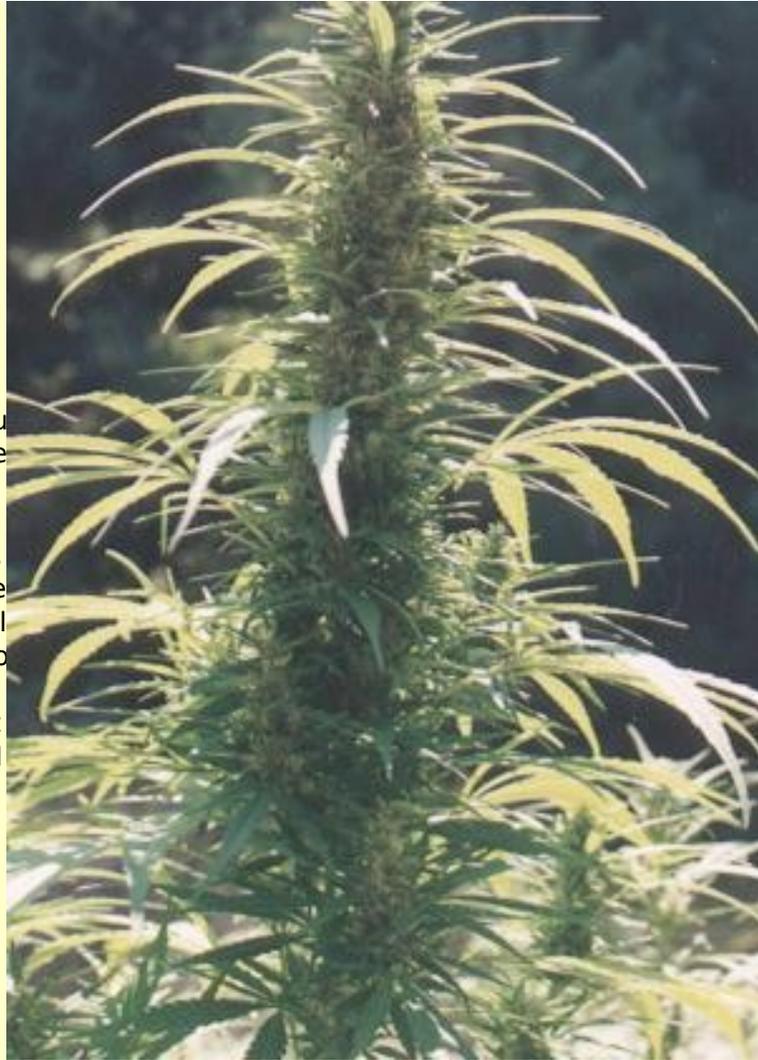


nk catalog

ed to believe. I have grown ou
e read that other people have
- Indica Queen

when they were 3 weeks old.
nuts ready to bust, I caught e
cting them to show sex for at l
tomatically at sixty days." -Ro

was a little (recessive) amount
nddoors in a small area, but if l



r: Dr. Greenthumb

y potent. Large yield. Potency: 3



catalog



Club (SSSC)

Individuals were selected to breed
in seed catalog

ainers, organic super soil. Seven
flowering within 50 days. The
ended up with, but they really
best ones and they produced slightly
me really nice colas. One ended
smaller flowers around the base of
in scent that I've heard some of
were the ones that tended to smell
Aurora B, from 8 plants. A happy
forehead right after lighting up, and
or so, my ass had grown roots to
Disney channel. heh heh. I'm no big
the AB an 8 out of 10. It's a more

It's a severe stone, makes me eat

Club (SSSC)

absolutely the most powerful strain
ged on strains and still am looking
s variety is the most potent, just
r."-Clone

..#5, but SSSC weren't allowed to say
I Bank, they call it "ShivaSkunk".

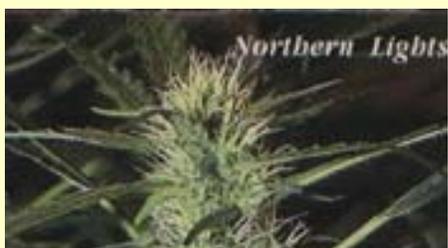
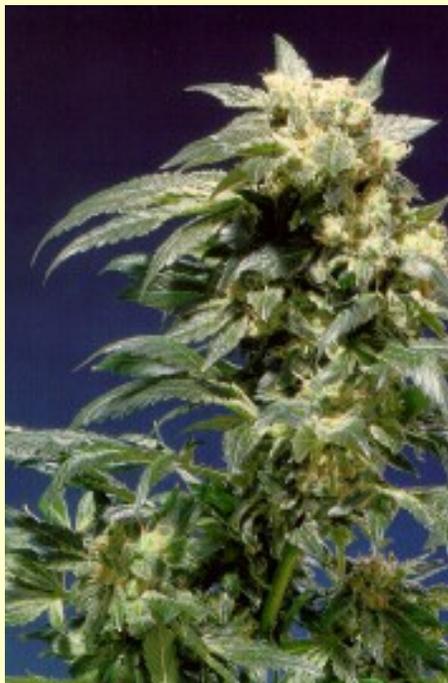
ed

'90. Much used for cross breeding
rd of N.L. Sweet taste and very

thern Lights® has dominated the
producing one of the most powerful
ed for indoor growing: compact,
ive plant for the indoor grower.

s variety has been around for
e yield is above average though
ising any method including SOG,

others and it was put out of its



e close to identical in appearance.
it didn't take after the NL x Shiva

The buzz was acceptable but it
it worth keeping for a harvest from
: was given one more chance even
grown from clone it showed male
l.
arly and freaked, doubtful but



dbank

e "State of the Art" indoor plant. A

h Passion seedbank catalog

ni origins.

3) from the original Seed Bank.
sounds a lot like the forerunner of

sion Seedbank

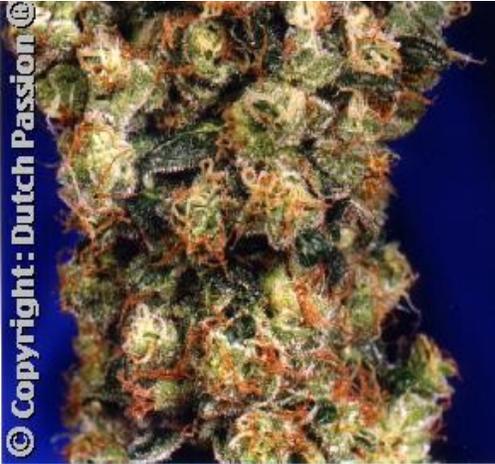
i. A very strong plant, almost spide

atalog



inbred and developed into a stable

strains have little or no taste or
and taste. The buzz was it.
think you can go wrong with a strain



0 years of select inbreeding. Bred
fer short bushy plants. The buds

at outdoors, flowers quickly and has
ee" bud, the plant looks like one..

h is Pure NL) it has almost no smell
e end of the flowering cycle, it
i weeks--bam! I have found this
flowering. NL is a great indoor

VERY distinctive aroma and taste,
ooong. Plus its one of the best
/ fast (8 weeks), wont grow much
m. which I consider nice. Only
ency to catch bud rot, and the colas
re down to max. 50% rh. you
and I heard that too much
d show up some indica aspects
hit and had a very dull buzz." -

h good results..." - pot newz

as engineered a superior version of
a short plant with a voracious
yields can be expected. Fantastic for
for a heavy, lethargic stone.

5 days. Height: 0.5 -
catalog

#1 flowered for 52 days, 2 and 3, 56
looks white in the bag slow clean
bag product. Info I've gotten says

and Durban.... I've grown it too
for sure and lasts a solid 2 hours
doesn't contain its hashy smell...I saw
DJ and he is a REAL hardcore....
has been in 18 years...this is some good

we heard great reports about this

traits and the yield is pretty good. My
is very fluffy, and very visible
after harvest the smell is so strong that
the thing is that if you are using CO2
systems with my nutrient mixture and
light. One of buddy's growing the

: on, and has a stronger taste than

own continuously for years. It is
v and finishes fast despite the fact

Seed Bank

skunky hash flavoured Indica. A
rancher specimens tend to be the

greenhouse: mid-October. Yield i

soil with organic ferts mixed into
oz. cups for approximately 4
e vegged for another 4 weeks,
most were transplanted into 5
sed through Ubino.
problematic. Some didn't
roke the surface of the soil, but
up with 16 seedlings, 13 "norma
y 13, 7 turned out to be female.
ned heights were between 42 and
nin. 44g, max. 83g, average 56.7g.



: being a bit fruity. The others had
but very nice. There were
row was kept a bit dry, so if any of
tolerate the low seedling to seed

Seedbank

g the leaves. 50% Sativa, 50%
, fairly clear high. Yields are

atalog

ed by Cultivators' Choice in

ame as a cut from a friend; the
real deal Cali O-- smells sooo
ure. But the high is just excellent.
oke too much. While its not the
quality of stone." - ~shabang~

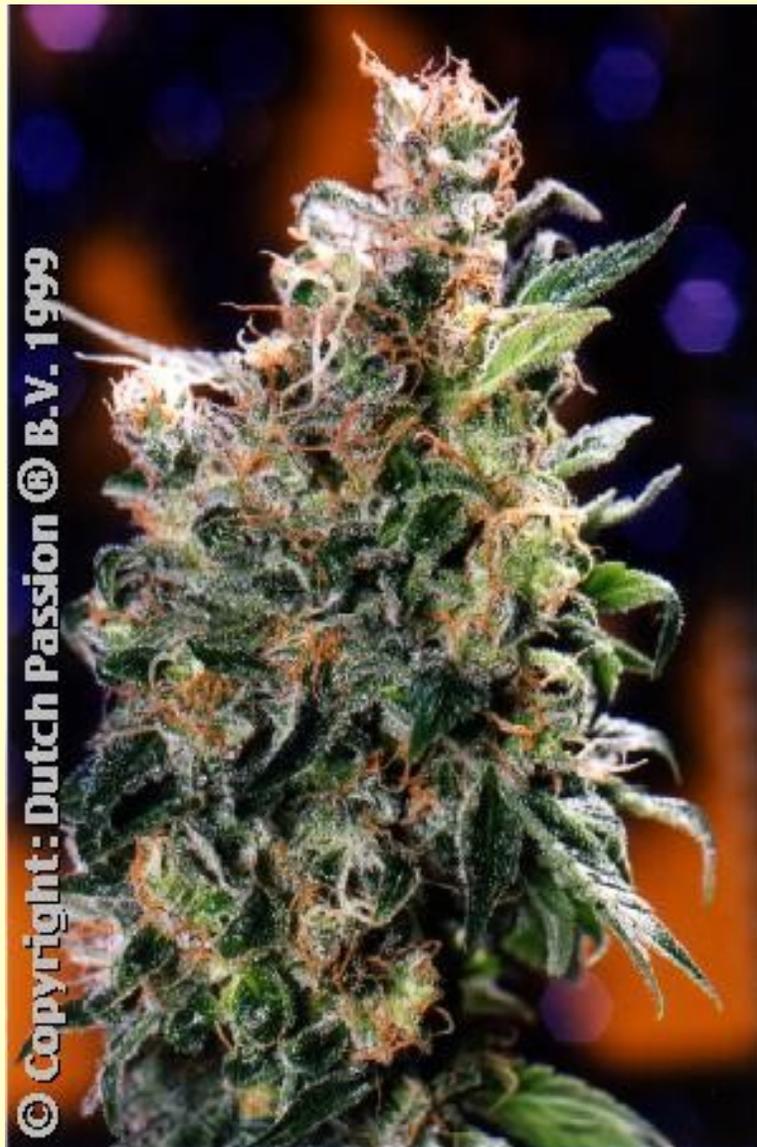
; like a fresh cut orange, tastes
nia over 15 years ago...." -

nd. The yield is pretty good when
a little thicker but not as sweet.
d eh?

i. There were 4 main colas on that
you saw so it's easier to trim.

ured so many others have that
of the best hybrid highs around.

es I found myself standing up to
sework you can get done when
nothing less than complete orange
e I'd been peeling oranges instead



ound is sticky too.
ut tests have shown it is *not* a
ie parents were stable is anyone's
ler the C/O to be
potency is good.
: twice about the strength until you
with this cutting going around

je-- looks good, smells good, gets

ake her stand out among the
ie smoke qualities-- the complex
The quality of the high is just
ig.

AB is more likely to impress the
look like the better weed. But the
ow on a deserted island, I would



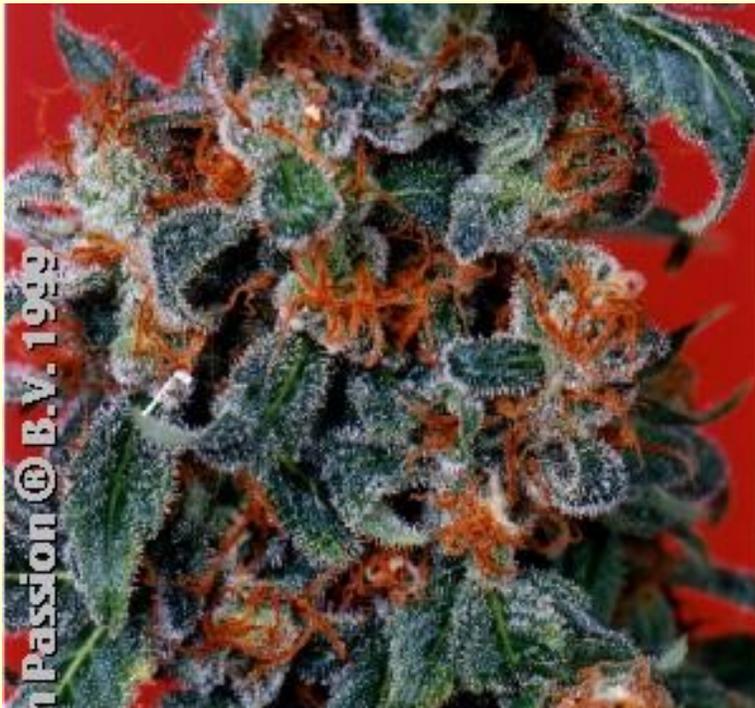
Passion Seedbank

ery appreciated variety.

right orange hairs. There are also
pered by the more green smell
fingers a little tacky. The
aste has been eliminated with

st harvest, soil/chemical, it had a
aste is there, but the is a citrus
y skunk #1. I prefer skunk #1 to it,

er culture with GH nutes, in a
he Orange Bud is from Positronics



icle. The taste is more citrusy than
t as an NL."

A and it is consistently one of my
stils, very dense "nugglet" buds,
cy taste. IMHO, orange bud is one
o Tse Tung

y tasty. Sunsets are great on
on the yields but still acceptable. Of
was still around. enjoy the

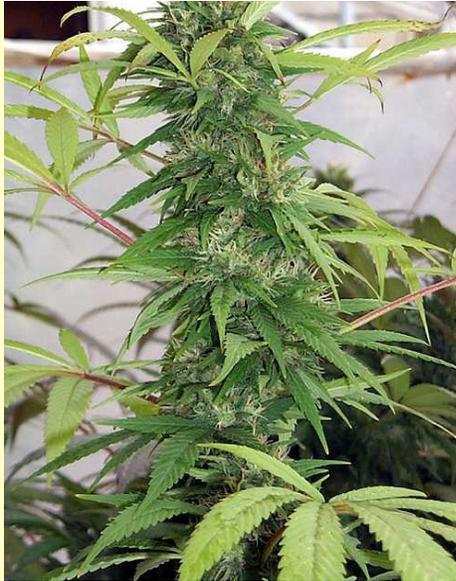
at by keep my MH 400W about 2
s, the stretching will be reduced.
om nutrient. It is also one of mine

oice

ined



opped out of it just before flowering.
bistils are so fat they're like
s of flowers and a longer flowering
atter if given another 2 weeks or
e nugs while shortening the
ver it was that I smoked in A'dam
one the same, but last batch had
n all, Cindy is better, but this is a



ined

tely best stuff I've ever had. One
ne next generation should be
ross the pond. Also way too pricey
t COVERED in crystals. The harvest
ody. Lots of capillate-stalked
is to any other as it's my first
don't have the crystal
re. I'm hoping to reveg & clone.
they're for personal consumption
Is about "real" American genetics.
inement of strains from Holland

ers Grimm

s or less. Our big-yielding,
ic, thought-provoking high was
ne variation among individuals. The
sinous bud sites - perfect for
os. Grimm catalog

ivaSkunk from Sensi and Princess'
ld mean that your plants are
you're having such excellent

but still a JH F2 from the same set
opular name) X Genius." -Webfish

ank

mmercial skunk grower. As with
ice is detected in its high. Super

Seeds catalog

Indetermined

by Breeder Steve of Spice of Life
Sensi's Big Skunk#1, then stabilized.
as a stretchy plant (that's the Big
the editor of Cannabis Culture, chose
months ago, with the Hawaiian Sativa
NL/ISS is more trippy, but no

high yielding and a lovely stone, its

potential in that cross) would be 85%
Sativa are substantial, though it

met Ed Rosenthal in Zurich at the vast
ly, and I have samples of over 20
their work and their strains would
not Skunk, and their Golden

one strain by Joker (Snow Spice for
from the Sensi Cannabis Castle,
to find the quality NL/Haze outside

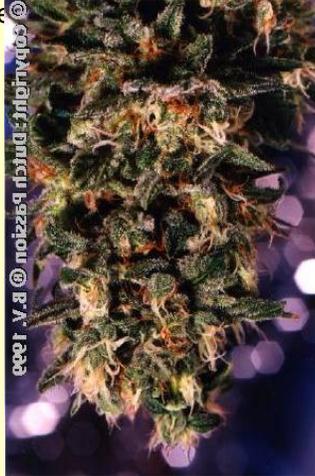
ive

cer. Decent bud, above average



eedbank

ercial, very heavy bloom, bumps
lections but it is one of our



on Seedbank

very special taste and high. Grows

ds

to super skunk. The buds are
by a bountiful harvest, fragrant
of the garden quickly. Fantastic

ots show. Flowering
ried)" - Sagarmatha seedbank

leaf ratio with large, full buds. Its

d (of course we know that's not buds are mildly scented with fresh when smoked, the Sensi Skunk live in the lungs. This is a good od of 10-15 minutes. **3/4" -

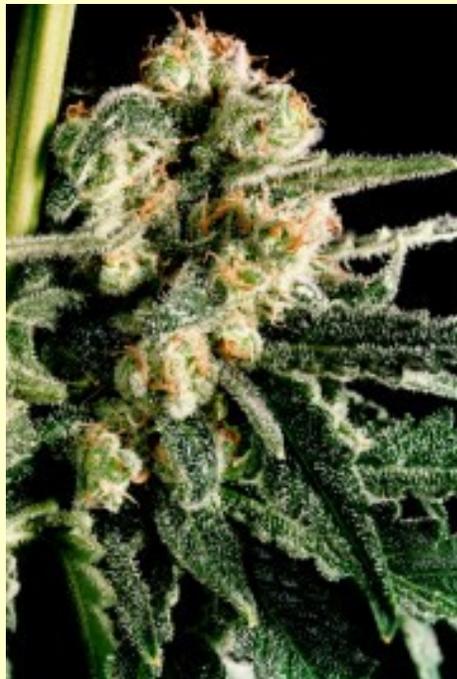
e 8th node, dark leaves, deeply

stink* up a large house.

yield. Pollinated by a male haze

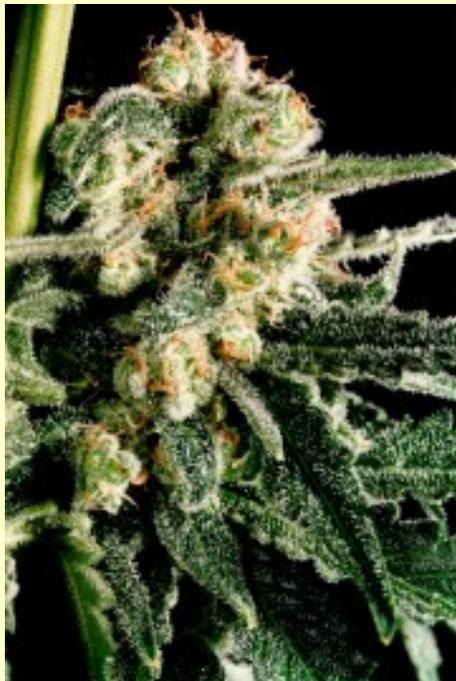
blas. Good resin production. om a J is plenty in that the high y stone, trippy. Not an unnerving

wer parts started showing just



ng hydro your stink factor will oil for 2 years). I also found these g 12/12 when doing Sensi Skunk : above to be the remedy. Also, crossed to an Afghani, the mothers I ep this variety forever. It is entered uld have won years ago. I believe ms so well: it is free of the genetic

ety. Excellent hybrid vigour and
reenhouse. Taste and high are
yield. High calyx-to-leaf ratio, you
n absolute must for beginners or



e never offered NL#5 as a pure
s word for it. (Due to previous work
having a much more powerful
all having an underlying buzz or
perhaps this is why it is such an
ood as 10 years ago. I don't
an original Basic 5, this would be a
r

es, sweet, fragrant smoke. Great
:sin production. I grew this strain
ow, cloning is a breeze. Only
er and the yields did go down
or so, it could very well be what

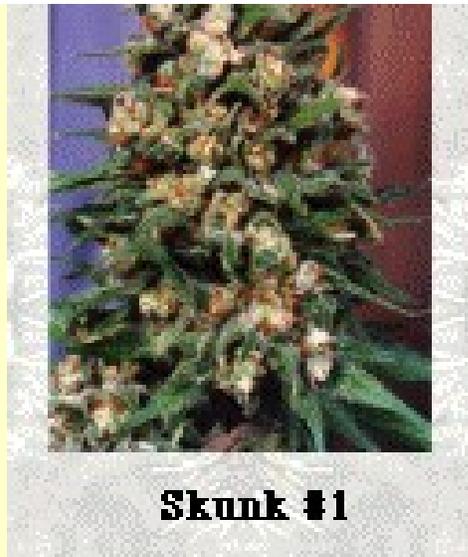
e of Silver Pearl. This variety is
in the next several hours." - Hyde

#1 (75% Sativa, 25% Indica) was
% Colombian Gold. Inbred since
arying in color from light green to
g "up" high. Excellent variety for
to manicure. This variety serves as



Passion seedbank catalog

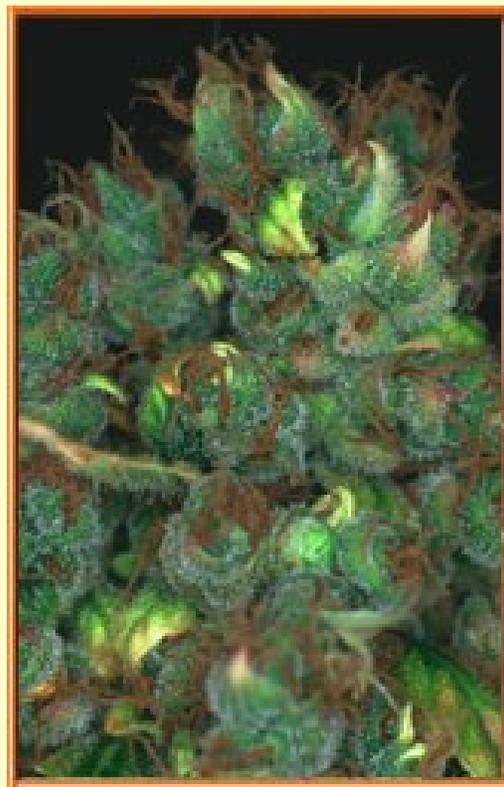
harvest festivals. One of the most
om an Afghani, a Colombian and a
s. The breeding plants were
ected the plants with the highest
ography. The Skunk#1 has a high
tips often lime green, mature
om 400-1000 grams, with an
corded. Indoors-experienced
re meter. (11 sq. ft.)" - SSSC



Cultivators' Choice in California in

#1 arose from an Afghani X a
less than 5% deviation. Now 11
an

abis Afghani inbred-line polyhybrid
as developed by Cultivator's Choice
to produce excellent sensimilla
dleaf variety of medium height
quare foot of Original Skunk #1
owers. The flowers have a strong
powerful and highly stimulating.
completely.
cted from 50 different cannabis
ualities in a broad range of crosses.
cted for its crossability and true
two previously selected individual
; been selected for its naturally high
most any other potent variety will



ecline in preference for Skunk
ame upon the scene in 1980,
recreational cannabis cultivation.
deration), originally a hybrid by
nsi Seed issue 1990), is a sweet
nk best. 60 days flowering.
nicky and difficult to get satisfying

me, reporter Larry Lamott was
) at 27 days into flowering.
distinct has given way to other
etics and indica dominance in the
o often crossed these days.
he Spice of Life Sweet Skunk, as is

really a good quality crop outdoors
eks from the equinox to finish.
f good bud per plant. Indoors it
weeks to finish on 12 hrs. Its
berly gives all the modern var.'s a

not smell skunky at all).
wn except some at the very tips.

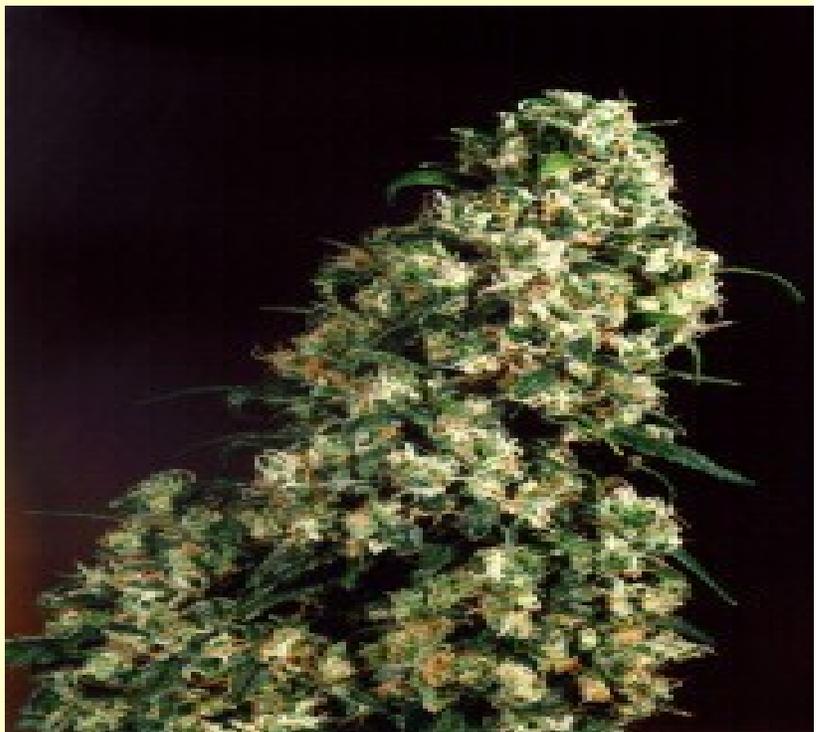
in public. Wonderful aroma
er." - Splif Lipsit

ll feeling of potency, its not nearly
oke. Anywhere in the U.S. this
hit extra special. This is definitely
d quality no matter what reliable

've used tons of light perfect
nky, great weed but just isn't that

ood pot" but I think it is pretty
' not disgusting or anything, it's
be offended but I don't like the

late 80's--don't even remember
yield. It is very forgiving and
ts are similar in size, with little
tiful short, bushy plants indoors
to finish than some other



Club (SSSC)

winner in its first year! The Basic 5 is
ome years and which has
wing. The female Basic 5, which
to be the seed mother for this
s, covered plentifully with resin. So,
assures excellent results for both
100 grams (more than 4 lbs.!) per
(up to 1/3) by flowering cuttings
alog

se, at that time, Northern Lights

the past couple of years. Taking
ugh my memories of M39 are of a

a dozen M39 seeds stashed in a
ds. She showed them to me and
rew them in a pan of bacon frying

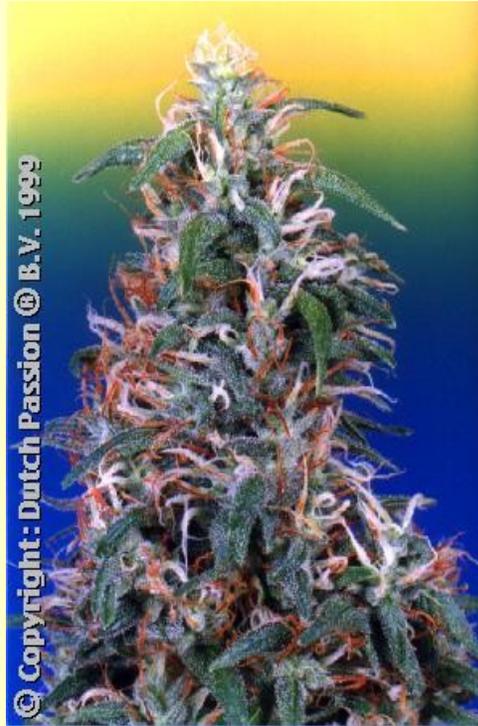
what Basic 5 was...though now I
E if it's NL#5, but I had that

y mature outdoor plants, because
d with an early Indica, to let it
the F2 generation. It has come
nder natural light: end of

bank

lection of these seeds. Selection
orthern climates (see
n THC levels are high. Sensitive to

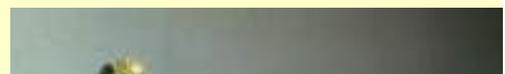
ssion seedbank



bank

: growers favourite. Will even tastes

to their Afghani ancestors. Brush



unk aroma. Despite the smell a
e winners of the 1990 High Times



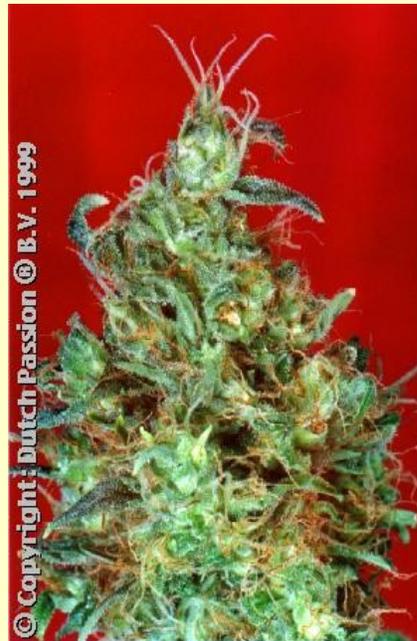
ca)"

ice the price was like 60 guilders or
hough not the densest. Good
both sides... it will put you to

eedbank

s not possible to grow fully mature
lights and greenhouse. Skunk was
stronger for outdoor conditions.

n seedbank catalog



edbank

has been grown outdoors in
h. Easy to grow, grows with long
tion.

n catalog

AMSTEL GOLD seeds. Now those
too confusing to explain name

er did mention Bubblegum. Good

ors) ~ Plant: Jun.
Seeds catalog

etermined

n of Afghanistan and the Indo
ics were developed outdoors.
stems over 120 days. Actually my
to evidence in his trial. The strain

green. In larger quantities is has a
an pack it in your pocket in ounce
a bag on them. Good strong
ht warning. This will be resolved in
nerations behind. To the
relationship of male to female for
t. It's not too likely with only
l smoke grower this is great
professional grower it means
dless to say the worst sign you
y stress situations, like dry-out,
reak out. In good conditions there
s not been as long as would be

: Super Sativa Seed Club (SSSC)

Club, listed as M27 in their
d: "M27 A U.S. hybrid top strain.
r was of an inbred Acapulco Gold
African). A great hybrid. One of our
: an enormous amount of
r Sativa Seed Club catalog

Seedbank

a very nice short bush that yields
don't like the munchies, also helps
it one night (save for early
ta20

ned

seeds at the Hempworks. I was told
to told that the Big Sur Holy Weed
- Damion

s to cull. - Wild Rose Seeds

days of flowering immediately after

Type high/strength: medium
Sept 12hr day exposure harvest
rly." - Positronics seedbank

r as I know any seeds are hybrid
fortunately, not good enough to
." -Lady J

veloped by the Canadian
only in cuttings or crosses su



of orange Pekoe Tea with
s between 2 extremely successful
en grown out for 7 years and is an

oor yielder, with excellent
h." - Spice of Life catalog

ed

arly girl.

Very potent, medium yield, with a
stem. An ideal choice for your

Thica: 10% / 90% - Appearance:
ch cold at harvest - Smell/taste:
cal - Height: 2m - Yield: med plus
day exposure harvest (# of
cs seedbank catalog

tivators' Choice in California in the

ornia. The plants are compact and
ield, with a hashy taste and aroma.
ly Girl is an outstanding choice for

nches with plenty of buds. yield
d at about 1 month of curing and
ue to accidental pollination.

ne late '80s. It was pretty average
else. I got some California Orange
hey might have improved it in

4 something degrees north, and
e was a lot of variation between
'-been there

. popular outdoor variety." - Sensi

arly Girl and Polly, an early

ome previous posts that I've
; early girl crossed in, very

stems right through flowering, which
stems are thin, green, sweet and sharp
very long high. Unless you grow very
tall having great trouble with my EP
in a 1.75 gallon container,
in (this is on 24/0). Root mass is

of three or four major fukups by
on June-1, they suffered a couple
on 12/12, which I wouldn't do now,
infused bunch of semi-flowering
eaten to one foot tall bare stems
damage stopped. One plant
opened then- which you should
show some bastard rabbits ate the
. I created a 'goblet' effect outwards
eaten back to about 18" in early
there was no single week that they
were in perpetual cloud/100%
ly small patches)- which I was

er to take than most, but the huge
they just hang around and don't
weeks to take- during this time, the
sn't do well indoors- mine seemed
then suddenly decided to revert, I

and south American Sativa in its
stems are long and thin. I noticed two
fields; 2 were much shorter
as well, more susceptible to mold,
of pink-grapefruit.
are common, but its well worth it. It
in the size of the plant, not the
output. I'm hoping for 3 or 4 ounces

grew some in and out. indoors in
doors its close to 1 lb. at 6 ft. finish
of sativa/indica. it has longer
stems like an indica. the high is kind
cuz

to the description in the Sensi
variety in height, but for the most
stems. Has thin sativa type leaves
grows very well outside and is the best
mother I picked finishes in less
many side branches. I have White

looking the former) but the yield of
at a backup of this strain if I knew
it looks fantastic after all this
train for quick, crystallly dense
orne

Skunk #1 outdoors. Sweet smell,

abis in Amsterdam), sold a strain

ms per plant

ern Lights #2. The catalog says:
ernment research program in
roven to be one of the best

er. The last pure G-13 seeds were
be nice, but I don't have one, but
or the last 10 years, the sativa
: current Sensi offering.
great reviews. The interest in
of G-13 with a claimed THC level
nd it will be hard to knock off, so
ome others strains that exist only
ers?"-Marc Emery

indica with a very strong stem and
ns to lack "personality" but is an

unky skunky badboy local bud.
ature of G-13, it leafs look at lot

ure G13 or its hybrids. That by far
s with a different type and if WW is
G13xNL; it grows medium nodes
n lime green hues so its when near
nixed citrus like smell. I've been
avor. It produces small to medium
high is very UNIQUE; it will take
LONG: its the best cause it been
lash, and none can even compare

variety of the "pure" G13 I believe
5 fingers, but I've seen six and
east our tax money is going for

d the weed and it was done. I
large a cola as an AK, but the
d is better and juicier in hydro
e is about 10 days to two weeks."

ho actually 'liberated' the clone. G
t = M = Marijuana. G-13 =

sold in the 80's and it is also 2/3
ne seeds directly from Alan
ka and he said that nobody has
eans (Mantanuska x
ony's best buddy and provider of
eat dense yields but not a 9 or 10
ow" and that the "peak19 was a

smoking experience not soon
ning tops that produce full, fluffy
that carry an extremely spicy scent.
tion, and is the personal stash for

ms/m2, Height:

p) in the judges' opinion. It had a
previous smoke. I smoked one
at 4.00 a.m. A few tokes of Kali
t sleep. With my eyes closed, I
ana in the last decade. Judging
acter. The buds are nowhere as
rs, maturation would not be

matured in late November, and
ent a problem for indoor growers
: was my favorite high- and if I
Magazine, May 1997

aste is every thing they say
the land of Aloha. BUT I would

an relate my experiences to those
ch is the bank reputed to sell the
High Time's Cannabis Cup a
ire) of a VERY Sativa-dominant
s out, I got a hybrid which looked
wide and the colas long and
oked "kind of" Sativa-influenced.
not outrageous. The yield is
1/2 weeks!" - MrSoul

the best example is Kali Mist, only something similar happened to

shed and made commercially, it MUST be advertised as such or Kali Mist seeds they're selling Kali Mist is 50% Afghani." - MrSoul

ed Co.

. lbs per 1000 watts! This is not a en anything like this in the world of re judged. The mother plant was ents, is finally available. We have n x Bubble Gum male. Since both d hybrid vigor. Flowering is 63 blow away the best Big Bud yield. really packs on the weight in the

nishing outdoors now. I've been ey. Kong shows 2 different tall (9') leans towards it's White are incomparable. It's the best d, excellent. It rates right in there t my estimation. The bush (10') , r yielder. I'd say 2 LBS plus. It's They both are heavy with crystal S~. Remember I didn't get or start highest recommendation. Good

H nutes with Pureblend growth es. About 6 hermaphrodites and may explain the herms. The 10 final results are: 10 KONG Females rying and 3 weeks of curing was ng pot pretty steady for a few

SLIGHTLY more than an ounce per
R the 4lbs/lamp that's being

need to grow, Holyweed is my first
plant." - Danbo

They did stop their sleeping time
8 hrs a day and they grow like mad
my life. The branch system is
like they can support half a pound
each. Start flowering next week keep

than the other does. For the price, I
got 10 strains. Had 7 female out of 10
clones, to get your mother. They all look
like / Afghani, did not look like the
mother. : dividing into two main stems, one
mother and one clone. I'm having a lot's of fun with it too.

clone of an NL5 or Skunk1. It's not up to
me and abnormally branchy, they'll
only grew one clone, never a
tall one that is really smelly. The
clone. ~shabang~

structure and smell
there are a lot of genetic goings-on
(anna?) Bubblegum and White
clone is a laboratory-manipulated

even if it is nice, but me I say bullshit.
They're as big and smell better. THIS
SO, I would of been better off with
I would say that there is most of the time
unstable that you end up with 3
clones that are unusable, (genetic defect or
contaminated with the fungus but the Kong is very
good. : were it rain all the time. I would
say the seed did produce a really good
clone. it was separated in two main
stems. to summarize, I look like a stupid
clone about the space and time and
I'm not very happy....

clone resin and look more promising,

nd. So I feel that I was taken for a
time to breed as it should be, now
be a mess again or what, I won't
T VOILA FOR THE KONG>>>>>
I but who knows..." - reposter

ie and money on it, it is way too
I have to be very lucky to find the
went faster and give very near the
ad to have wasted my time and
salt fert, 1 plant = 380 gr. It was
ave the same yield with my old

really good harvest finally; I was
I have ever had. If we don't take
for many strains. Due to the lack
a clear metal halide for the last
S did finish faster but with a lesser
nt ones were under this super cool
you live in a place on heart where
:. If we think about the Time factor:
I could of get the same yield with
in (with clones) during the time
e Kong is not really for you. For a
yers will search for the resin gland
ie Kong to the numerous Big Bud
it is just a very good yielder but
the final thoughts are: No, I would
ste) and No neither I won't use
Time/yield factor. But yes, a
his friends that he have had a hell
at 4 clones = 1 pound. (Almost
though)." - Orchid Man

they end up being 4 feet high. @
drink more than other strain: the
branching and root system. They

smoke. More resin glands under

of the best, which is deceiving if
rlier seeds so; things might have

and potent. You might have
} males. Use the strain that look
give the best yield. The best MOM
branching system. Use large

Sagarmatha Seeds

Alaskan Northland. Highly
. The buds are huge and solid as
acks more power than an icepack

, Flowering time: 45-50 days,
Sagarmatha Seeds catalog

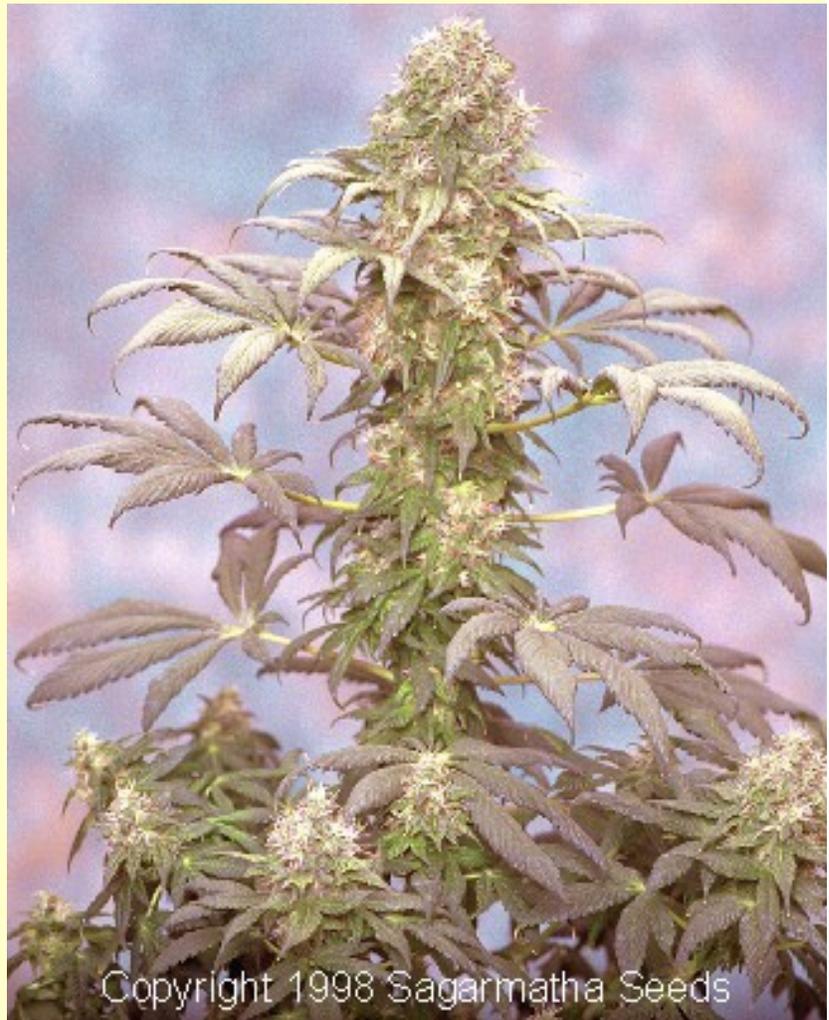
erage when I think back. The only
to Alaska I had the real deal
Thunderf*ck has an insane
indica dominant "sit down and
a laden." -Geronimo

for Matanuska to be a pure strain.
ules out the chance of it being a
uskas/Susitna Valley, just outside
Alaska.

he name " Matanuska Tundra "
, Rob from Sagarmatha actually
ck to 'Dam and crossed them with
Thunderf*ck didn't originate in

s of Matanuska have become
o from Sagarmatha got lucky and
to Holland. Doubtful, while there I
the most sought after weed in
ble clone would take an act of
, especially seeing as how he is
him coming or going through

d to the coffeeshops in bulk. So
om Sagarmatha." - Geronimo



lub (SSSC)

ese seeds from a colleague top
s of 1 lbs. The potency is super. In
two weeks more to mature. The
log 1987-88

e

an a simple Kush/Afghani. Much
as something unique. The
hat keeps popping up when
a little while back and discussed
t don't quote me on it, I wasn't

till about 18 months ago,
wed about 18 months ago at HBC
with. Boy did I create a
I would be happy to work
ago, Vancouver breeders did not

omulan was the same bud. About
nan mine but had lost some of its
brids. Emery's employees told me
and that was their Romulan base.
y otherwise.

nulan is a very stable plant that
know that he used pure Romulan
er decides to publish a photo of a
Times are small for Romulan
gger buds with less light intensity.

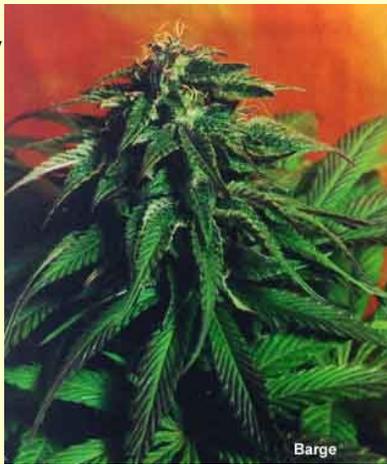
ite widow produces some killer
ulan or Romulan/white widow, it
ill be Heaven's Stairway who will be

omulan is because of it's stable
own at HempBC only confirmed it."

ve

sted oats. Tight little strawberry
ems are the blondes. Wicked

en: Tight" - Spice of Life Seeds



ve

r. These seeds are from the first
reen bud with royal purple accents.
most sickly sweet.

Oct. Yield: Above Average-Good

eks to flower but the yield has
my climate controller. This wint



outcome. Over a gram a watt is
/ burn turned into butter with the

m, ebb&flow

st soon, very large colas, most
ice quality nuggs, nice sweet sm
it all, very state of the art indoor
hich is on the way. CO2 will be
just to keep the temp in check,



Sweettooth' over Shishke after
ams a sq./ft). Sweettooth makes
reat. The Shishke is a heavy
perfect temperature conditions.
arities in the veg growth of the two
ke more stress (it gets hot where I
erm, clones from the same mom
d the high is strong & up. The
y". Both plants have fairly "up"
Shiva

it. It's rattled me pretty hard
e to it very quick (smoking fat
wave~, hard to describe, it puts a
ne upon trichome, dense nuggs
to a party and not put the hurt' on

n veg state, but I'll tell you the two
al to me since they have been
e ... I usually just tag them, clone

ds (looks just like the ad for
d, but both share a very similar
es.

c anything like the other Sweettooth
nk Sweettooth was sold after it's
notypes I found are very equal in
honestly say that I think the
at 63.

o tell which plant is influencing the
re potent but maybe not; both are
get back up or else I feel like I'm
a feeling at all (as I look at the

ed

ay on Texada Island, a longish
ver, by BC Ferries, specifically as a
: who knows the history." since I

mother, very few seeds are known

e seen it reach up to 13' on

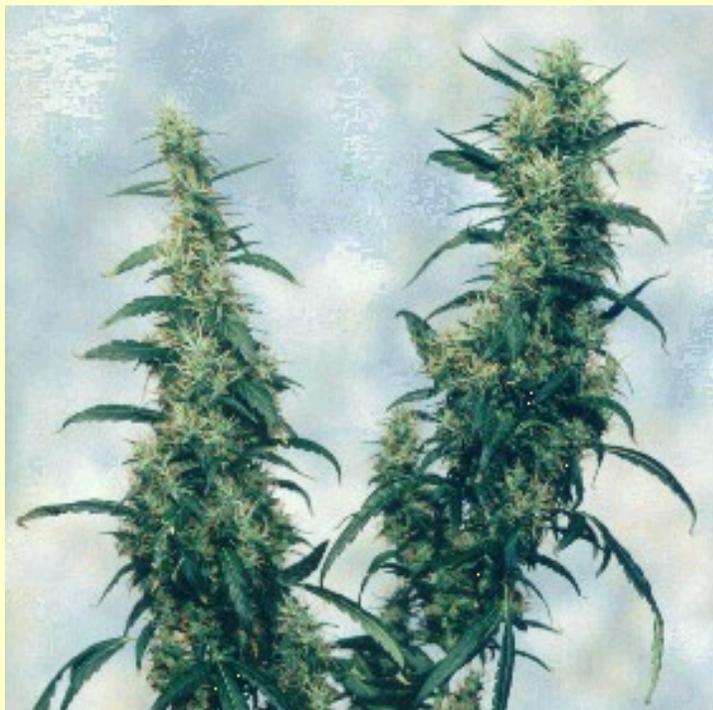
s heritage) can be determined. It

tas who wish to have a high-energy
g qualities. She has a unique
g, the experience is always
igh tide.

7. Flowering time:
Sagarmatha seedbank catalog

orough covering of white crystal
mell. The buds break up into
aste green, mild and bio-y and
nd spacey. ****1/4" - Homepage

ig Thai like leaves. My mother
with added incense tones to the



the selection. I got lucky and had

elevated buzz. Soaring through time

Just from this one, consider it a treat
It is highly regarded and very

Says of its yield and height are NOT
and an ounce. Her buds were quite
high to leaf ratio, hardly any
focused high. One side note I have
is not much but sorta

That kind of high it's very super UP
and down that's the best exotic
leaves, fast rooter. I've heard and
from 1 rather than 7-14 grams so
and buds with orange hairs I've
looked eye not very visible but its
55-70 flower time. The high is
need concentration. BTW if you
put the Kali is the true winner." -

It is the best choice. The problem
leaves you temporarily
is a pure Sativa. Kali Mist/Western
between the two." - Nurse Hawthorne

Sagarmatha Seeds under the name
Sagarmaths' Jack Herer. The strains are



(SSC)

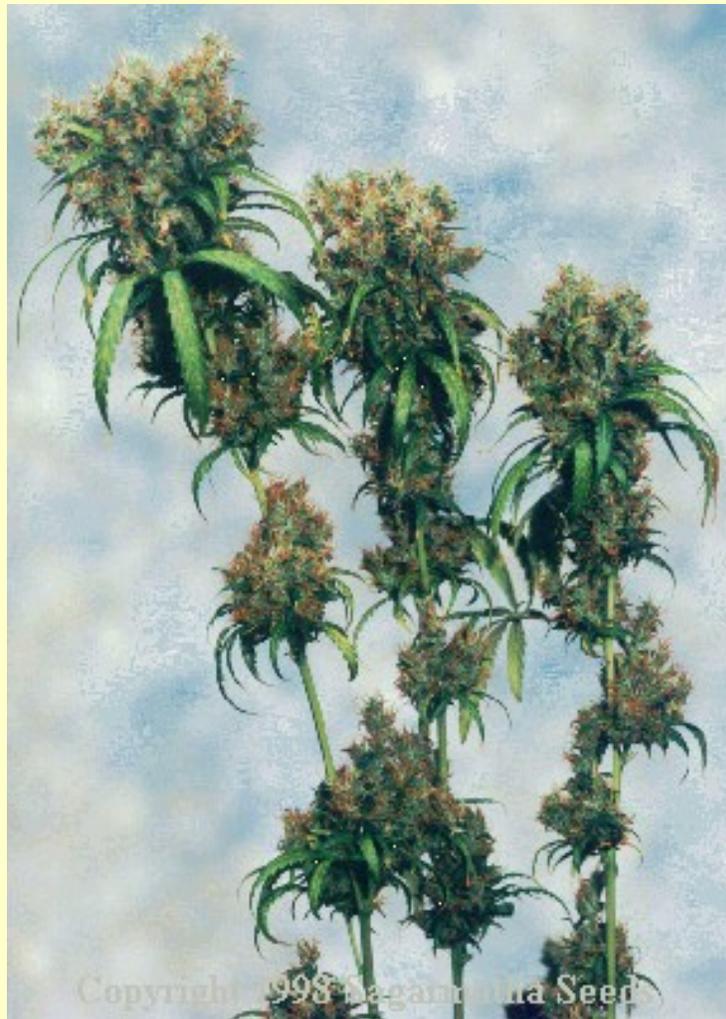
is a strain that was developed in the
and outdoors unless flowering is
indoor." -

California. Possessing a sedative
sly smile. From the first toke till
I qualify for every grower's needs.

photos show. Flowering
Sagarmatha seedbank catalog

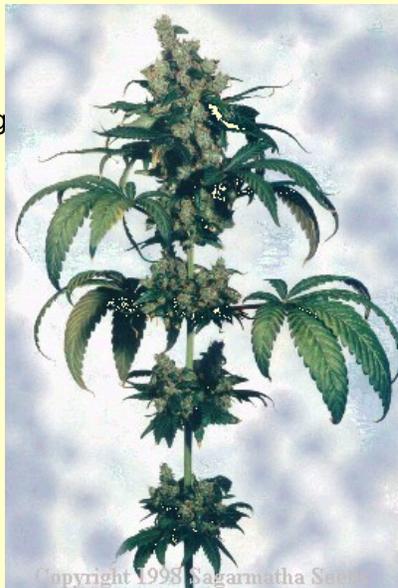
It in A'dam and it was one of my
been growing since 95. Since then
I'd so far (still drying) the #8
I had at 47 days. Very resinous,
I got seeds for 200 fl. and Sensi sells

at Sagarmatha. She said that it
was some variation with the
I says it has a very strong aroma



more strength and taste than original
the smoker with a bubbly high and long

roots show. Clip center
grams / m2 (dried)" - Sagarmatha



Sagarmatha Seeds

Characteristics of Williams Wonder.
Very tasty and possesses the
the smoker with enough energy to
persuasion along with a slightly
likely one of the world's wonders.

Need for pruning.
325 grams / m2 (dried)" -

ds

Extremely resinous with an uplifting

support.

six ounces wet, the other seven

buzzy.

very potent as well, but both had a

king buds, and the other lady

indica female named Bubblegum
(Kali Seeds) and when in '94
had the same genetics.

ale.

led to buy his SPECIAL
original, pre-Serious Seeds, version
split both had their version of Kali

SPECIAL gene pool of both parents.

g dark orange (almost brown) hairs.
ay with some slightly skunky
e. Although the high does not hit
l then only moderately effects your
Amsterdam

s or less. Our big-yielding,
ic, thought-provoking high was
ne variation among individuals. The
sinous bud sites - perfect for
os. Grimm catalog

ivaSkunk from Sensi and Princess'
ld mean that your plants are
you're having such excellent

but still a JH F2 from the same set
(popular name) X Genius."

u, after you have grown this cross
lose!!! So clone all your females, if
n Apollo has a sweet fruity/citrus
en if you can't remember what it
ed with Cinderella88.The A-11 is
y have ever smoked!"- greenbear

ed around 50 days, and a Durban

nse buds, low odor.

ry racy, even paranoid. Buds very
ype in the gene pool (Durban).

(likely a Durban imho). The dad

he Durban and haze side.

set, and floppy like Durban, means

rs Grimm Seeds

a VERY RARE female to her male
ation. Short statured & heavily
r/leaf ratio and OUTRAGEOUS resin
gressive generation and, as
nfluenced by Haze; clear, energetic
it Cinderella 99 finishes flowering
reeking of tropical fruit aromas can
ly propagated. One final accolade -
-Brothers Grimm seedbank

the "cubed" generation resulting
at a true-breeding strain with the
" - MrSoul

Created with the Keepsake Studio.



ss medium, 1:1:1 ratio of GOOD
lower to leaf ratio, manicuring would
se for a 400watt, but not tight like
alternated Big Bloom & Hi-P fishes
tent well manicured buds. Good
st vegging. By far the best I've

own for all around goodness." - flwr

a 88's mom). Cafe'Girl is the seed
ary 1999. She's a beauty - BIG
our is very much like ginger ale." -

hat was purchased in Amsterdam at
, it is considered to be an f2
buds indicating that the father was

bought in Amsterdam near the
ack with the Sensi logo; I
er characteristics were so fine I
Haze-influenced high with the most
esin production, doesn't stretch -
m after 2 years of cloning & many

buds were always too heavy at
y ShivaSkunk female with one of
produced a male which was then
o indicate the fraction of Princess

to Princess herself (incestuous, I

rom the ShivaSkunk) Sweet fruity
est/slowest maturation period in a

and bud structure, scent/flavor
o major phenotypes; short & dense

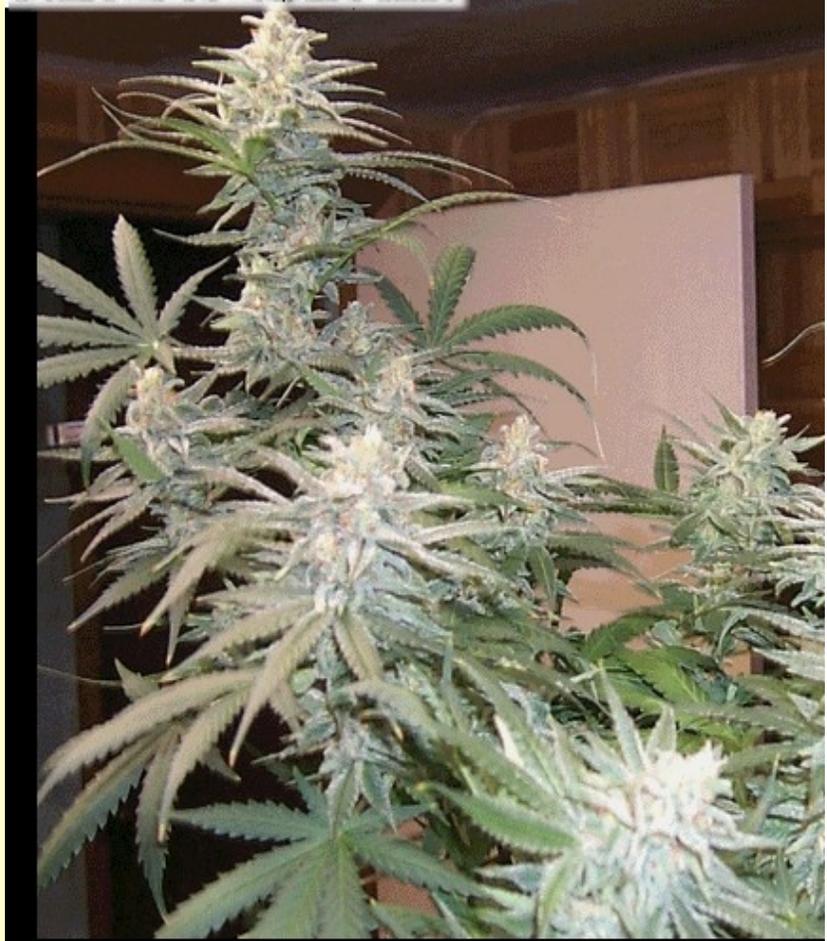
st and produces excellent yields of
in floral formation and some height
ggets of fruity scented & flavored
ORANGE pistils.

ain has been embraced by the
gnized for their excellent
e's NO OTHER seed bank that has
and the info is first-rate; even



The entire garden day 40

Created with the Keepsake Studio.



er can feel well-informed about the
as good as a cutting from Princess
al"; there's a personality to all
and nose, and when you take a hit
omes in the yield department; 25%
ng with some ShivaSkunk genes in
the traits from ShivaSkunk in the
anches because Princess had a
, I got lucky and it worked. The

NL#5, and Haze. Crossing a male
f possible recombinations of the
ss", which has many
l structure and pineapple
ffspring (generation after
aracteristics found reliably in most
etic contribution from Princess
(which also has an increasing
s: P.50, P.75, P.88, P.94, and
crossed and the offspring are
this project is going; even the
ther uniform and HIGH quality. The
s time. So, you see, since I have
racteristics distinctly different than
MY work." - MrSoul

ment of Cinderella I crossed a
ose seeds to begin the cubing

s that kind of high and each time I
ncess buds is a bit scary...it's too
e photo) and her flavour is just so
al generations would create a strain
JG high. It was successful beyond

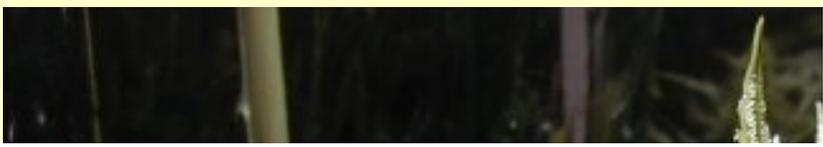
)...P.75 has a well-balanced
ith a tropical fruit flavour, and
ect from Princess." - MrSoul

I am most impressed with these topped plants. They have buds to the bottom of the stem. great for SCroG

Created with the Keepsake Studio.



3 lovely ladies



the 99's should also, I would think. I

more interesting line although
it grows more like a vine than a
floral clusters is very intense and the
I didn't know it was Cindy, I
ways to accommodate the plant's
original princess and a Green
of including Bg's Princess genetics
of differing genetic backgrounds

I've grown an awful lot of them, and
dominant hybrid phenotype with
a flower/leaf ratio and unparalleled
experience, they usually root through
-MrSoul

Very glad I grew this one. Fast, nice
most really bite ya in the ass, the
from my house--shit that hasn't

the ebb-and flow system using GH
I have to say these plants are
branches, including some of the
!" - KGB

great density at 28 days. Still no
in the future I will do a whole garden of
most finicky feeder I've ever met." -

their 4th week of flowering, and the
tallest 4.5 feet, and all were topped
even getting a full 12 hours per day
they do under natural sunlight." - Rex

who was growing it outdoors in Maine
fortunately, his outdoor grow was
is, but it's difficult to say because
that the buds are DENSE (you HAVE

smoked the mother that this is the
Hawaiian... think back to when you
think about the tropical fruit flavor,
a little undertone of "stink" to go



recommendation, but I've
habang

looking for a badass sativa high
like at Weedseed. I've personally
the breeder put a lot of time and
They are nothing like the j. herer
with a more sativa look. The plants
growing, although I had no idea these
with tight node spacing so looks to
resemble the j. Herer (only minor prob
found! It sprung right back after a bit
which btw, includes most of the "hot"

...Cinders passes the test with
high like a potent version of silver
throat." - Mike

or Durban?)... WAY STRONGER!!! At
grown indoors so I expect the outdoors
growing and easy to take in too much as it
I kind wonder when trying to find
out keep a bowl of some nice indica
e." - dead man talking a.k.a. M.G.

...a thing but I think we know that
the buds are dense and sticky. The
it is obvious that it is high grade

VERY heavy sativa high bordering on
bordered to mellow out the edge. 3 tokes
for and tight nuggets. The plants I
all sativa x-mas tree shape and
a permanent fixture in my garden!"

...ect it to be a LITTLE "leggy" when
I flower 12" clones for 7 weeks in
unces. Yes, "crystal" production is
weeks of flowering look like white

...e in Alaska June of 99

...ine turned out to be female. Don't



add perlite 30%. By itself,
your mix. Add lime until you get a

at 6.3-6.6 pH. Make sure to check
any overfert in time. You will find
d 2200 PPM overflow water at times

ivation. It is a short, plant with
tell the sex when the plant reaches
this point.

started flowering by day two and

with 10 days or so. They produce
en you harvest, and the high is
s. A friend of mine said she
everything.

anks Guys" -Mr. Worthington

. My screen is 2 ft from a 1k hps
s c99 and how much of the screen
and burns,

ding from 1 to 2 ounces dry. You
The final height will be less than 2 ft,

om made system. I am about 1-2
r is c99, I have heard soooooo

d positive feedback as we've seen in
owering and hermaphrodite
n some glowing reviews.

ers into a 2-foot tall plant with an
ave found that 40 clones (10 RW
with single colas, or at most, two
s running the length of the rows.
ou let the colas "fall all over one
best to keep them well

s are made up of MOSTLY flowers

7 Sat/Haze influenced, tall 5'-6' with
in one lady in a 5 gal pot, she
indica-like, there was one special lady
indica high after the first hour and
several connoisseurs said that it
fantastic. And the strain is very
of 7-8 different strains grown
crossover again. There's really only one
5 beans, in that respect there only
my \$.02." - Budm

high variable, IMO the variations are
present, 3 ladies were in pots of BCGA's
as a haze dominated phenotype,
pinched at the 6 node, she grew into 6
tasting wake and bake, uplifting
pinched at the 6th node, she had
very fruity, but yield was bad, at
the 6th node, she grew the
awesome, trippy and thought
1.5 oz. All said I really like this
bring down its size (5.5') and



peppery aftertaste. High is UP with
to their background, but the Jack
is pineapple . one is sweet while
high does also create a slightly
and creativity (strange but
is) I highly recommend this for

this multiple hybrid of many years

d Bank catalog

r the past couple of years and is

weeks. Very indica predominant.
uzz. At the other end of the
ze predominant. Taller, lighter in
of the haze. Wow, my first real
it very inconsistent strain.
ring jack in a smaller growing setup
e in finishing times. So in
e finishers. The wait, although

rearm sized) colas. Seemed to

ect from all of the hype. There are
d, IMHO; I don't think I'll do it
e; just over six weeks to finish and

ystals and long, thick brick-colored
uds and clusters, sort of like
that skunkiness that we love.
smooth with just a slight
with stony, visual, and a bit silly

s. The bud structure is lent from its
The buds swell oddly like freshly
n white crystals. When smoked, the
ntially in the lungs. The high hits
ely brings out the best in both

on adding to its white, fat cola
ng time is proly within a week or
n 12/12 light set has been around
it's creeper...3 good tokes and
on this one." - Uncle Ben Dejo

h Dutch strains, but Jesus H.
ere really blown away. I have
t surely tasting the buds from
ever.....

ce of Wonderland! Creeper weed,
oofy! We must have laughed and

have grown, and this particular
tle moldy).

n this states: "Short internodes,

nd feel on the palate that is like a
It leaves an interesting aftertaste
experience?" - Uncle Ben

ds found in buds of Jack Herer that
d outlet of Sensi Seed Bank. Thus,
/ in the deepest part of the buds
rs missed at first.

ied, but there's this "evil" scent in it
d (notably the Durban/Thai hybrid
Y fruity. The high is almost too
second meeting, after getting
of weeks before, so he decided to
ncess will induce your body to
uch like Haze, but not quite as
ou get progressively higher during
centerfold and find "Yellow
j" of stalked, capitate trichomes
e Haze.

feeds heavily and requires about
a-dominant strain, and finishes at

ess. The father is Shiva Skunk. He
ess.88. Seeds of the 0.88
beit not perfectly stable yet...but
s genetics, which should be a

grows VERY well indoors, stays
reat KILLER Sativa high/flavor.
and much goes to waste with
e almost no waste.

ught a 2 gram bag of Jack Herer
on Achterburghwal straat. The
about a dozen seeds in the bud. I
ds appeared almost white due to
ssful and I got a 50%
rth pattern (surprising since Jack
for a hybrid. Appearance shows
ter green in color than typical

ing of the two females.
ng of the two males (surprisingly,
s siblings' seeds). Unfortunately
flowers.

Several small, poorly rooted
dent of the method used; RW

d pot of 50% perlite 50% Hyponex
. per gal of pH 6.5 water. Once
ring the first week they "shoot" up
row has urea-based nitrogen) with
thorough leaching with plain water,
aller. After the first week of
of pH 6.5 water; I soak the pots
ng. Flowers appear Sativa-like and
d denser, much heavier buds than
kunk or similar strain, since the
ons from the bud with only tiny,
it the fan leaves, are covered in
ich were culled (tried to flower
d to have a sweet, skunky taste
product should be excellent.
rd week of flowering and they may
e were selectively pollinated using
e seeds will produce plants with a
e that, inbreeding concerns aside.
crosses which will incorporate the

age yield. It clones remarkably well
nique Ginger-Ale female (Ginger
for a long time as a reliable
fruity smelling, perfectly balanced
irimm seed catalog

ose plants that produce big,

nt. Her flowering time is just under
ste like Ginger Ale & the high is
arm, friendly and non-paranoia

with 40 clones of Cafe' Girl and
er plant even @ 1.25 plants per

iginal. I found the genetics to be
nt plants. however, the mother I
crystal formation, and it was
. the high is very active / cerebral,
eavily influenced on the sativa
ike pecans...
vatts / sq. foot. I don't know why
unk #1) makes it a bit of a pain
ecommended." -frank white

..good crystals...stretches like
can grow out several to find a good

door grow, but inside also a number

catalog

n female). A superior plant with

a and grow like a indica, well sort
s are a great compromise between
y of the Dutch seed bank home
a Uno etc. and that should do the
an forever. Leda Uno has leaves
ated type), cheap seed price,
nergetic, talky, happy and a very
o something, not just eat
avorite and Leda's mine. Easy to
ut the high is what will grab you,
@ Interpolm opposite the train
e heard they were out of stock but
ose heavy, sleepy, valium type
: Colombian marching powder in a

: available at several coffeeshops
er tell you where I bought it so if
a sub-standard one! If memory
plant to grow), supposedly lemon
k genes in it (rare for a Dutchie),

ower at a short height it will have
at a very young age). I hope you
eda Uno x fem Leda Uno) and
d them with other Dutchies and
t smooth Dutch taste, very cool
f Dutch sativa/indica varieties
xcellent results. You seem to be
its finishing date as I was, at the
not Dutchies, so a 60 day
as going on a seed buying trip I'd
d sativa dominated." - insider

a

orth latitude. Finished and
y 5 footers with nice sticky colas.
planted clones, using slow
arvest.Yield: 6 to 8 oz. per plant."

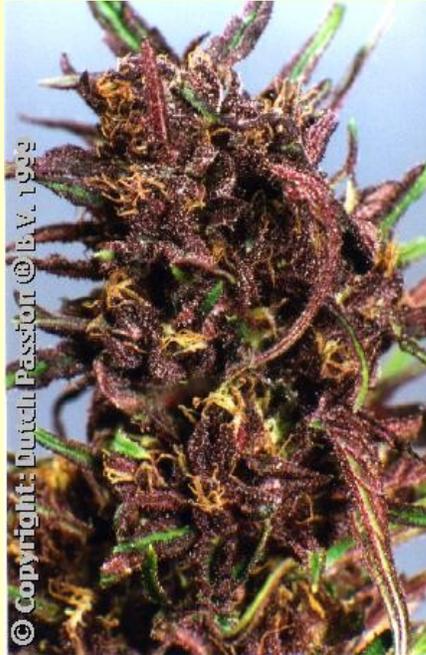
lds and some plants are very

:" - Positronics catalog

eedbank

; have been crossed in Holland
he Dutch climate and have a
eginning of flowering. Up to 90% of

ssion catalog



ible resin development. Produces

with medium green leaves,
e buds look like pieces of hash,
lorophyll, very plant-y (like fresh
od for passing around at a
ter out of a bong than a joint, or

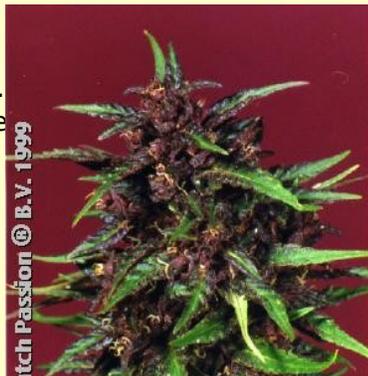
urple, sticky with T.H.C. Very easy to
h, but delivers a clear and sharp

bank

the plants turn purple during

aving a heavy perfumed aroma.
ut 50% of the plants turn purple

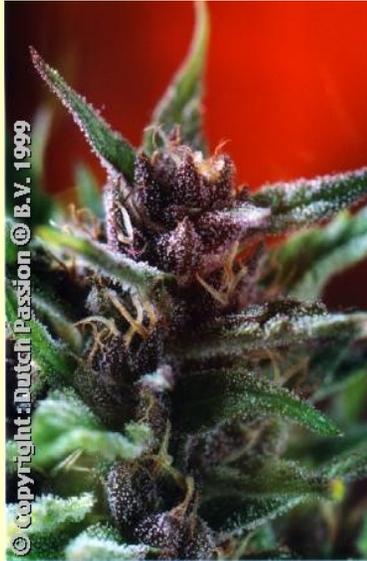
Passion Seeds catalog





bank

e #1 and an early Skunk. About
and 12.5% Indica.



illog

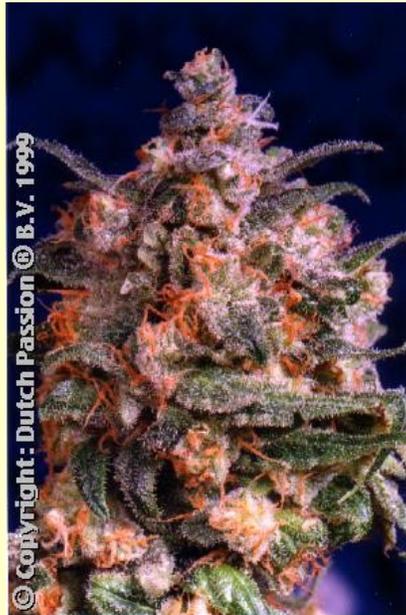
bank

female Oasis/Shiva/Haze crossed

mine had not germinated so I
with Buddah was a lack of potency
rior. I still have an OZ stored away

bank

vement. A three way cross
eties. This strain has an



g

Seed Co.

l skunk tastes. Smell: A rich
nge haired fullness of the super
e thick, densely crystallized cola
ing, that has the strength of the
a White Widow. - Green House

de germinate May or by the end
ide, it will be ready early autumn.
1997, 2nd - Place - Cannabis Cup

these plants. Like not so little
belong in a Japanese Garden or

the beginning of flowering has
divine aroma to them; something
lyxes and the subtending leaves.

I plants for sure. More like
g during the first four weeks of
development to give you a
ne flowering was initiated.
plant for double-stemming. I look
t sixty days. It will also be
s of flowering." -Moose

eds

little space. Very soft taste and
een quality and yield. Strongly

of dark green and contains sparse
it of pine. Not particularly flavorful
h but expansive in the lungs. The
1/2 " - Homepage Amsterdam

and's cannabis breeders' next
ed with white crystals that they
uds smell a bit mild, citrusy. And
and has a spicy citrus taste. The

eds

omegrown Fantaseeds

many different genetic
line." - Prince Caspian

sters and very resinous... smells
ing." -aviyam

uple Misty as well as da Widow,
under intense light. One could
cs as somebody was trying to sell
o some Misty (the house special) I
plant in my opinion, about a 7 on
. maybe a little higher but still not

paper towel. Germinated seeds
aw them they were about 3-4" tall
ere the late sprouts.) They were all
s. Even at this short height about 4

' oz. per sq.' under a 250!!! Tastes
Serious is great too yields even

te deep orange hairs. Lots of bud
d have a taste that is sweet but
it you keep smelling in the car
rage, but not as good as Chronic.
is soaked through with resin

n Oz for hours. 2 modest bong hits
check out the Homegrown
ough I've heard that anything in the
major growth pattern, color, or
cern is yield, and don't get me
ut I'm sure it's easy enough to
e new stuff. My number one so far

both KILLER. Both the AK and the
like the sweet taste and sheer

eds

ucer in terms of yield, fat donkey
roma. This plant has it all.

end Original Misty from
gger harvest potential and a sweet
saw almost zero variation between
l from this strain than from Chronic,
ven more powerful stone than the
ore than a 1/2 oz per SOG style
en flower for 8 weeks under HPS.”

ed Co.

r it has 60% Indica to 40% Sativa

and resin nodules that stand out
and it has sort of a shit smell to it.
and sticky. Not mouth wateringly tasty, it
and the smoke expands slightly leaving
and a hit to take. This is bong weed, as it
and 1/2" - Homepage Amsterdam

and to be ready after 8 weeks, the
and white on your nugs. You must be
and ROWS THIS STRAIN I'M BEGGING
and ACTION!!!" -Ganja-k

and it is the best choice. The problem
and leaves you temporarily
and a pure Sativa. Kali Mist/Western
and between the two." - Nurse Hawthorne

and same and an easy winner of

and green) with patches of darker
and entire bud. The scent is very green
and and is a bit expansive in the lungs.
and ! We love this bud. One or two

and to the indica side. Great with

and indica dominant, 70-day plants

flower, very easy to grow Germ
eld depends... over all I would say
ak47." - LaBud

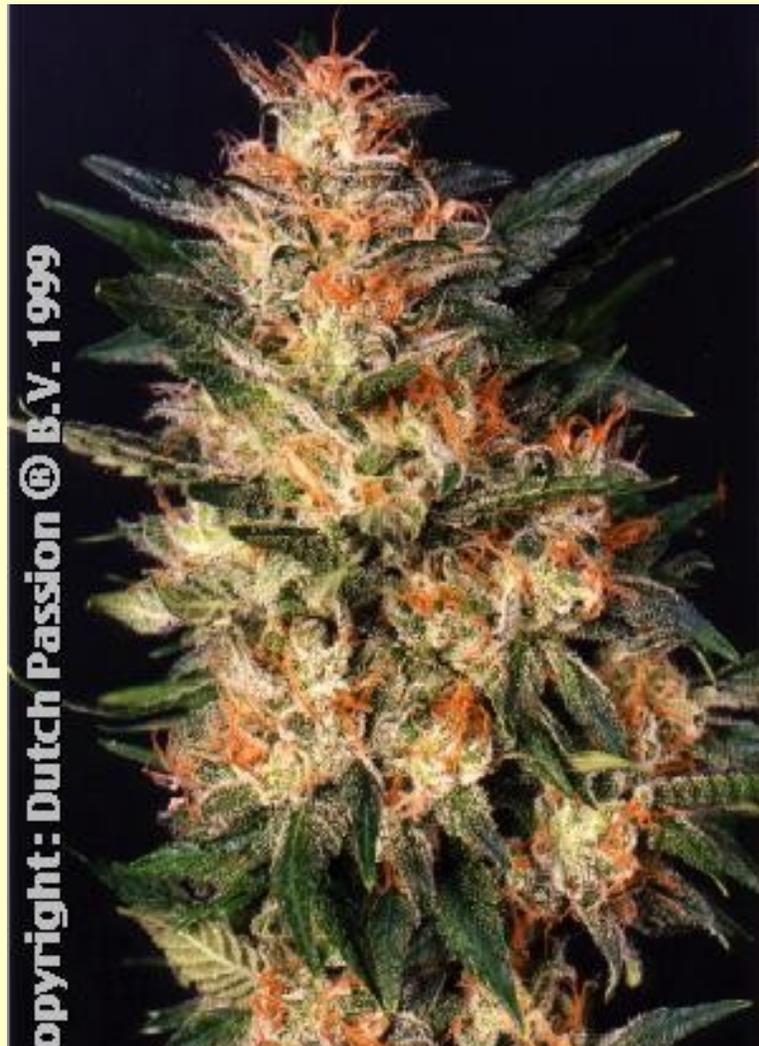
he phenotype, but pick the short
ave smoked in many years. A
2 a joint: "Too much...waaaay too
ery cerebral, extremely potent
, about a 3-4 hour consistent
d it over anything I have smoked,
" - Posterboy

of the strength of the crystals - the
ou better try it for yourself. Smell:
l whiff ... turning sweet. If a plant
isuals: If you have ever seen a
sort of hairy crystals we all craving
r stem then you probably did not
be believed! Stone: After the first
feel it just under your eyes and
e: Originally the union came from
indica ratio. - Green House Seed

ended to grow it for 2 weeks.
e White Widow for 8 weeks, but 10
weeks of the flowering cycle to turn
from regrowth and stresses the
..try it! Achievements: 1st Place -

with THC glands, even on big parts
edbank catalog

ian and an Indian. Suffice to say
recent years in Holland. The plants
ke and great "High". Very potent.

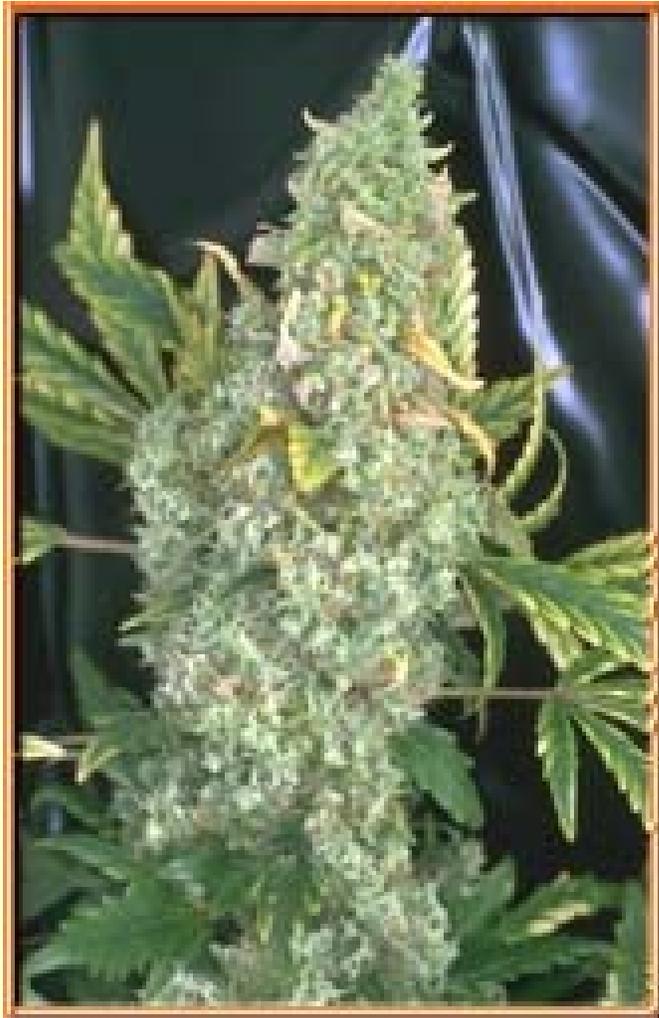


ponic Cup. A compact, medium
ous with profuse white, crystallized



ed by light green leaves entirely
rse, barren brown ones that dot the
about its Northern Lights
haps overfertilized, perhaps not.
it cerebral, and bit forgetful and

I reports that I have read state that
lls WW. On my last trip I tried 3
egrown Fantasy (Hydro) and one
rent. In all honesty my least
have the resin coverage like I
asy was excellent, as was the super
ll very much unstable and therefor



in a-dam. Someone from Dutch
130.00. This plays a part in the
what happens when we inbreed f1
ve of the hybrid and p1 plants as
egin to dial in your own
riginal WW. It is considerably

ne for other herbs, which seem not
one of the more fragrant herbs
uld do so lousy in hydro, as I find
at was super potent but not real
a couple times to some thing that
. Some of my friends loved it but

bimby Madness a stable sativa
(L#5 x Skunk#1) giving it the

i (only one candidate...maybe not
L. head is 20% body, 80% head.
drop from the brain when
rone to powder mildew on the fan

very sweet in a skunky kind of way.
on body to the flavor. I still have 3
pointed in white widow, what with
the cake with white frosting, but,
wildew (if that is the correct term)
ing. I currently have more WW

His show said the seed would come
excellent. Out of 5 females, 1 was
less side branching, 8+ wks. All
quite a tolerance to the kind, but
if I smoked it. The crystals are
had very slight taste differences.
ence of it. I kept 4 out of 5 for
e. I intended to keep 1 or 2 but
have several chances to evaluate
(in Amsterdam) to anyone. Great
best all around highs, VERY
old Indica for communication

grams each. They had 2 or 3 nice
look and the crystals never reached
crystalline and did spread to most
to dry unevenly the way I dry and I
process. The WW was just smoked
ocular but a .25 gram joint glued

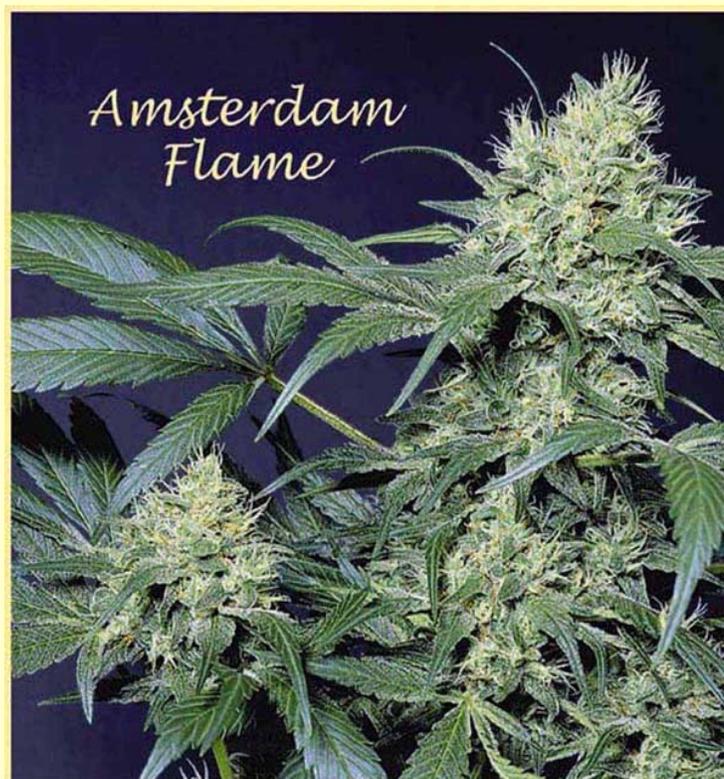
determined

a Super Beetle with a Porsche

ed for the lovers of cannabis best.
lling tales of mysteries. A plant
rvest time!

grams." - Paradise Seeds catalog

in organics with mostly Guano of
(for growth) and so on ... 53 day
mell. Large main cola, crystallizing
ry much leaf, only the crystals



sold in the 80's and it is also 2/3
ne seeds directly from Alan
ka and he said that nobody has
eans (Mantanuska x
ony's best buddy and provider of
eat dense yields but not a 9 or 10
ow" and that the "peak19 was a



uite a while. For me it is the
which is where I got turned onto it
; as well, and even he said it will

moke to really understand. It's
et smoke" though. Tastes like

me I was in Amsterdam. I wasn't
like blackberries but the high wasn't
e it is an indoor variety only it
and some sticky-sweet, but just



Seedbank

famous Chitral-hasj of the
od harvest, nice herbal taste and

een nodes. The crystals are not
lertones that set it off well. Dense
s than skunk. However, the smoke
ansive in the lungs and will make
munchies! ****" - Homepage



an Indica this plant can produce
g high with a heavy resin content.
sweet scent. Winner of 3rd place
est choice for growers that are
effect and sweet smell in mind.

rious Seeds catalog

in. The first was NLxAfghanxNL.
re the NLxAfghanxNL. Big Bud has
didn't identify with any Big Bud
picy scent with an overpowering
ecommend Original Misty from
gger harvest potential and a sweet
saw almost zero variation between
l from this strain than from Chronic,
ven more powerful stone than the
ore than a 1/2 oz per SOG style
en flower for 8 weeks under HPS."

o into Serious seeds & Sagarmatha
and Sagarmatha sells it under the
tion rate of some of their Slyder
ches going. They assured me
Indica strain are " a Northern Lights
tively fast maturing with dense bud

l potency seem to have been true;
feet long x four inches thick) are still
grams, which I consider a lot. The
re strain. I saw two distinct
is buds on short plants, and thin,
ent. The high is half body, half
ut of 10." - KGB

with 3 males. During veg these
er flouros. All of these plants had
; far as width and color. The color

. They grew like sativas. They were
were cut down in approximately 10
ed bud look with good size calyxes

ese plants were chopped because of
since they were trained so that the

od as the others. It could have

somewhat crowded it's hard to tell if
ra. Sativas tend to tolerate more
nd. Buds have the braided look
is plant was on the edge of the

lded the same. These were
lyxes without the braided look;
d for both of them.
pped during flowering like the hand

: plant of the bunch too. It had the
owers as they withered. How this
buzz. It was the first to show pre
s ready for harvest so this one is

these parts. The stuff smells like

When the plant was chopped early
visual distortions after smoking it
be thing that could knock some
urn out when the buzz wears off.
plant should have been harvested
now.

the final report since not much

moving to Jr., and because they
ny other plant grown from seed in

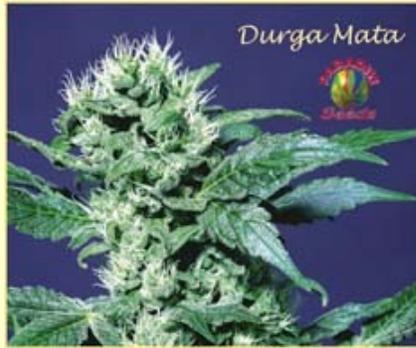


early Oct. Yield: Average" - Spice of



ing but nevertheless tasteful and

Paradise Seeds catalog



n yields with short flowering period.
cy makes her the favourite to

- Paradise Seeds catalog



ds

Several generations of select
with the highest density of

dry. This species is truly worthy of
armatha has provided for her
ity aftertaste. The high is uplifting
the sunshine in and don't get burnt!

e height: 1.5-2 m.

ank

bubble gum/bubble berry famous

o.

le - germinate May or by the end
ide it will be ready early autumn. A

with a hint of Haze. Dense, highly

better when you look at the

ermined

ere was hardly any trimming to do
rity at about 15 inches and each
ly thin, so thin that as they were
d the buds up though and the
nell was awesome, definitely
ctually could feel the different
edless to say I am happy with

Seed Bank

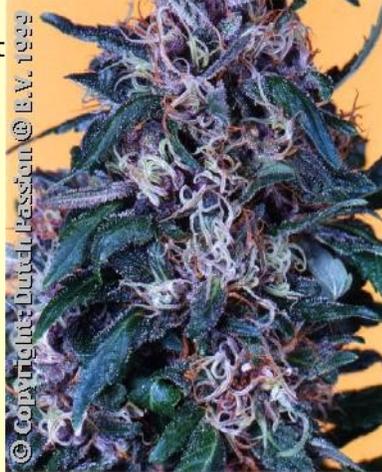
5% Northern Light, and 25%
e plants are strong and easy to
have a minimum amount of
Not susceptible to spidermites." -

Passion Seedbank



ities. A heavy Indica variety wit

on Seeds catalog



onics

ativa crossed with Indica
t smell

vest date (Netherlands natural
or / greenhouse / outdoor" -

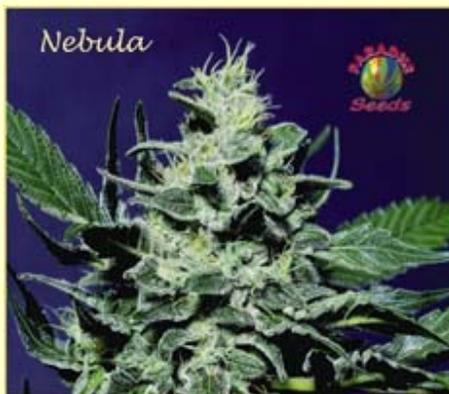
ot 2 good plants, I could discern 3
et. Another one has extreme big
and is a very good yielder. One of
not so tight. They start to flower
e app. 50 days. Take care that the

plant just started flowering under
uld have a honey like smell. Cant

uld not buy a strain that is
2 good plants - you might buy 20
suspected from the look and feel
F2 Hybrids from commercial Sensi
3 but its just a guess. Yield is very
with these huge fat flowering
s do get resinous but not as much
res. If you choose the Kush you get
ativa, but nice no sativa "thinking
nation, short flowering period, high

Is. Its flavour and scent,
bound to get you into the realm
far beyond your grasp. When you

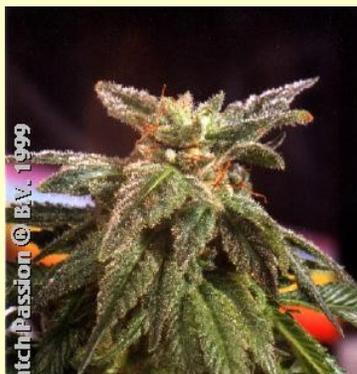
ms." - Paradise Seeds catalog



eedbank

ca cross. Big fat buds. The aroma

ion catalog





ude and strength as the majestic
. The potency of this plant will
ig and physically stimulating, the
ke should be enjoyed mostly by
of adventure. The matrimony of
"flavourite" delicacies, providing

how. Flowering
- Sagarmatha seedbank

i was Romberry, has really come
es in a Stonehedge and Mat
he Matanuska Tundra would work
5-.75 meter, the one MT/P19 girl
l at 13", and basically all of its
reat in "Arena" style grows for the
"Magic Crystal" (WWxCalO) from
L2/12, and the flowers are twice
ainst skinny colas, because the
; can lead to really fine
do lots of selecting and

o the Stonehedge sativa
bout 3.5', has tight dense colas
uska Tundra phenotype, very
was flowered at 15", very sweet
the two, like Tony at Sag says,
urning out as good or better then
nder one inch, he was very
and one Mat T type gal.
n, maybe even tastier, and its

of three F2s, are the taller
one is shorter, and will prolly be

SC)

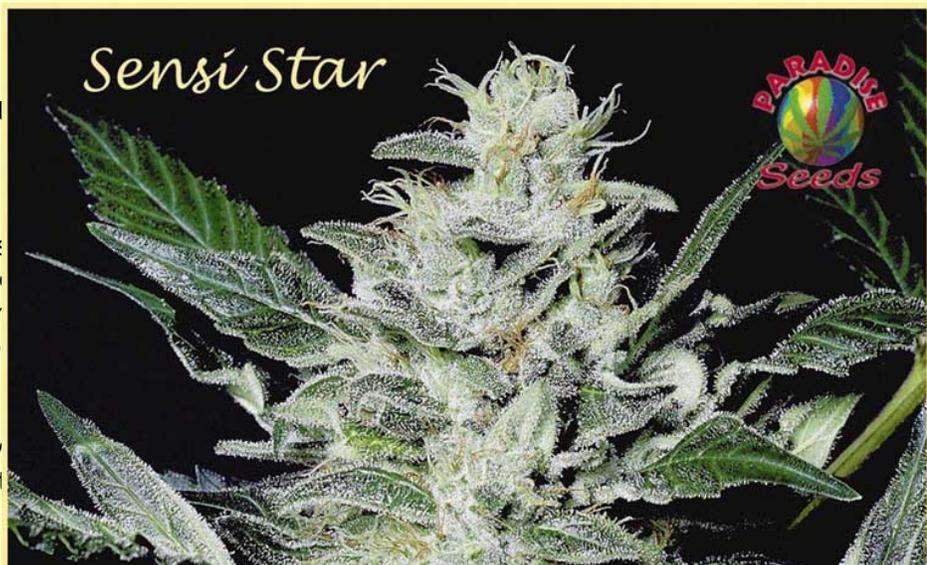
northern climates. Cold and mold
rams per plant. Some variation.
s well. The smoke is very strong."

y compact buds. The dense,
t is breathtaking and gets you

rams." - Paradise Seeds cat

fat) and about 1/2 oz of les
high is really physical. Sm
with it actually, even though
ne I light a j of SS, I'm surp

most indicas. Grows short, y
grow as many as you can t



king plants. Ended up with
ter 4 weeks under flores w
d using CO2 with temps in 75-85
er 3 are about 2 and a half feet
l buds. I have never seen better.



. This hybrid is quicker and sweeter
abit frosted resinous
leaf ratio of Early Pearl / Skunk.
gory.



te in greenhouse: mid-October.

ike honey, not my favorite flavor
days ago, he says they are on
mion

n ticket to do so, thanks mike)
heavy toker and Ill tell you, 2-3
Share a blunt with friends and

t. This seems to be right on
e grown. The taste of the EP (very
by this strain. I love the taste.
avorite "Utility Smokes". Great

er a bit heavier yield more body
ce." -Oldtimer1

otato stone and Silver Pearl is
eld." - DAMIONSIN

Super Skunk is really kind bud,

NYC

ime. This plant has the power of
the ease of growth of Skunk
to be one of my favorite
head rush. I'm no great fan of
stuff." - retro13

formed very well (especially
I weed-- very resinous, nice fat
le do. The high is strong and
y the Silver Pearl would probably
- Shabang

sinous they stick together), the
tiva early pearl. This has to be
h is a full-on trippy head rush."

an say: its growth characteristics
ort of like incense and toffee. Its
'hangover' after a night on it),
tiva, but is characterized by the
ly.

ie parents), and have decided
two main phenotypes, and when
teristics coming through.
ormal, easy plant to crop without
o crop. It takes cuttings well. If I
an have a very nice growth
s stick out on long stems (an EP

d in light crystals, making the
ge hairs, as well as hairs that are
ip substantially releasing a
hen smoked is mild, yet sweet
d comes on quickly. It's a bit
- Homepage Amsterdam

t light green, sparsely coated
ry dense but snap crisply apart,
ie buds smell piney, skunky, and
gh is quite spacey, but energetic
)

ds

is growth and excellent crystalline
s of an old style Cambodian type
h and pleasure. The high she
aphic outlook. Whether taken in
operating heaving equipment

ge height: 1

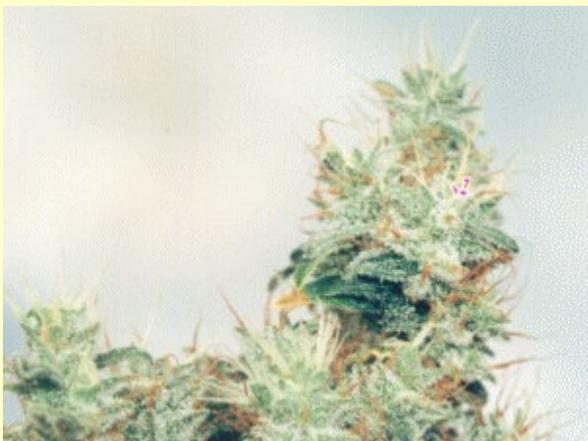
said that the original seeds had
) . These vets in turn said that
odian strain they brought home.
edge description, so perhaps
le" Sativa-high plant, with a
as a heavy Indica influence as
on of Serious AK-47 (Sag and
seems to me Serious got to

but rather heirlooms or private
ith Stonehedge and Early Riser
to them by a friend). Their
le in Alaska call that name to a
GA experiment (probably
g and NCGA) teamed up briefly.
ed to the "new" breed. I wouldn't

at all, but rather is a combination
very seedy (hehehe) and the
rmanently lost some of their own
and boycotts at their seed grow
edge is not the original, but a
uld explain the new reference to

of strains reads like a novel.

ie. Although you could see some
: spacing on the long end of the
us. The buds grow in dense
roma of the plant is subtle, an
ent resin production which picks



j. I like the way the smoke
re not sufficient in this case to
produce a heavier yield. I do not

dense nugs and a hashy flavour.
he other strains available.”



ositronics

ance: looks like Mexican Sativa

Netherlands natural
- / greenhouse / outdoor Early

ostly indica crossed with a skunk
, but for now it's still unknown.
it was faster, it has an flowering
me.

ome growers did find the great
grow very fast, vegetative grow will
outside and it's an easy compact
may change because the Dutch
t growing plant, it's very good in a

closed from the picture beside,
tt (Natrium) lamp, total space
vegetative, this way we are able
rom Nederlicht Growshop we could
picture beside you can see one
0 watt (natrium) lamp and the
, use big containers. This plant
uphoric alike and the indica part
t has it's own taste and is very
ome growers like to keep them in
in those last days, it is easy to

that they got as a cutting from
The seeds are from Paradise, a
ince WeedSeed picked them up.
ommercial plant." -shabang

suspect that plant will do much
ing it and the plant is better
buzz without much sacrifice in

from the breeder himself...It
re grown out at least 35 strains

Amsterdam directly from
ys, but the high is very mild. I
grown something much better,
y because I had no desire to

, but not top grade nederweed by
% withered pistils under 45 w/sf
e trichome production is about

autoflowering. Even clones taken
al weeks old. This screams
it despite the continuous

the lack of trichome production.
d....
ud leaves to snip out. Clones
for ScrOG. Medium high yielding.
rain.

o me at least) breeder in

you will get the same results buying
with some Top 44 seed stock
The original ma sent to me is the
considering this plant based on

< it was about 3 years old
fiction. Plant was grown in cc jr.
mark on the CO2 is because
so I don't know how long it was
real when the roots grew out of the

mark it's a horizontal trellis used
s).
caught pretty quick.) After this dry
just have been because the fast
. (Because of this I ended up
h leafier bud than I should have.)

ned. Main harvesting took place

the Shiskaberry that Shiva
on too ;-) Because of the speed
bly trying to fill the area I wanted
a fast flowerer it veg's at a quick
ting it spend time under flouros
buds on the garden edge did
on't think you could go wrong with

one under the screen just to get
the constant flowering it does).
it up to the NL in 3 weeks as far
after spending so many years

ms/sq.' number. Because the
; , most small, with a big hole in
in case I failed---I hate empty
en 1.5 and 2.25 square feet. With
nall amount of cooking bud was
ill if I had trained well since big

ather than the larger resin glands
e a coat of crystals the T44
oked like I imagine WW looks,
mend harvesting early and

or the smell, which I don't like, of
in the background is the best
y to contain the smell when I

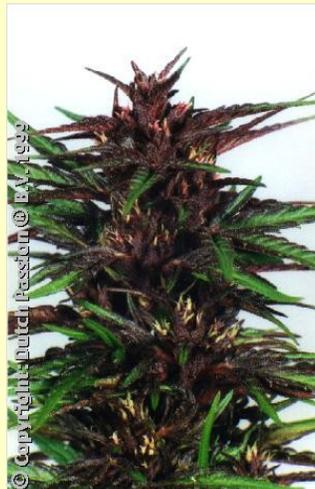
t with a buddy on a ride. He
mokes almost once a day I
d the buzz but was not happy
ng was kind of funny myself and
w..I wasn't exactly catching them
ly for me, but it did calm down
ring power of the buzz.
s have a unique buzz. It's
you want to. It starts like a sativa
d guess what...you can then

on't puff some more. Bottom
z since couch lock isn't all there
d will keep it in case I get back

ave any other comments on the
the next Flo Sheet." - flick

d high. 100% Indica.

ision Seeds catalog



eds

rant weed with a strong buzz.
ame was derived from her

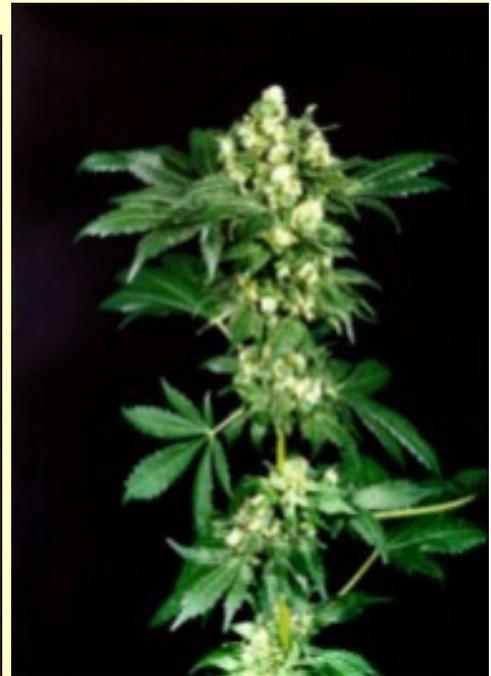
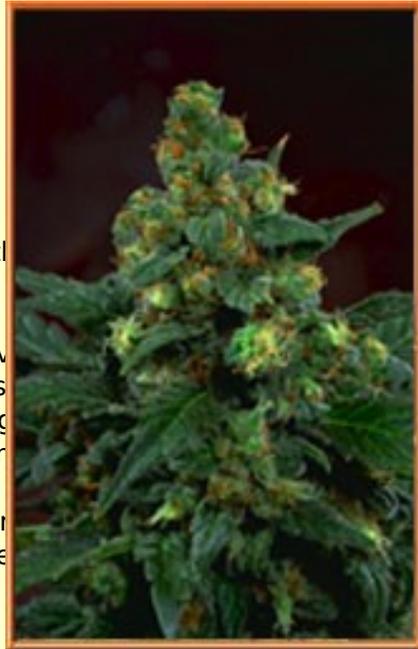
time: 50-60 days. Average

Southeast Asia

ik

and. Very broad leaves, 100%
e. Rather high flower to leaf ratio.
ally narcotic high. Average yields.

/ resinous and very consistent. The
y good "up" high.



produce short squat plants with

like. The only other Afghan I ev
d were very dark and the buds
y different. The leaves are hug
alog. They're a very light green
t the way I would have liked. I
t guano, a touch of cow manur
-1, and water. They're two wee
he Sensi Afghan is weak and

ed northern Californian Indicas,
it buds covered with sticky, smelly
y mature in late September. In
resinous nuggets in 50-60 days."

ik

Improvement was made on its yield.
Short Christmas tree like plant,
with a bigger yield and better taste.
Very consistent too.

<

make it. One just wasn't able to
blossom. The other grew but lagged
because it was male. This was nice since news

leaves with smoother edges on
the main stem during flower with the other
differences showed in bud structure.
It grew tight compact buds with

the shape of its leaf stems. Weird huh,

was kept mainly for how well it did
but it got thrown into the mix by
a mystery plant until grown from

the other three if it didn't suffer from
a lack of covering of resin. This has
to be dealt with if you're into

it and it had been done earlier and

was done so that the main stem was
covered with the buds, which look like
a Christmas tree and was the stronger of the 2 that
this plant is that it did show a
good amount and it didn't show another sign of
being a male or two could very well have been

it would probably require attention when

it is used for good reason. Mazar is an up
side to compete. It's that good now.

It here seemed to be an edge to the
others. It will be some KOs when others get to

it will be a good one when given the



cause it ends their day. It's
is from clone. Buzz will probably

harvested on time. Except for 5
now. All and all so far so good

Bank

s to grow his own Indica. Hash

it. If the laws were different I'd
ozone ... so much in fact that m
e, excellent hash producer. Aft
ff my arms from leaning over
smells a whole lot more like a

ape smelling bud per plant. It
eptember here in the Midwest."



ion Seedbank

cellent indoors and outdoors.

qM (outdoors) ~
ssion catalog

ink

t taste and strong high. One of our

covered in long hairs that range
ent is sweet and citrusy with green
g-scented bud. It almost doesn't
-expansive in the lungs. The high

ntrolled conditions, outdoors: a
gal. pot. Huge plants when
e buds are unusually thick and
a guesstimate) The stone is not
ne space and time (if you can get
aroma producer while growing

nd not a reseller is MasterKush
sed them in a-dam. He gave me 5
d have had them now for about 6
is mature...the plant matches all
tunately is way too physical for m
n Mike Tyson.... I much rather
ist a woose but I at least like to

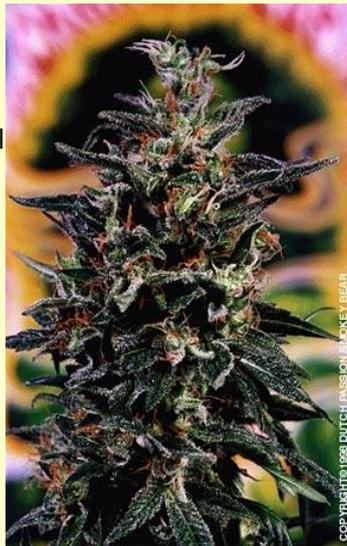


is me out but maybe my body
ive a delightful aroma to them; li
plicity in the growing characteristi
r is short-statured and a heavy
y smell it releases but as I said,



Seedbank

C 33. A very nice outdoor pl



weeks if AT ALL. There is
es. This comes directly from Nevil

ber of weeks after germination

r goes away even if all auto
e genes recombine to the
h Ruderalis. Ruderalis doesn't
m western Afghanistan were often
also will often initiate flowering
wering is initiated it cant be
j and it just makes tiny colas. It's

was developing a version of
veral generations auto flowering
hink there might be Ruderalis in
have used it quite a lot. In
t. Sensi sell a hybrid version and

Sensi Seed Bank

orthern or rough outdoor areas."

without regard to the amount of
north or in a place where there's
ns, but you might lose the

It of much work by Nevil with NL
d resistance (or rather, a lack of
Basically, Sensi are selling seeds
ie from, this one melted to
e to fine either. Also remember
grow all your seed. Only 25% of
r be male or mature to late to be

did flower. Ended up with one
e buzz even from the leaves.
rest under a 24/0 light period."

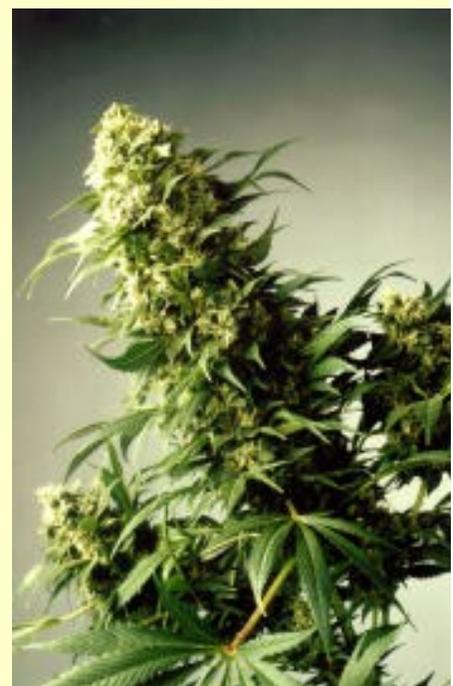
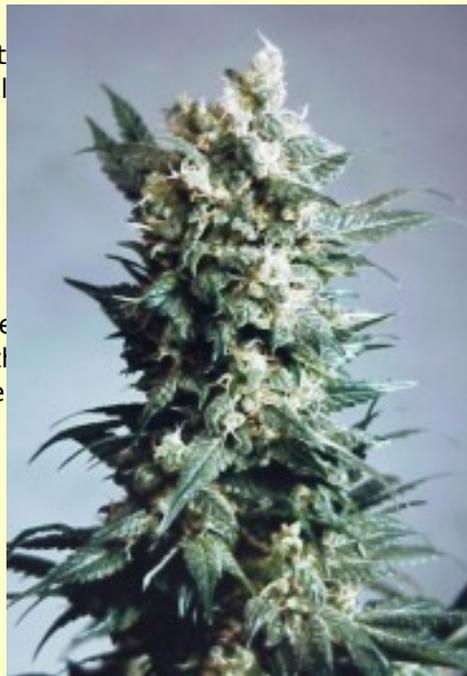
p. Best for inside cultivation."

rk

n the collection. Its pleasant
ers." - Sensi Seed Bank catal

ain that we call Garlic Bud be
Garlic Bud and is added with
ery nice. The flowering time
nsi Seed Bank

o the high."



me. About the size of the later
0 (we thought the guy was nuts,
e." -Wesos

ous Seeds

winner 9th Cannabis Cup. A very
tasting producing an incredible
ant strain! Expect severe cerebral
7 as the name implies will blow
the power of this plant, "A real one
p, and in '94 it blew away the
he overall Cannabis Cup. The
are a delicacy to the proud farmer.

0 cm." -Serious Seeds catalog

strated by a secret trip to
of Mohammed's sons died in
uality hashish. Although hash
of that country greatly reduced
Mazar-i-Sharif were being
plane to Pakistan to save the

oor of a car, Nevil made contact
tween his eyes straight up to his
l that it had been processed by

machine guns at him, Nevil set
suaded him to send a squad of
s of healthy Mazari seeds.
sh or opium. Nobody had ever
I tried there trying to explain
out what I wanted, he asked too
d me a bandit, but I had the
987

le those babies mature. My AK-47
smoke I or any of my friends

itering on my part - I was
nce, though I did get a couple of
opped back before flowering.
g mothers weren't great yielders,
it spacing. Although I did get one
I won't be growing her out again.
igh nutrient doses and they do
e mother, although you can go
r is my growing technique and

y non-paranoid. No racing. My
pecially creative pastimes. Good

nts of both sides of the cannabis

s throughout. Some buds are
een smell that will make your
ems to chew on are all the
ave plenty of polleny crystals on
is expansive in the lungs and a
ly mellowing high ensues that is
a Coffeeshop. This bud could get
aster

how it grows yield and buds
es one grow short and yielded
woody like taste its high was
er one. It produced hard size
e queen of resin) with very little
le out and gasping for breath
m smoking too much of this

ant. I have 2 mothers: one mostly
nt than the other that went the
ers with lots of clusters had great

Jays potency was strong and UP.
er than the indica, solid dense
days. The high on this is the
I found when I smoke too much
ugh like G13xNL and plan on
given the name Uzi... Well hope
Jankmaster

I favorite of mine, that is because
lar type of stone but much more
of high... it makes me unable to
- Mike

ger and yields more. But I'd have
onic toker as many of us are. It
ial high (but still very strong) with
o. Too many factors involved
AK doesn't smell like blue berry
ersion does] A small extract fan
then it fades away so you need

grow than WW. I got the seeds
reasonably fast, flowers in about
big problem. The ones I grew
id the high was excellent."-

erperienced grower. Skunk strains
ources. AK-47 is a multi-way
la

. Will grow short to medium and
depends on what you pick...an
cture that packed single blades
y smell, very crystalline, almost
it leggier but seems to be the
very dense and much whiter
nd the high was like taking a
d to search for another...you will

ral high. She is tall with large girth
rl can satisfy any connoisseurs'

s throughout. Some buds are
een smell that will make your
ems to chew on are all the
ave plenty of polleny crystals on
is expansive in the lungs and a

ly mellowing high ensues that is
a Coffeeshop. This bud could get
omepage Amsterdam

ed Co.

layan alpine flowers with a hint of
structure set on a pale green bud.
it's flower, so the feeling is a sticky
ow of new ideas in a fluid sort of
s and Sativas. - Green House Seed

side germinate - May or by the end
outside - it will be ready early
door - But a nice surprise for

al herb. The kind of high where you
now you feel!! The taste reminded
/brown pistils. Seeing as how it has
aits." -Geronimo

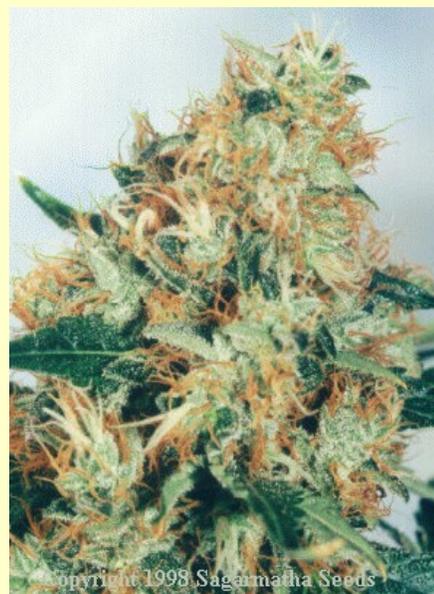
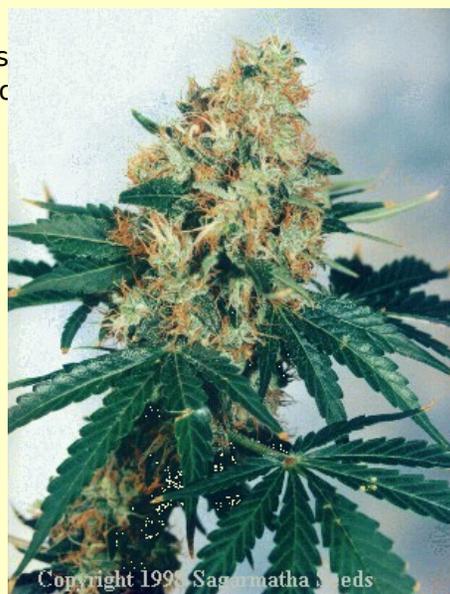
Seedbank

le the plants have a Sativa
ell and taste and a very clear

passion catalog

nd savory taste. She pos
nd lethargic. Great for the

Clip center cola.
(dried)" - Sagarmatha



. The mother was growing
or high fences and no nose
and very fluffy. The leaves were
owed signs of pollen sacs after
ow out the seeds I can get a
backcrosses who knows. I have
rets to big 4 indoors even if you
back a little.

4 the Mullimbimby. I know 4
and Lebanese. In the late sixties
as bringing back with them a bit
is that it took them quite awhile
nd grew out their seeds. When

inate itself over many years. It's
- Delta9

eds

inally developed from seeds
to make it possible to be
smell and high yields with punch.
weightiness to the feet. Persons
to the kitchen and back again.
smoke another toke, and slide

ter cola. Flowering
" - Sagarmatha catalog

itiva Smell/taste: very sweet

in Nov 12hr day exposure
atalog

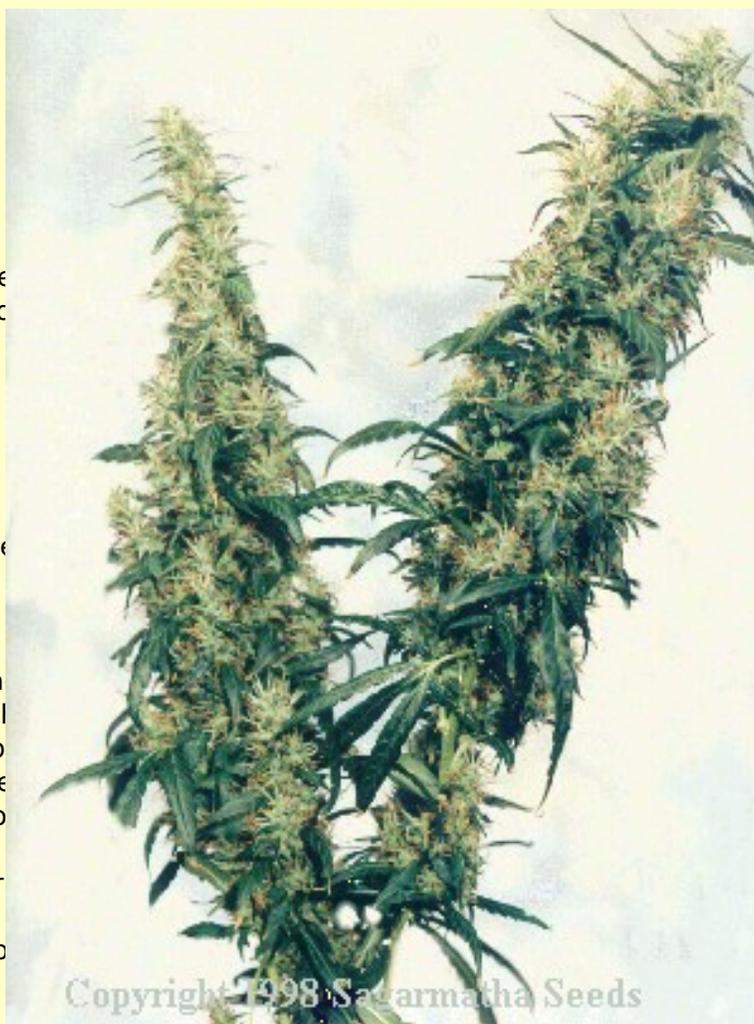
armatha Seeds

e with a long-lasting cerebral
slight sandalwood taste. This
K." -Sagarmatha seedbank

er roots show. Flowering time
Sagarmatha seedbank catalo

strated by a secret trip to
of Mohammed's sons died in
quality hashish. Although hash
of that country greatly reduce
azar-i-Sharif were being
lane to Pakistan to save the

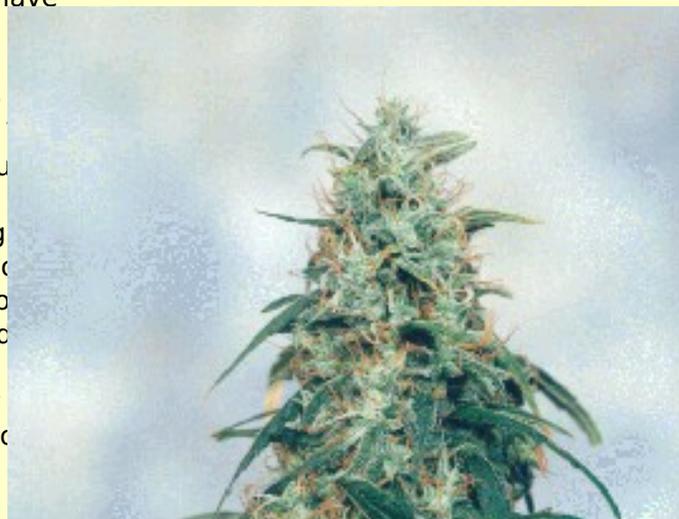
or of a car, Nevil made conta
ween his eyes straight up to l
that it had been processed b
machine guns at him, Nevil se
suaded him to send a squad o
s of healthy Mazari seeds.
h or opium. Nobody had ever
tried there trying to explain
ut what I wanted, he asked to
l me a bandit, but I had the
387



e those babies mature. My AK-47
smoke I or any of my friends have

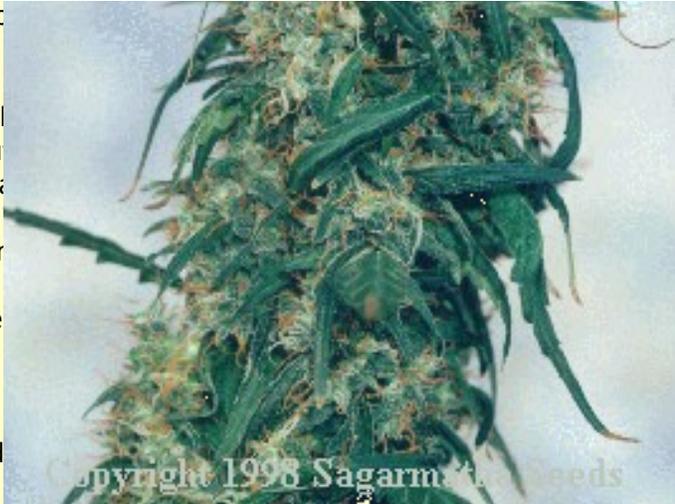
tering on my part - I was
ice, though I did get a couple
opped back before flowering.
ers weren't great yielders, bu
acing. Although I did get one
I won't be growing her out ag
gh nutrient doses and they do
mother, although you can go
is my growing technique and

non-paranoid. No racing. My
pecially creative pastimes. Goo



its of both sides of the cannab

s throughout. Some buds are l
smell that will make your mou
chew on are all the non-smoka
leny crystals on your fingers.
e lungs and a bit of a cougher
ensues that is conducive to
This bud could get you to ope



how it grows yield and buds
as one grow short and yielded
woody like taste its high was
r one. It produced hard size pine
en of resin) with very little leaf a
and gasping for breath really
aking too much of this one:))...

nt. I have 2 mothers: one mostly
nt than the other that went the
ers with lots of clusters had great
ays potency was strong and UP.
er than the indica, solid dense
days. The high on this is the
I found when I smoke too much
gh like G13xNL and plan on
given the name Uzi... Well hope
ankmaster

favorite of mine, that is because
ar type of stone but much more
of high... it makes me unable to
Mike

ger and yields more. But I'd have
onic toker as many of us are. It will
gh (but still very strong) with a
Too many factors involved
K doesn't smell like blue berry
rsion does] A small extract fan
then it fades away so you need

grow than WW. I got the seeds
easonably fast, flowers in about 7
g problem. The ones I grew out
e high was excellent.”-

perienced grower. Skunk strains are
es. AK-47 is a multi-way hybrid

Will grow short to medium and
depends on what you pick...an
ature that packed single blades
/ smell, very crystalline, almost
t leggier but seems to be the
very dense and much whiter than
e high was like taking a sledge
rch for another...you will be very

al high. She is tall with large girth
I can satisfy any connoisseurs'

s throughout. Some buds are less
smell that will make your mouth
chew on are all the non-smokables
leny crystals on your fingers. The
e lungs and a bit of a cougher.
ensues that is conducive to
This bud could get you to open
sterdam

ntaseeds

i% Indica, beautiful and nice

ns only one female resulted, and
nic ferters 80 watts per sq. ft., of
ies of only slightly better quality,
Crystal will not be a repeat, I

; can be one thing and the beans
illusion or anything, I just mean
I find examples that are like the
; pack." - Budm

arly bloom. Large buds full of
h. Very high yields, easy to

atalog

ie outdoor grown buds are thin
brown, full taste. The high is

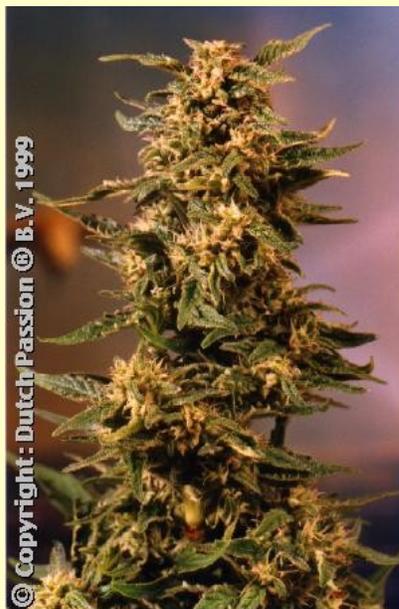
ay. The Original or true Thai is
ompared to indicas, many
o get a plant with an up high that
tree in its growth pattern with its
watts per sq. ft to have decent
drop most of their multi fingered
ow room temperatures (under
eal conditions and that's why
ts on " period each week or day
y down to 10.5/13.5 over an
or two) and is prone to hermies ,
ial . Their seeds are usually
rmed and matured (and that
s or other markings on them.
spy long buds, don't " resin up "
s harvest time and you have to
but mostly during the middle to
re called "Katoeys" in Thailand)
ou'll have enough seeds to grow
outside. The only good hermie is a
s, some say it will stop hermies
growth patterns, shapes, heights

ding by commercial growers for a
ngsters) over the last 25 years.
ain cola and others look like a
/ also with some Thais or
igh but is almost always strong.
grow a few sensimilla style the
surreal side if you grow it to its
own sense Thai that was very
ropical grown Thai with that trippy

ion Seedbank

ng grown in Holland for years
ear, fresh smell. Sativa high, very

n seedbank catalog



nk

reet aroma and an up high. One of
even during the worst season. If you

Best-quality early varieties in the

confined to Natal, but grown widely
by experienced growers giving
about 8 weeks outdoors, 10 weeks

are consistently good sativa plants with
a flowering period 8 weeks. Also good

Bank Catalog 1995

is very sweet/fruity smelling. You
can't stash, but definitely not for
those who liked the high of the Durban. They

twice and pulled it early due to
it not maturing. The Dutch version?

Seedbank

hybridized, 100% Sativa. Large
fruity or anise flavor. "Up" high
and produce earlier flowering. A



more accurately, has the most
/... If you come across what
from stock developed in the
and two primary concerns-high
This stock is perfect for the i
has broad leaf blades almost
nk, or a delicate purple. Bran
not ovoid down to a four-foot
otent, tastily sweet or spicy,

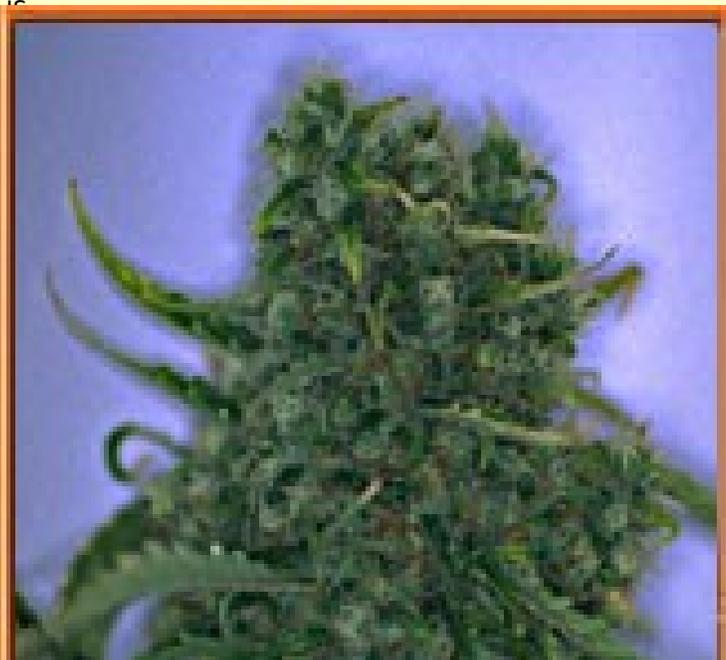
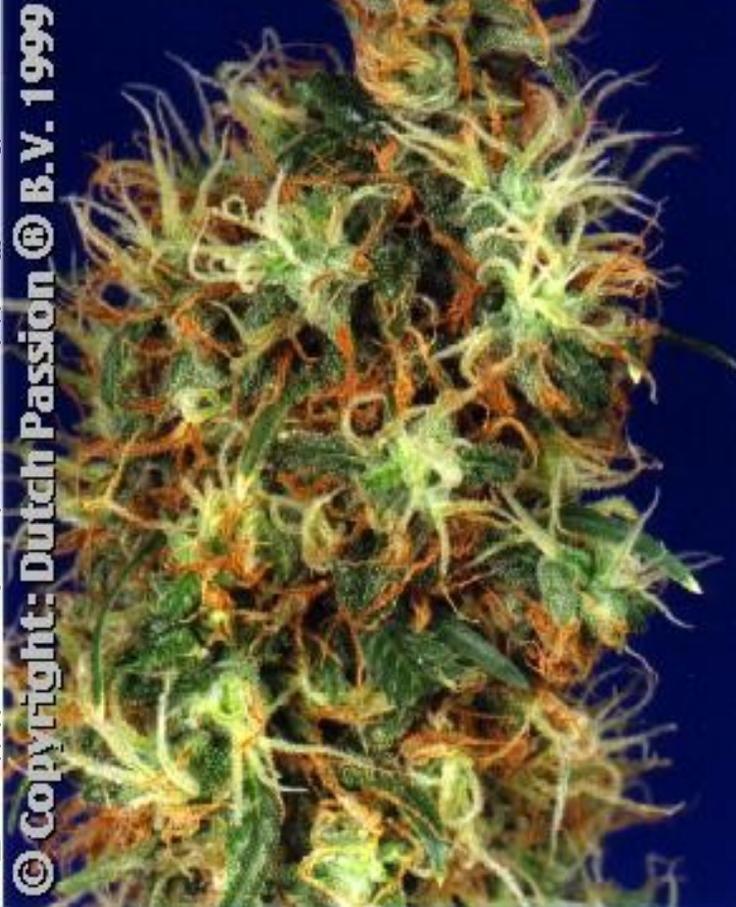
reat high, similar to Thai. Or
es. In Holland it flowers the
suitable for indoors/outdoors

thers sold from other breeders
u buy the best strain of Durban
doors, and it offers the up sat
n seed."-Big Bong

crop of their durban 1/2 ind
and i grew them out this
ry similar but the HBC durban is
n was different. in my opinion, go
nothing at all against Sensi Seed
on's version agree that D.P.'s is
indoor life under 1000k hps a
erences were eliminated. i.e.
seedbanks in my book but th
ree too and maybe the ones v
fore someone orders and is

. Take the bottom 2 branches
a 'goblet' shape. These bran
/ branches should be cut bac
to flower very rapidly- you sh
These will have shot upward
! foot from seed or 1.5 foot fr
t better- its clean, spacey,
pressed about but for person

an Poison, and that it came f
rica. Only those two plants w



r plants in the mix; a male, e
m the sources they had to dr
of salt." - SCW

mall test clone from the fem.
organics, mostly castings. Sh
iming for 2 foot high at finish
change the node spacing wh
g is about where I'd do it nex
a, but weight has more to do
u get, and resin weighs alot).
t get." - ~shabang~



but I did have one plant that
ths. Recently I switched to scrog,
een in a 2 x 2' space with a 220
he screen method. What I have
re has been no vertical stretching
is our #1 favorite day smoke. A
ial smoke. The moral may be
Durban. Like I say, so far, so

re too close to the light. I may
the Durban grow until it nearly
out 3-4 weeks from the rooted
o some extent.

3 weeks. That's sooner than I
ctually having Durban go all the
re weeks, while I'm away on
lights out. The sweet indica being

the stalks beneath the screen
before I opened up the dead

d. I had to pull them all out and
stay small that I saved, and it
k out." -cha cal

but not practical to grow. And

packaging but it was bought
her "brand" of durban so I cant
naturity was nice, coming in at

the Sensi isn't much better. That
like tall indicas. I'm not saying
eed I paid. Paying \$28.50 per
gh that I've selected the non

ve some coming in the mail any
were not close." -Vic High

ture yet, all pistils still white on
no body. About 90% head, 10%
fluffier and less size to the
y many old-timers like it.
physical characteristics. It
over before they finish. the colas
touted as an early variety. The
order." - Splif Lipsit

tion Seedbank

one. A classic.

qM (outdoors) ~
is Stairway catalog

ica, 87.5% sativa - Positronics

ouse cultivation Appearance: The
Height: Medium tall Yield:

nd skunk (probably skunk#1). Its
o this plant (durban has a slight
je skunk (but can still be cropped at
s are firm, very resinous and
o most sativas. The reason for the
sultant lower yield than ideal, so
encies & cutting prob's) have been
weed (purely a matter of personal
ink (similar, but from southern

Sativa Seed Club (SSSC)

ossed with our Durban South
of our own favorites. Harvest
or 15" - / S.S.S.C. seedbank

/Thai. I have 5 healthy
whole room full of these babies
ET, DANK scent and flavour that
e time you'd smoked HALF of it. It
be crossing Durban/Thai with a
: this project!" - MrSoul

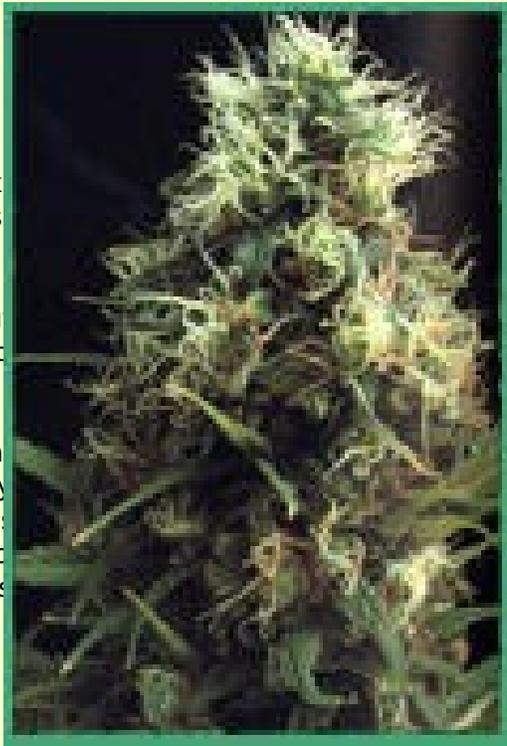
grew back in the 80s - I know
lecting individuals which best
ou remember (circa 1977?) with
I really wish you could
because of the Durban
kfully, the weed cures to a
n pollinating THIS female with my

reeder calls the cross Durban Thai
e his last 7 original Durban Thai

ed

happened a few times as a
ake me blind for 20 minutes
is that kind of smoke. Its lik
e muted. You will see flashes
fast without all the physical
pulled em at 75 days with
imilar to Durban, not much bu
e out to get a reaction and t

eaves were enormous and th
(10% turned). This is definitely
like tripping for me, lots of vi
shortly after coming down fro
r sativa to grow requiring lots
ounded and much mellower



Life Seeds



et and will probably add a
m every possible node! E

ical sun." -Sensi



Seedbank

genetics. This strain has been
us grow potential. Indoor as well as
s already one week after turning
s ripen very fast. This variety is very

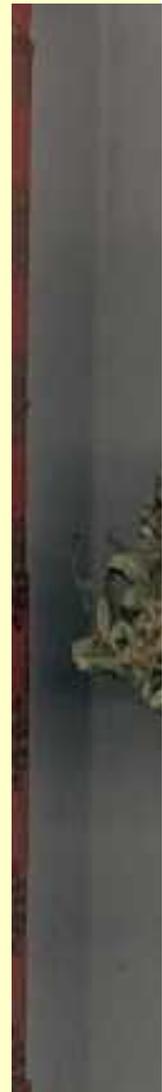
July 1st, and finished on Sept
I been a tall, full season plant
ica then I expected, but had a
dlings, and failed to regenera
a Thai male, but that hybrid
e the description at H.S. said
h I had more of it." - 67ed

d that it was a bit temperame
ale, 1 tall female (with slight
' . And even though it s descr
ome plants exhibiting the typ
gh I only used an 8 in. pot for

i fairly branchy plant and mig
arm unit to it the next go rou
ne room, maybe just as perso
val rates with the first batch
ubes instead of peat pellets.
re pampering than more robo
h a new stock." - Rippo

elman

nale so I can't say about
gh was up, visual, and a little bit



it would." - 67ed

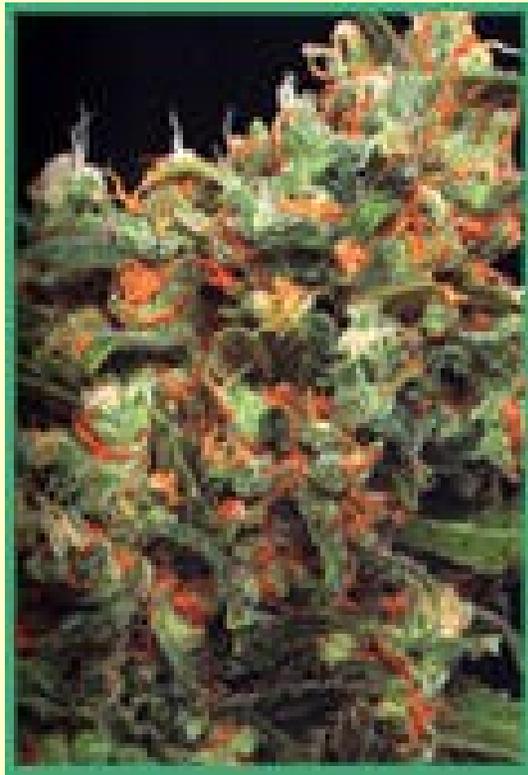
MO not good for indoor. The high
und."

pure sativa Appearance: very
o-flower ratio Smell/taste: exotic

: date (Netherlands natural
/ greenhouse / outdoor Seems

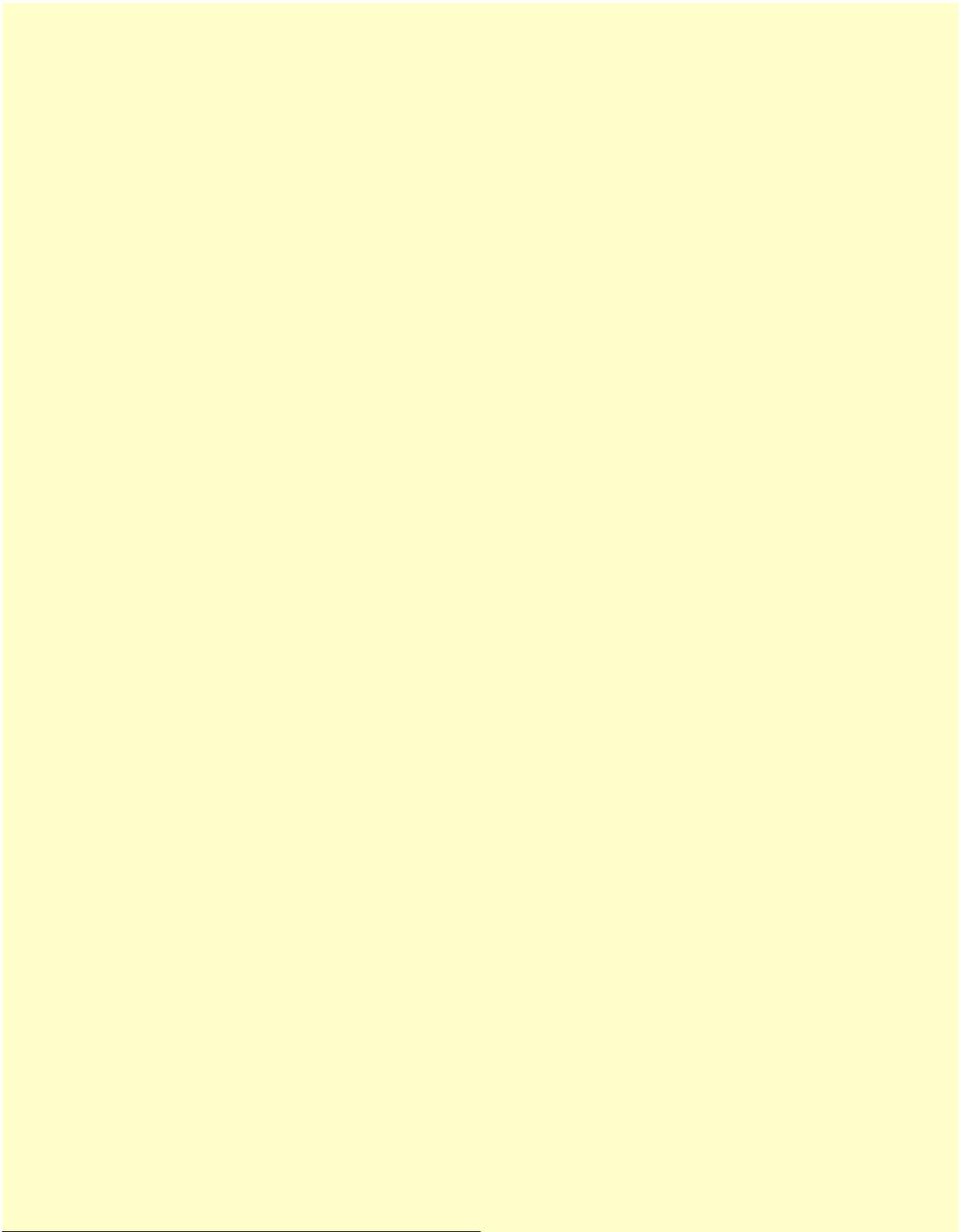
flowering, disease resistance, very
ica.
0 degrees latitude." - High

ffer a SWAZI strain. The only
for item # M5. It doesn't exist in
id M6 Indica-creeper hybrid. I then
vil offered a Swazi strain (pure) for
Swazi (pure) is no longer being
9 catalog, HashPlant/NL#1 X



bank

rell worth the wait. Exotic taste,

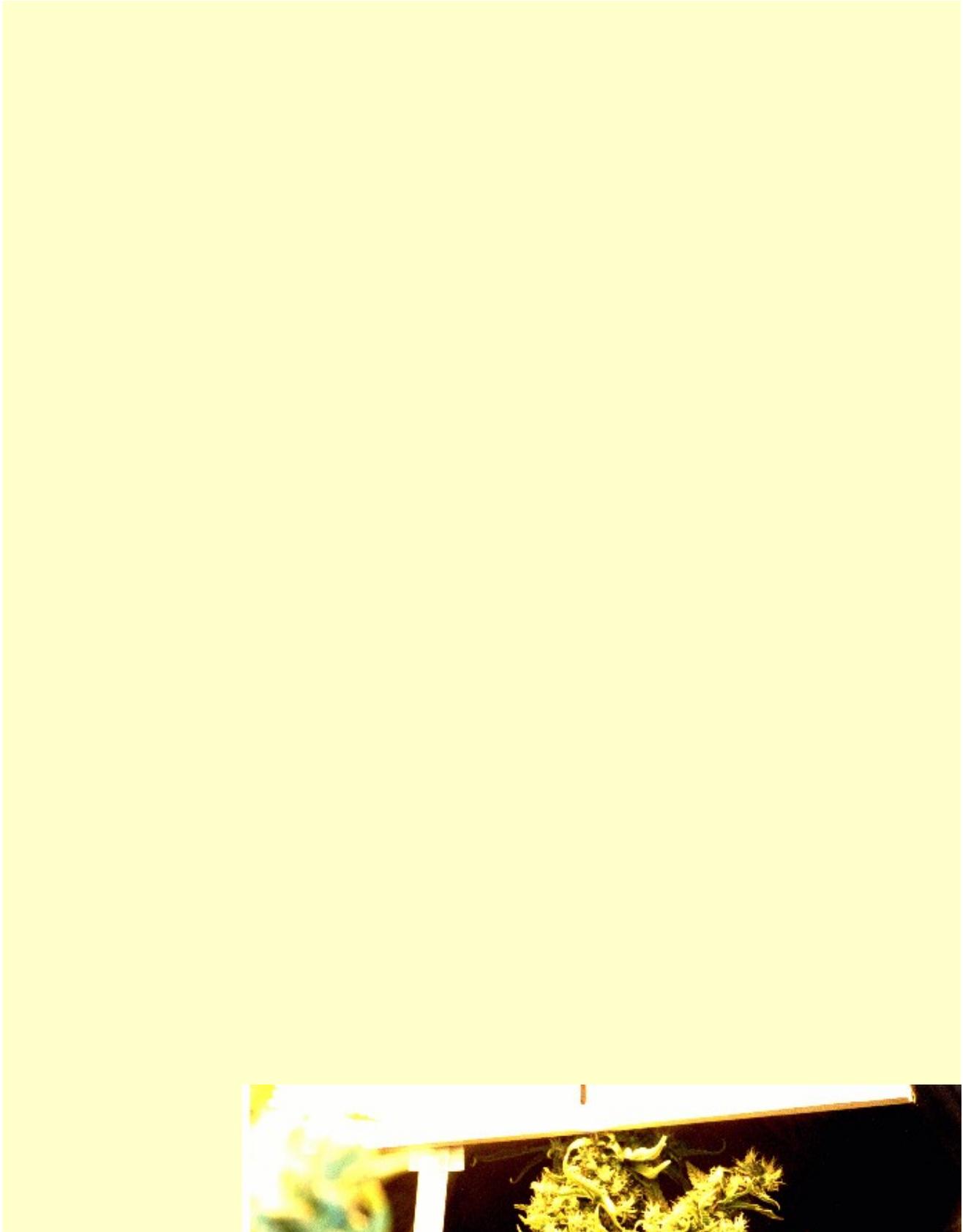


Next Strain Listing (Alphabetical Order)

s to cull. - Wild Rose Seeds

days of flowering immediately after









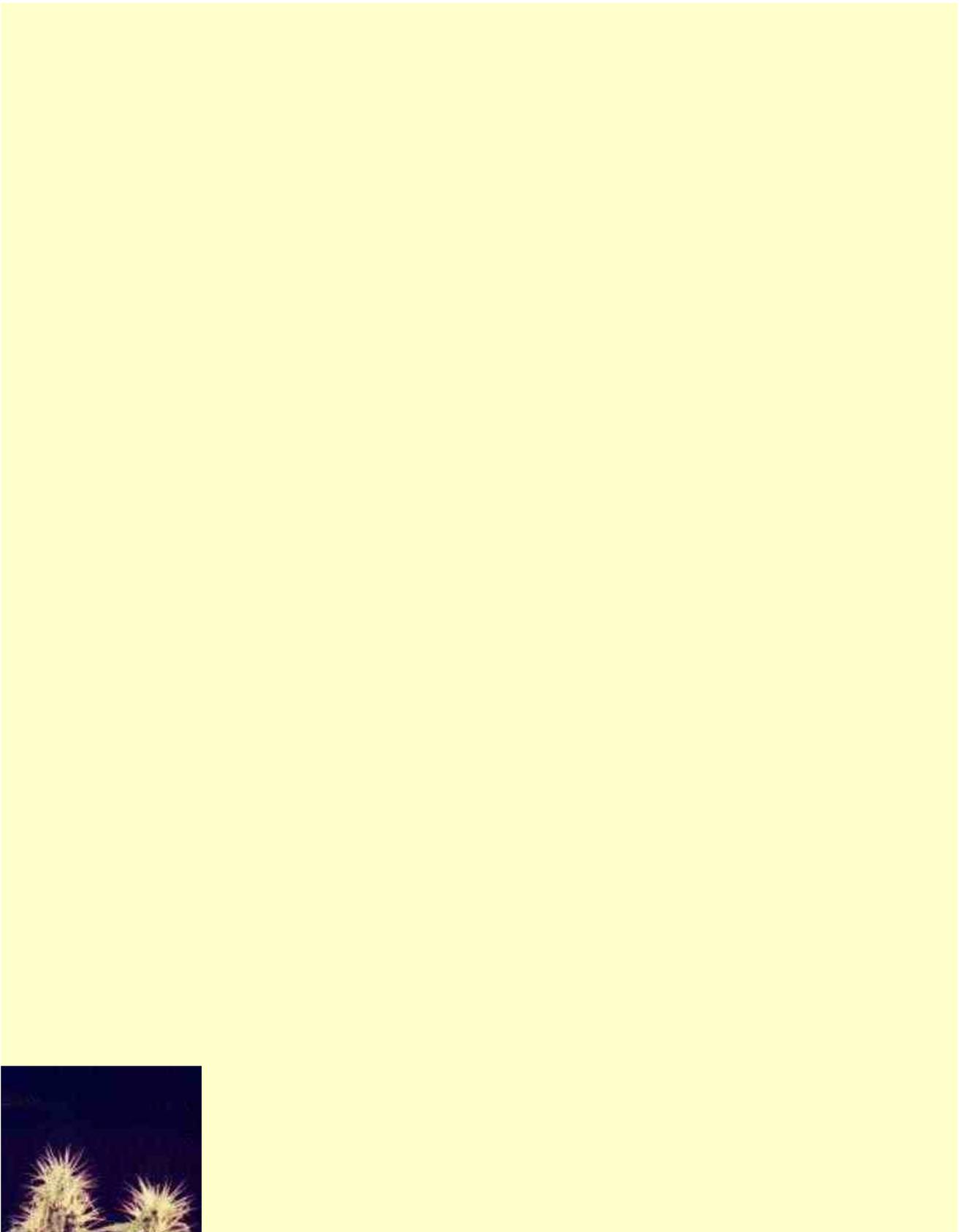
**nales, Day 38 of
ue from HS**





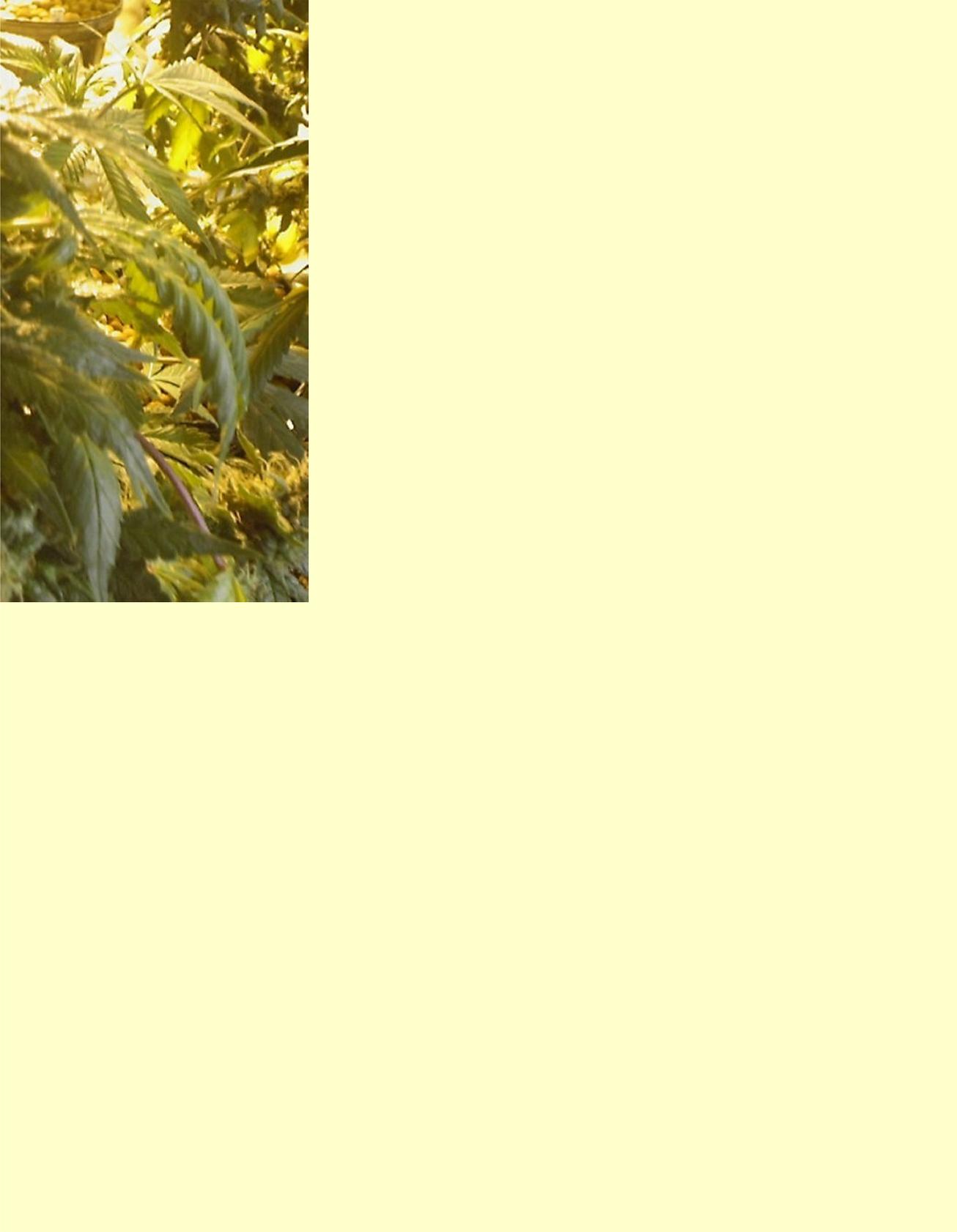


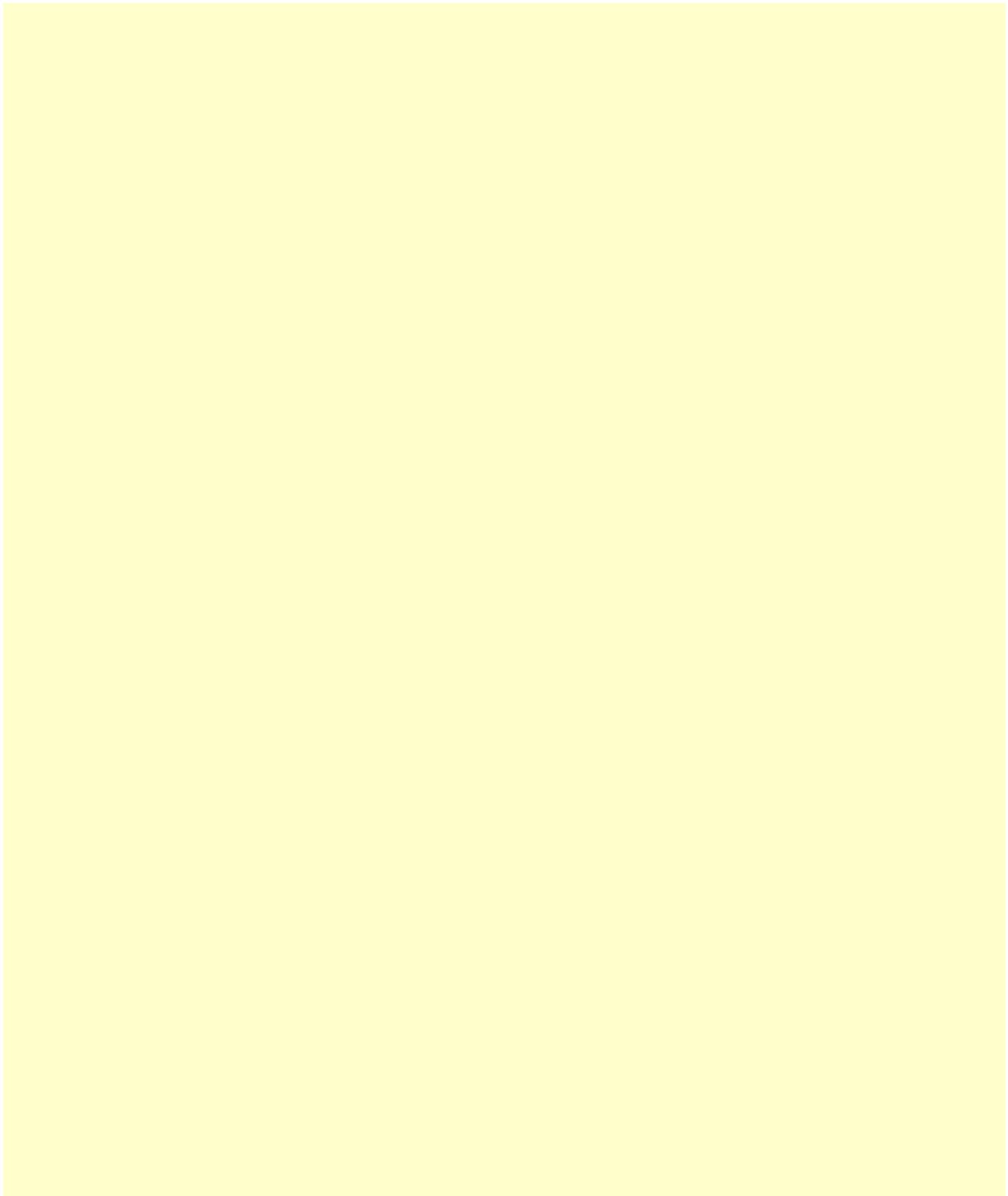
Barge





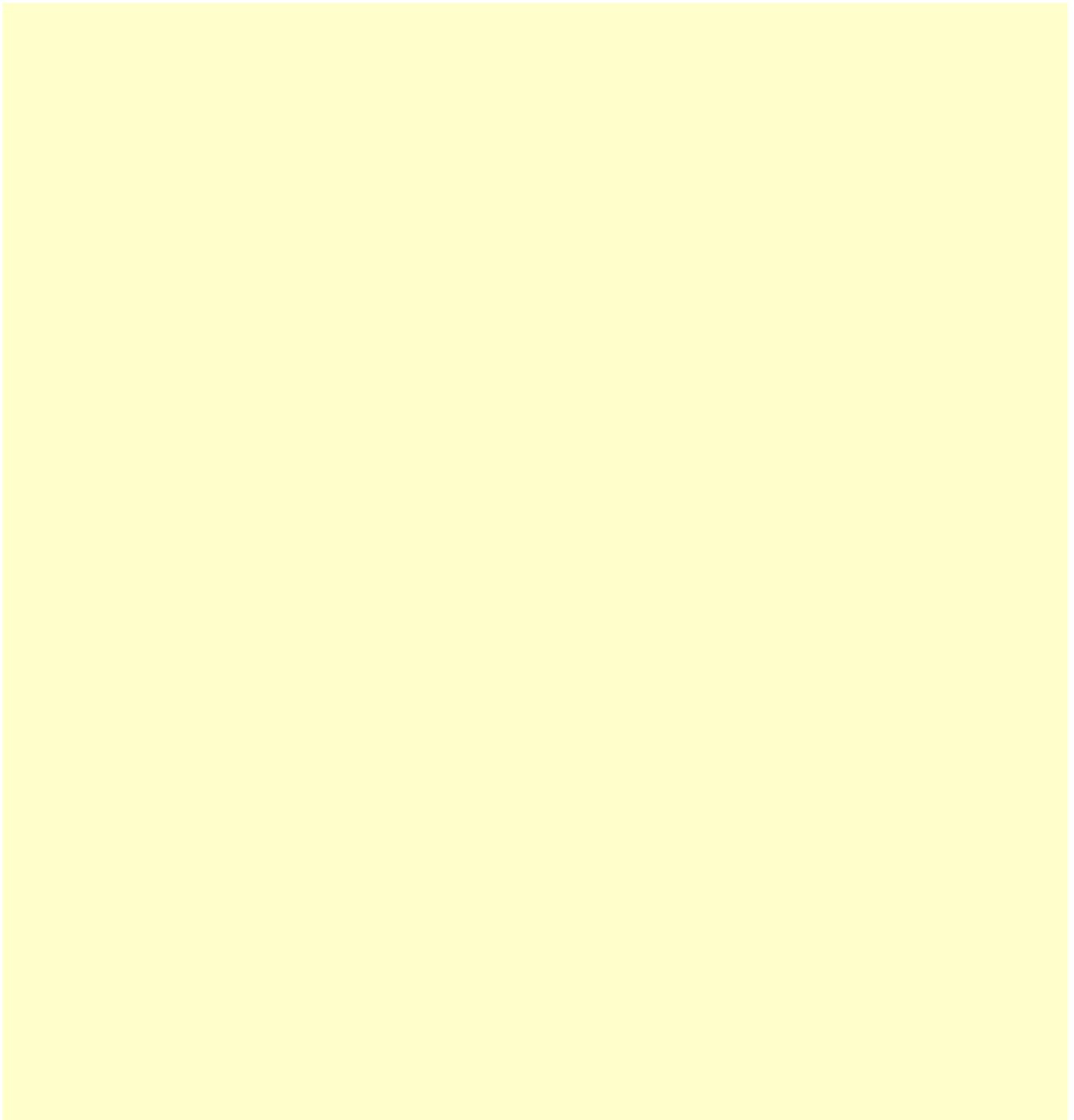








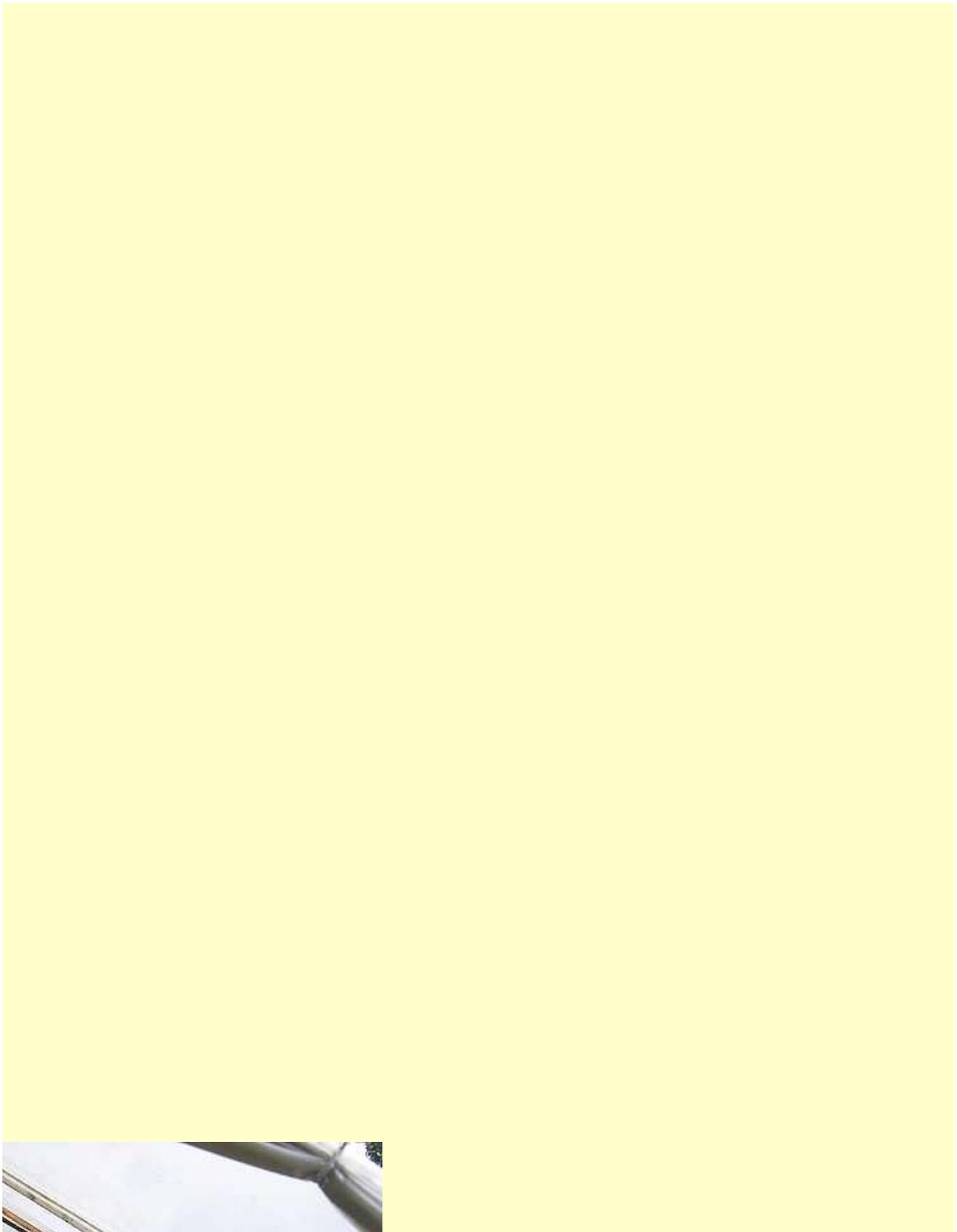






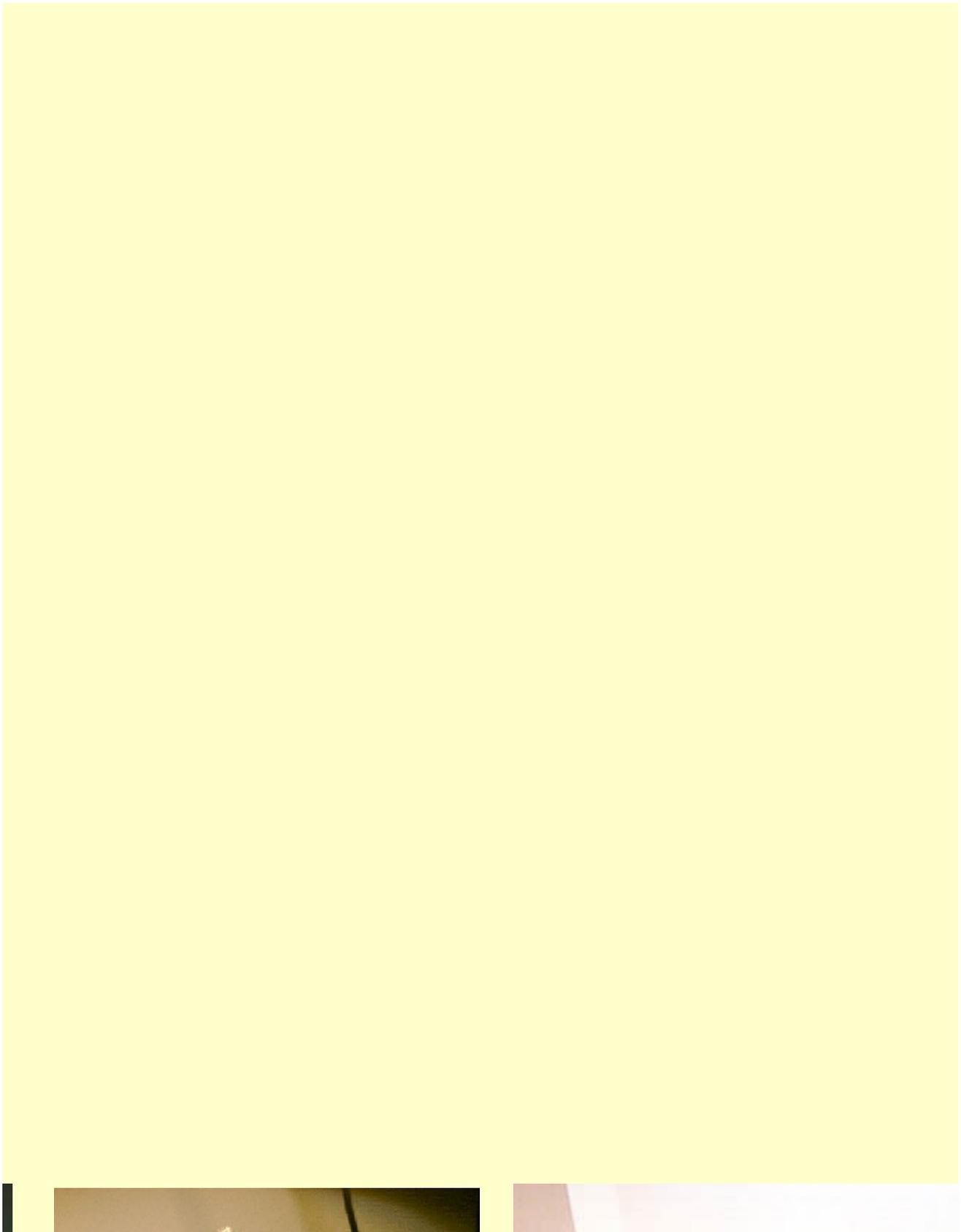




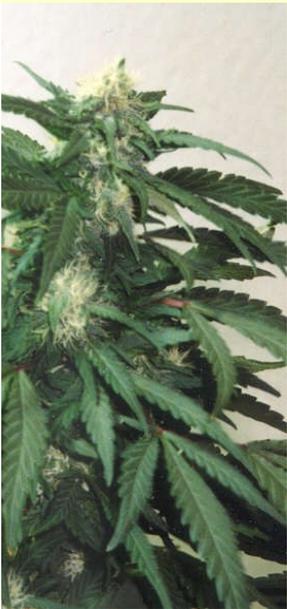


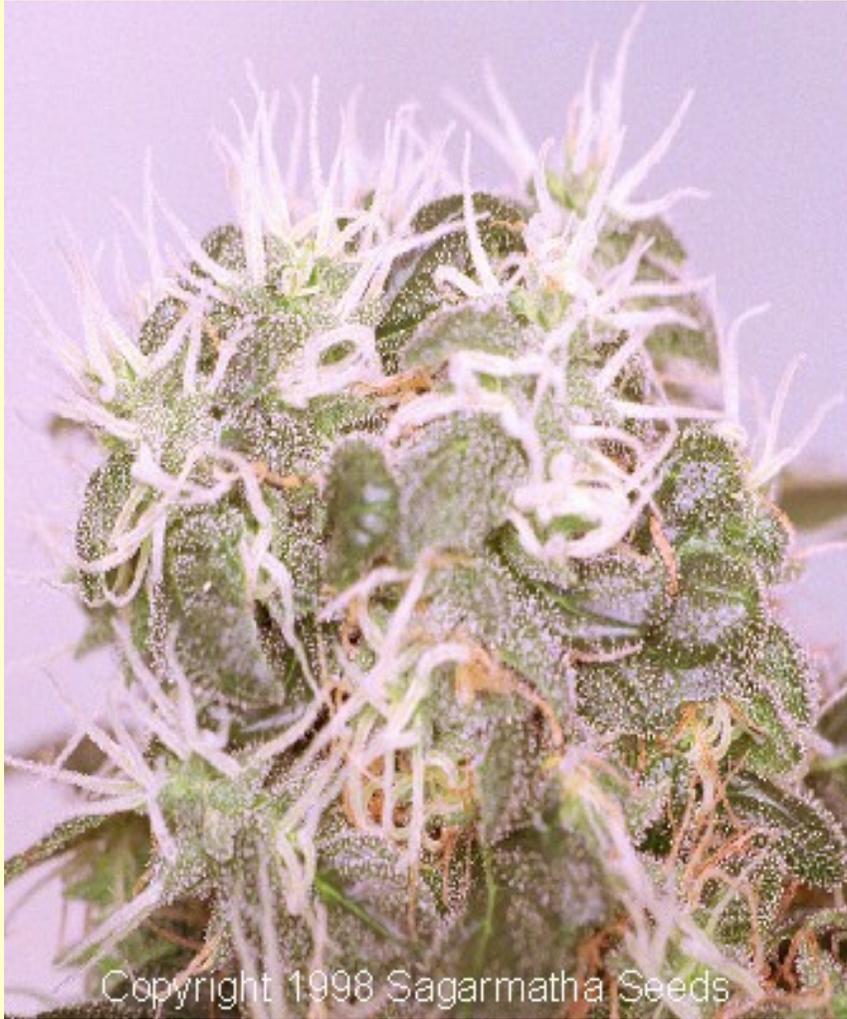




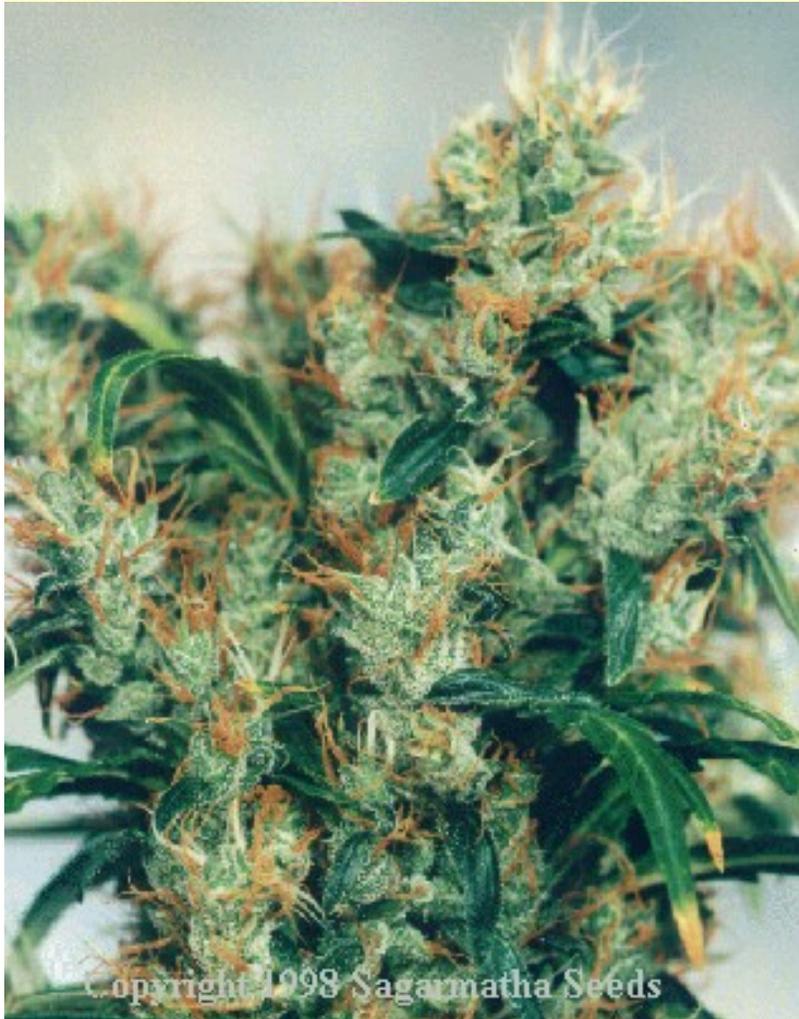






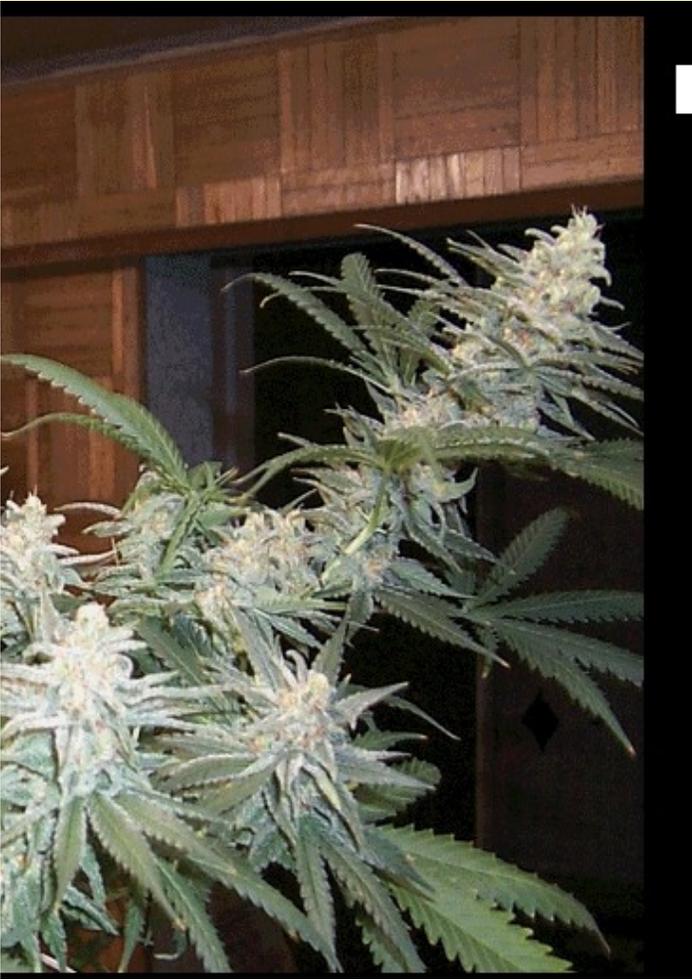


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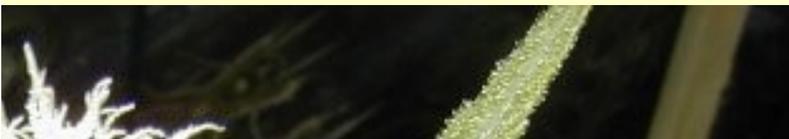
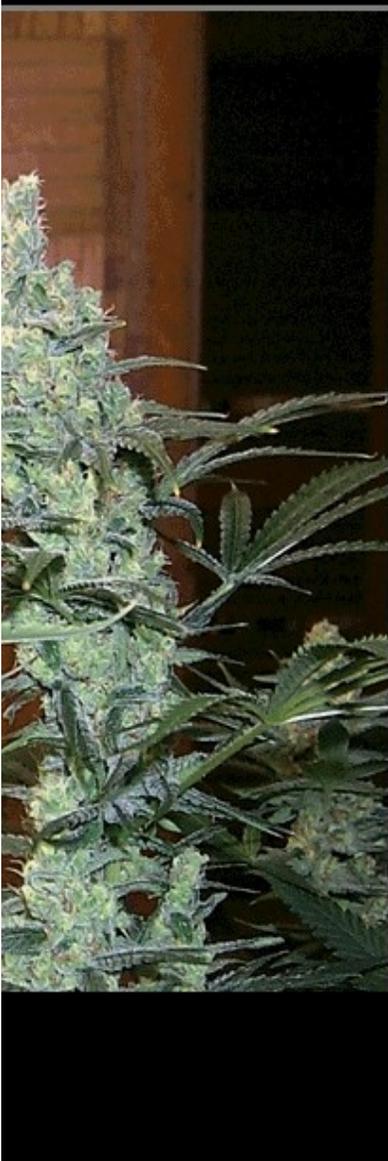


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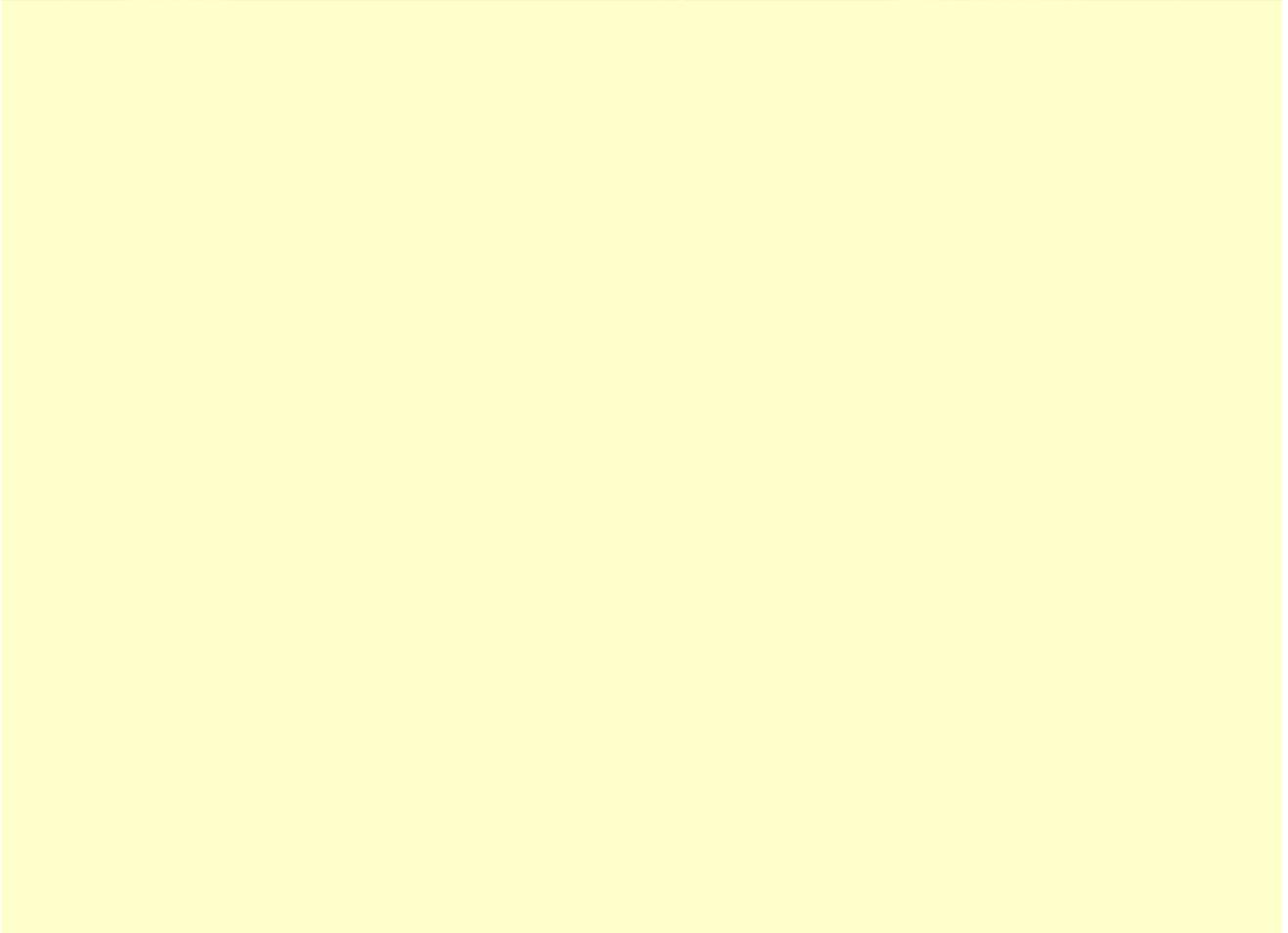




d all the way down

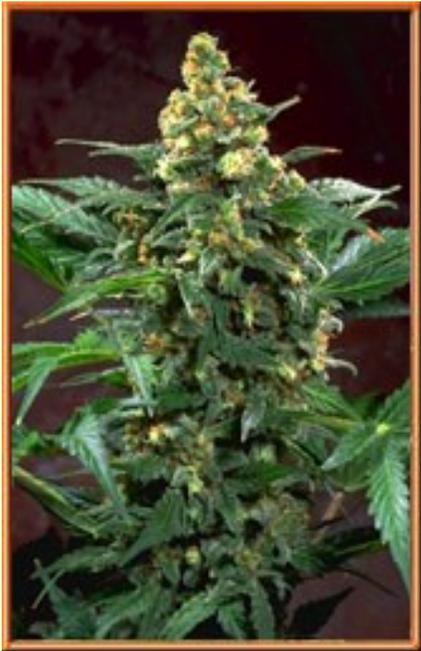




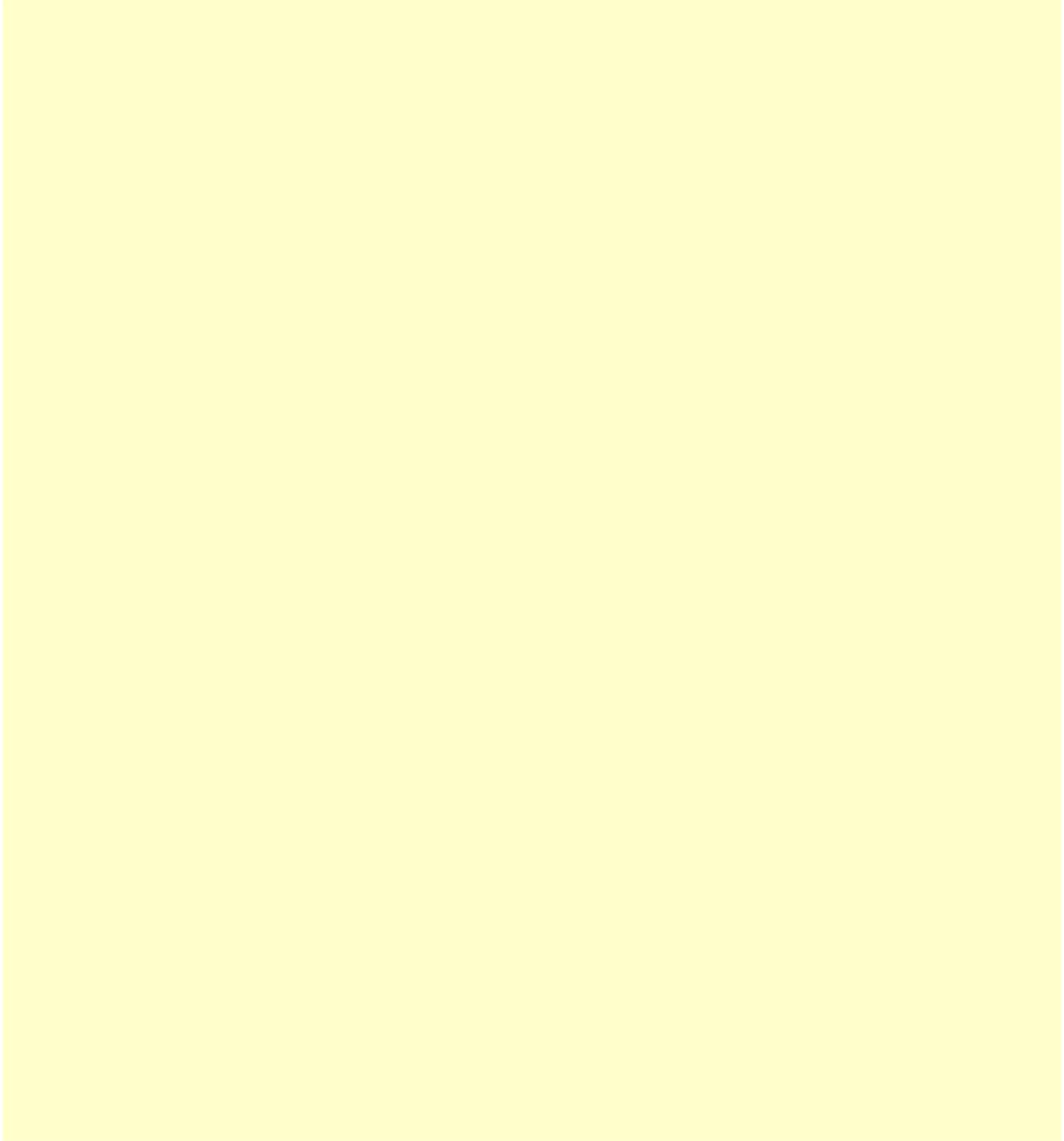
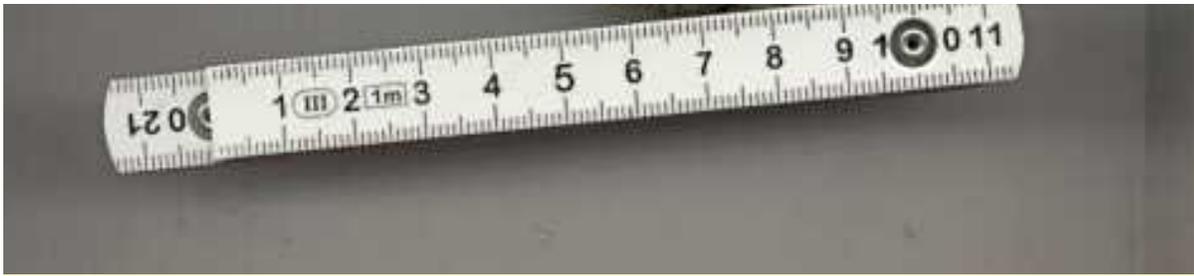


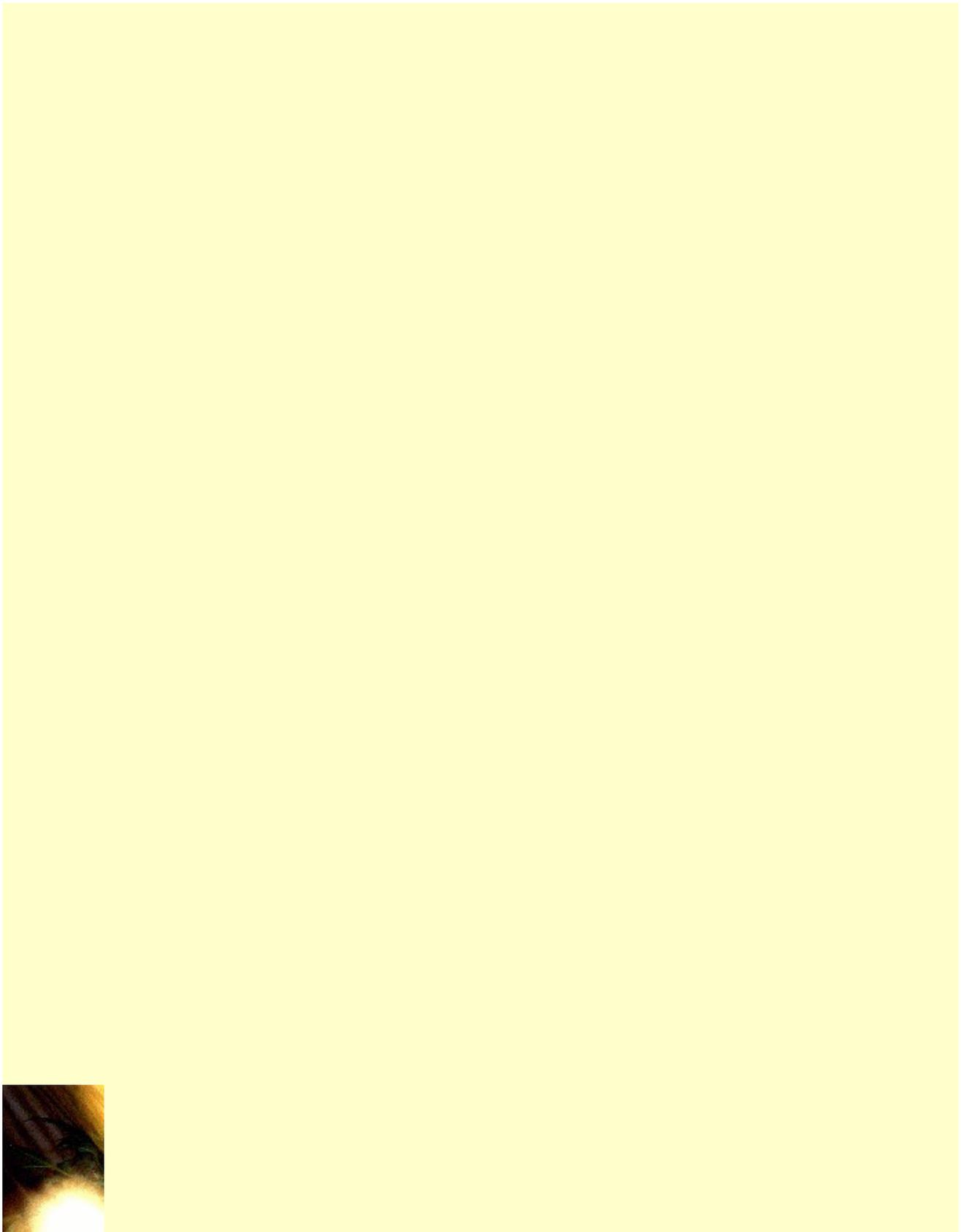




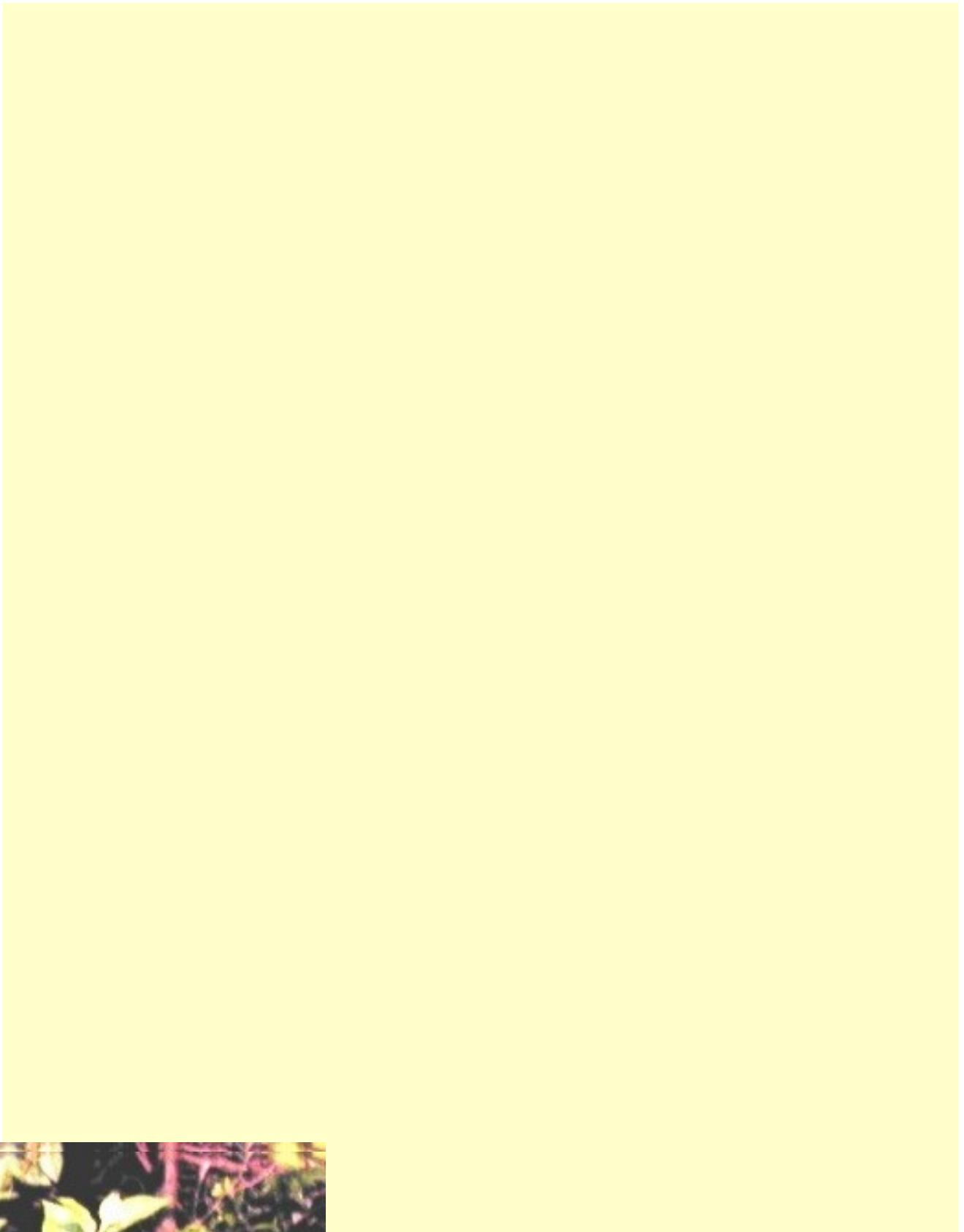








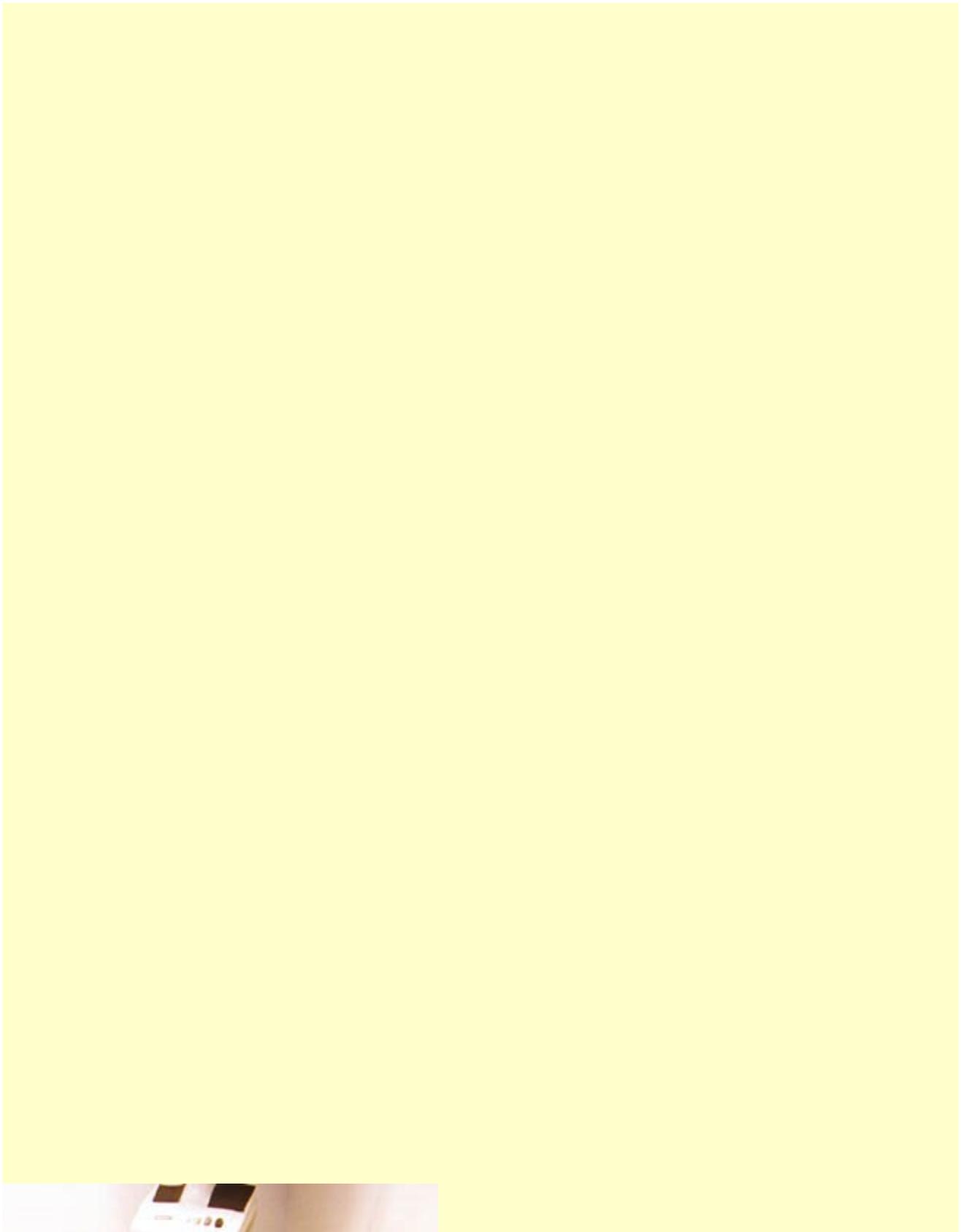




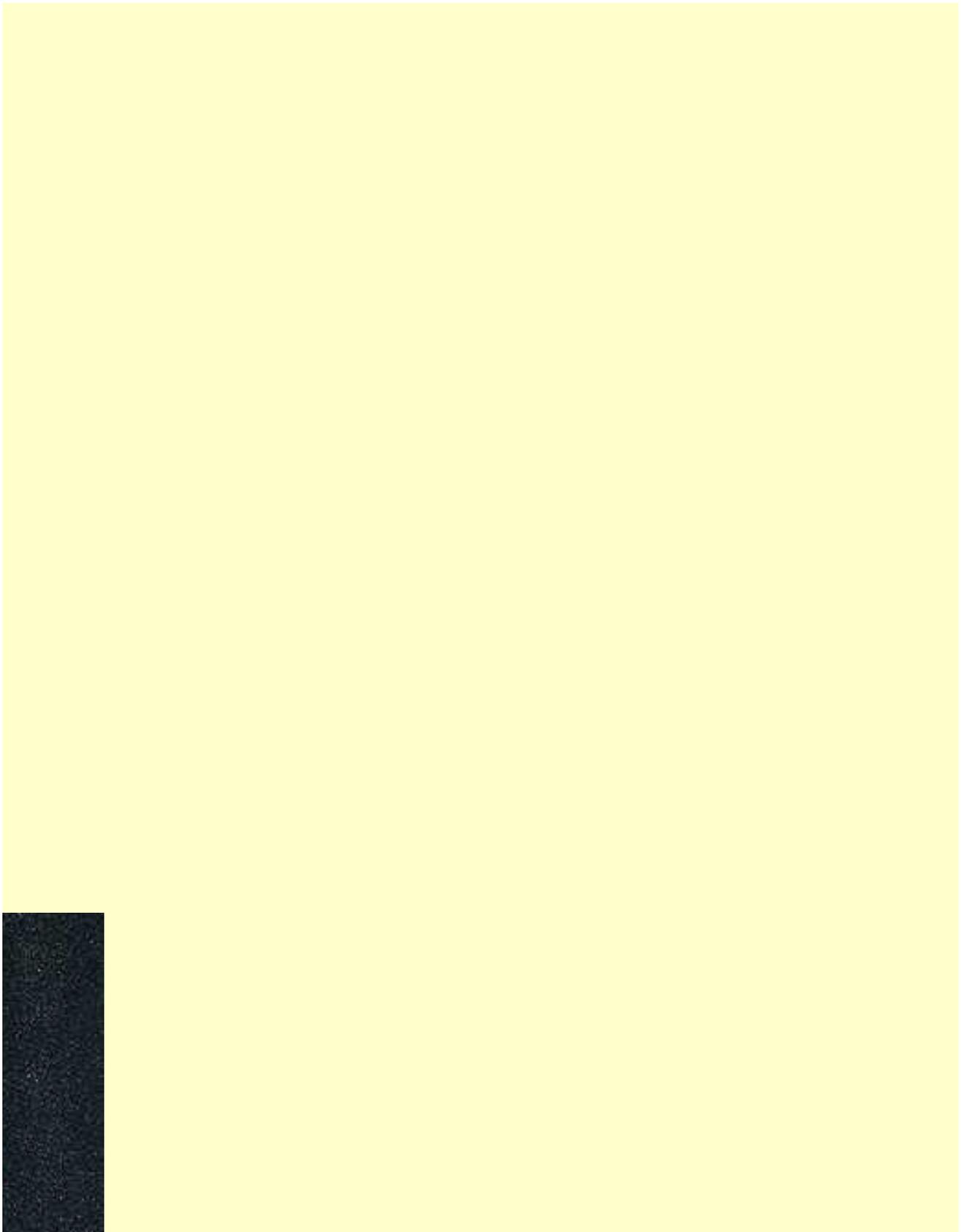


















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[Afghani #1](#)
[AK-47](#)
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[Amsterdam Flame](#)
[Apollo 11](#)
[Apollo 11/13](#)

[Aurora Borealis](#)
[B-52](#)

[Bazooka](#)
[BC Big Bud](#)
[BC Hash Plant](#)

[BC Skunk](#)
[Beatrix Choice](#)

[Big Bud](#)
[Big Bud x Skunk #1](#)
[Big Mac](#)

[Big Sur Holy Weed](#)

[Big Treat](#)

[Black Domina](#)

[Black Hawaiian](#)

[Blue Moonshine](#)
[Blue Mountain Jamaican](#)

[Blue Velvet](#)
[Blue Widow](#)

[BlueBell](#)
[Blueberry](#)
[Bolivian](#)

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[Cotton Candy](#)
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[Domino](#)
[Double Bubble](#)
[Durban](#)

[Durban Poison](#)
[Durban Poison X Mighty Might](#)

[Durban Thai x Cinderella 99](#)
[Durban X Skunk](#)
[Durban/Thai](#)

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[Dutch Dragon ®](#)

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[Early Girl](#)
[Early Pearl](#)

[Early Riser](#)

[Early Skunk](#)

[Eclipse](#)

[El Nino](#)

[Euforia](#)
[Five-in-One](#)

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[Haze #19](#)
[Haze Skunk](#)
[Haze Strains](#)
[Haze X Northern Lights](#)
[Haze#19 x Skunk#1](#)

He to Ni**NL to Sh****Si to Z**

<u>Hempstar</u>	<u>NL#5 X Hawaiian</u>	<u>Silver Haze</u>
<u>Himalayan Gold</u>	<u>Northern Berry</u>	<u>Silver Pearl</u>
<u>Hindu Kush</u>	<u>Northern Lights</u>	<u>Skunk #1</u>
<u>Hollands Hope</u>	<u>Northern Lights #1</u>	<u>Skunk #1 - Basic 5 hybrid</u>
<u>Hollandsch Hoop</u>	<u>Northern Lights #2 a.k.a</u>	<u>Skunk Indica</u>
<u>Huron (Niagara X White Widow)</u>	<u>Northern Lights #5</u>	<u>Skunk Passion</u>
<u>Jack Flash</u>	<u>Northern Lights #5 X Ha</u>	<u>Skunk Red Hair</u>
<u>Jack Herer</u>	<u>Northern Lights #9</u>	<u>Slyder</u>
<u>Jack Herer x Haze</u>	<u>Northern Lights X Shiva</u>	<u>Smokey Bear</u>
<u>K2</u>	<u>Oakland Indica</u>	<u>South Indian x Skunk #1</u>
<u>Kali Mist (a.k.a. Western Winds)</u>	<u>Orange Bud</u>	<u>Special K</u>
<u>KC 33</u>	<u>Orange Strains</u>	<u>StoneBlue</u>
<u>KC36</u>	<u>Original Haze</u>	<u>Stonehedge</u>
<u>Kerala Skunk</u>	<u>Original Misty</u>	<u>Strawberry Blonde</u>
<u>Kong</u>	<u>Peak 19</u>	<u>Super Chrystal</u>
<u>Kush</u>	<u>Pluton 2</u>	<u>Super Haze</u>
<u>Kush X Mighty Mite</u>	<u>Pole Cat</u>	<u>Super Silver Haze</u>
<u>Lady Widow</u>	<u>Polm - a.k.a. Jack Herer</u>	<u>Super Skunk</u>
<u>Lambsbread Skunk</u>	<u>Power Plant</u>	<u>Swazi</u>
<u>Leda Uno</u>	<u>Princess 75</u>	<u>Swazi X Skunk</u>
<u>Leda Uno x Northern Lights</u>	<u>Pure Haze</u>	<u>Sweet Tooth</u>
<u>M39</u>	<u>Purple #1</u>	<u>Swiss Miss</u>
<u>Malawi</u>	<u>Purple Haze</u>	<u>Texada Timewarp</u>
<u>Malawi Gold</u>	<u>Purple High</u>	<u>Thai</u>
<u>Mango</u>	<u>Purple Skunk</u>	<u>Top 44</u>
<u>Mangolian Indica</u>	<u>Purple Star</u>	<u>Trance</u>
<u>Masterkush</u>	<u>Romberry</u>	<u>Twilight</u>
<u>Matanuska Tundra</u>	<u>Romulan</u>	<u>Two Blue</u>
<u>Mazar</u>	<u>Rosetta Stone</u>	<u>Valley Girl</u>
<u>MCW (Mighty Mite x Chemo x W.</u>	<u>Ruderalis</u>	<u>Voodoo</u>
<u>Mighty Mite</u>	<u>Ruderalis Indica</u>	<u>Western Winds</u>
<u>Misty</u>	<u>Sage</u>	<u>White Rhino</u>
<u>Mullimbimby Madness</u>	<u>Sage x Big Sur</u>	<u>White Russian</u>
<u>Nebula</u>	<u>Sensi Skunk</u>	<u>White Widow</u>
<u>Neville's Haze</u>	<u>Sensi Star</u>	<u>White Widow X Northern L</u>
<u>Niagara</u>	<u>Shaman</u>	<u>Williams Wonder</u>
<u>Niagara VE</u>	<u>Shishkeberry</u>	<u>Willy Jack Jack Herer</u>
<u>Niagara X Shiva</u>	<u>Shiva</u>	<u>Yumbolt</u>
<u>Night Queen</u>	<u>Shiva Shanti I and II</u>	
	<u>Shiva Skunk</u>	

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Origins

The Origins of Indicas

In the 60's we brought seed back from Afghanistan and it was a pretty mixed but now call indica type was what was used to make bulk cheap grade hash for export. It came from a high altitude area where the finish time was 8.5 to 10 weeks and a height of 5 ft to 8 ft but all wild slopes nearer the snow line was the wild indigenous sativa type, which was rubbed for consumption. All these were fully seeded and being a wind pollinated plant to some extent. C sativa L types survived via nature being able to grow through the snow and are common in Pakistan Kashmir northern India Nepal and Bhutan just below the snow line. The phenotype [different with every farmer] is rogued for slim leafed plants and selected for this business of knowing an Afghan phenotype is a load of cobbles its just a monotype selected. I suspect that that it was a fairly recent import as it wouldn't have been selected for hash in the west, whatever a Sadu certainly wouldn't smoke it if there was real

On Sativas

“What makes a sativa difficult from a commercial point of view is that a typical sativa requires much encouragement, well beyond what is desirable for sea of green or mass cultivation. It takes up 4 - 8 times the volume of space of a tight compact sativa for the same yield. A sativa 10 - 16 weeks of flowering versus 6 - 9 weeks for an indica, almost 100% require Thai sativa or a Hawaiian Sativa ounce is worth probably four times more than the effort to require that to induce growers to commercially crop a sativa. We know no one paid for a typical ounce price in Vancouver) or \$1,500 US an ounce (4 times US ounce price for any sativa, no matter how fine, so the sativa pot is never on the market. If you want to grow sativa, it will never be sold to you (unless you are visiting Thailand), you must grow

My favorite, with reasonably good yields, is the Hawaiian Sativa, requiring 85 - 90 days to flower. It has good sized buds and does not stretch out of control. The Golden Triangle Thai sativa is also good for flowering. Both are energy inducing, buzz n' crackle, kinds of high. Great for active people and alertness. Of course, amongst friends, a sativa is very prized because there is no other otherwise.

Prior to 1978, what pot was grown in North America was limited to below the 38th parallel in California on down south into Mexico, which is still the world's largest producer of cannabis and it was all sativa. Once the indicas were brought back by American tourists to the states within 7 years, sativas were almost gone from the growing landscape, because of their inefficiency.

The indica crosses by Federation I favor would be with Mikado (indica, 45 days, purple buds, p Sweet Skunk (Sweet Pink Grapefruit indica crossed Big Skunk#1 from Sensi circa 1990, alert, cerebral yet strong stone with a very sweet citrusy scent.)” - Marc Emery
Origins of Northern Lights

“ Northern Lights is a stabilized Cannabis sativa crossed cannabis Afghani hybrid from the 1970's near Seattle, Washington. The northwest of America was the center of indica cannabis meaning " without seeds" , this begins the female clone technique that is common in cannabis breeding. Due to the poor weather associated with this region, growers resorted to growing cannabis inside under lights long before growers in other parts of America. Northern Lights has been highly regarded for many years throughout the

and distributed by Dutch Seed companies, starting with Nevil's Seed Bank then S

The variety was inbred and selected for short early maturing plants with large flo cannabis afghanica parentage most closely. Northern Lights has been preserved inbreeding without any marked improvements other than hybridization with othe Lights is a dark green, fairly short variety with leafy but very resinous floral cluste 12 hour photoperiod to mature completely. Conspicuous about Northern Lights is "Cultivation Tips"

"Northern Lights came from the Seattle area, but I am convinced that the initial g Back in the late 60's and early 70's the principle sources of pot on the West Coas occasional Thai Stick and Nam weed thrown in for good measure. The Thai and N butt, and the entry of Colombian into the market out here in say, oh, 1972 (first I with Mexican. I remember Christmas of 1972 some friends brought up 100 or so p it for anything! No one wanted to smoke the crap. I took off for the holidays and c squatting in the house trying to move the dope, when they had planned on spenc sun. They looked whipped!

Up to that time there was no real point in growing Mex. Oh sure, some tried, I ha you know what they got. I grew two 8 footers in a closet in my flat in the Universi Besides, it was \$100-130 per pound! Why go through the effort? The higher quali as the war was winding down, and Colombian was king at about \$400-450 per po more people started trying to grow. And getting nowhere; huge Christmas tree pl they were lucky.

So, everyone knows what happened then, someone or some group, unknown to r and the rest was history. The first crystallized sativa/indica hybrid I saw was from H the scene had been going on a bit before that. And it was a fricking monster of cc Diego visiting a friend and a grower from Humboldt brought some of this stuff do mean huge, but one small joint of this stuff didn't even get burned down. It went and shock. This couldn't be!

Anyway, Northern Lights didn't just pop up in Seattle. Obviously some seed from here, and we started messing with it. The problem with Seattle of course is that c outside past September, and the California weed was maturing in late October. T but then it needed to be short and quick. Some early results of the breeding activ growing room, about 100 plants in soil buckets under fluorescent lights (and boxe wall). The plant would be recognizable today as essentially Northern Lights. This know were connected to the California scene, no question about it, and I would b plants from there. The time frame is just right, for one of the group was going to But it's also almost certainly true that this same story didn't happen only once. P around here at that time, and never connected with each other, naturally.

I've been growing the same plant from seed and from clones ever since, off and c same plant from that basement room. I have three distinct types, and have repla was able to get ``name" brands from Vancouver. So, for all intents and purposes Northern Lights is, or at least a similar plant. But as to whom actually takes credi various types sold today, that is not known to me. I retain no pure strains, becaus 8 years ago. I bred the three female types against several ``name" strains to pre it looks to me that the Dutch seed companies have the real thing, or close." -SCW

Strain Notes

Colombian & Central American Strains

"There are surely many types of "red" Colombians, Ecuadorians, Panamanians et they have been grown hundreds of years. Its is doubtful that any seedbank would yield is way too low for growing inside. The Dutch have the best commercial seed and growing ease as much as for the high. Those sativas have problems indoors and are naturally predisposed to longer, airier buds and 2. The intensity and spectrum have enough ummmphhh. So, the Dutch breed over and over and over and over Afghan #1 to add bulk and reduce flowering time. They want the most bang for the high not the supreme or even only importance. That's why the real connoisseur prefer from Dutch seeds. The real Acapulco Golds, Colombian Redbuds, Yucatan Golds, Kenyan Mountaintops, Kona Golds, Maui lime greens etc. all have several things in are grown fairly close to the equator and they are all grown outside. The Sun and place just give those outdoors pots a quality of high and power of intensity that e match."-Will

"In S. Cal in the 70's (I lived in Whittier from 70-73 and Redondo Beach from 73-7 primo Mex's that would blow you away. While its true that there were plenty of buds a least 1 or 2 Mex's a month that would turn you slant-eyed---and at only 10 bucks starting getting the commercial Colombians that you described--brown and tan. Cost about 200 a pound because guess what happened in 1971?

The pot world really started to change in 1971--there became a new designated (connoisseur Colombian. These pots cost an unbelievable 50 to 60 dollars a lid --a would ever pay that much until...I smoked some. Colombian redbud--marijuana tobacco and an indescribably "red" flavor and taste. The resin from a smoked joint you had blood on your lip. And Colombo Goldbud--totally gold pot that had absolute or green in it---a spicy piney taste and an exhilarating high and Colombo blackbud devastating "creeper"--one of the hallmarks of the Colombian. These pots were the wave of pots in '72-'73---the sinsemillas. The Mexicans had been losing market share started flooding California with green and brown sineses that could really pack a wal and gold/brown sineses that went for 50-60 bucks--just like the connoisseur Colombian enough, in the 74-75 years Hawaiians started becoming available. They were seen were of course unbelievable and went for up to 100 dollars an oz. (lids out, ounce Thaisticks started becoming available--they were 20 bucks a 2.5-gram stick and v blowaway pot. To round out this smorgasbord was Jamaicans, which briefly were to export crap.

Those times were the best time ever for pot. Plenty of primo Mexicans, sinse, Colombia as the 80's approached, there were lots of more indica based stoner pots that was super heavy Afghans and skunks but the lighter budded sativas became much less runs across some primo Mexican and says that there is actually more good Mexican claims some red Colombo being available. So getting around to my point and that tasty if it is fresh." - DB Cooper

Hawaiian Strains

"Lemme just describe this Hawaiian a bit more for you.. Totally white in appearance color to the buds, combined with a thick coating of resin, it gives that total white

too. There ain't no way I'm trying to break open these nugs with my fingers. sciss the bud like it was one dense mass. Very sweet smoke, has a deep vanilla tone u This is definitely an all time fave (right along with this guy's Blueberry... he's doir

Northern Lights Strains

Because Northern Lights is one of the most widely crossed strains of cannabis, NI heritage are listed under the heading of the cross, i.e. NL x Haze is found under “

Skunk Strains

Because Skunk is perhaps the most widely crossed strain of cannabis, Skunk cross heritage are listed under the heading of the cross, i.e. Haze Skunk is found under

Chronology of The War On Drugs (Neal Smith)

****FOREWORD** (see below)

1840 - During an attempt at alcohol prohibition, then-attorney Abraham Lincoln not crimes...A prohibition law strikes a blow at the very principles upon which

1842 - Cannabis makes up about half of all medicines sold in America. No o

1850 - Cannabis prescribed as the prime medicine for more than 100 separ

1875 - California, in a blatant act of racism, bans Opium smoking by Chinese replaced by smaller, less reputable houses. Usage increases.

1876 - Turkish Hashish exhibition at Philadelphia's Centennial Exhibition wa again to "enhance" their enjoyment of the fair.

1883 - First Federal law against drugs. Congress heavily taxed smoking Opium of raise revenues. Controlled by Treasury Department

1884 - Supreme Court decision making corporations artificial persons. Give:

1888 - Using 1883 Opium taxation law as precedent, Federal government b banned Chinese from importing Opium at all. Government now surrenders r

1894 - Indian Hemp Drugs Commission report released to British. Study dor smoking Cannabis, urges against any prohibition based on "no appreciable p mind,...(and) no moral injury whatever."

1898 - Spanish American war starts, with William Randolph Hearst's "Yellow campaign of racism against Hispanics, Orientals, and Africans, and the thing

1900 - Eli Lilly and Parke Davis, in a joint venture, develops strain of Canna Cannabis Indica, to be used in their medicines. Mellon bank, 6th largest in / Texas.

1906 - Pure Food and Drug Act (Wiley Act) passed. Opens door for governm

1912 - Wiley Act amended, giving government right to determine if a subst

1913 - Pancho Villa, Mexican freedom fighter, recovers 800,000 acres of So value by William Randolph Hearst. Villa and his men are great smokers of "C campaign against Cannabis, using Mexican slang word "Marihuana," and cla Hearst applied Cannabis to Blacks, claiming that after smoking it, Black mer

1914 - Passage of Harrison Anti-Narcotics act, requiring taxation and permit doctors who still prescribed Opiates. Six months later, "American Medicine" risen with sinister consequences resulting from the character of places addic associate with. The news media of the day continues to mis-report drug issu same effect as morphine and cocaine." WWI starts in Europe, with assassi-nation of Arch-duke Franz Ferdinand of Austria in Saraj

1916 - USDA issues bulletin 404, urging the use of Hemp paper. Departmer paper: "Our forests are being cut three times as fast as they grow...it is adv promising plant materials before acritical situation arises." Since Hemp proc the need for hazardous chemicals such as sulfuric acid and dioxins, USDA u

1918 - Alcohol prohibition starts. It's likely that certain interests like duPon production of non-petroleum fuels for the burgeoning automobile industry. c synthetics. Secretary of Treasury reports underground drug trafficking flouri organization, smuggling was rampant, and use of forbidden substances was

1919 - Alcohol prohibition begins, just as Ethanol is about to comp biomass fuels. Mellon has a hand in it.

1921 - Tobacco cigarettes are banned in 14 states.

1924 - Heroin importation or manufacture was banned, despite it's pain kill illegal use increases. William J. Burns (of Burns Detective agency), now Bure the proof is very conclusive...overwhelming that in all strikes in the United S These radicals...take advantage of the ordinary strikes that occur throughou and disorder." Racial unrest was consistently, according to Burns, ascribed t was considered a matter of "a general intelligence nature," along with radic organization among unskilled Blacks as especially sinister. Bureau finally rei Harlan F. Stone voiced fear that "a secret police may become a menace to f the possibility of abuses of power which are not always quickly apprehender interested in politics or other opinions of individuals, concerned only with th Hoover, Burns have to go along. Even with Bureau out of radical hunting pic red scare' alive.

1926 - Herbert Hoover sets up Chemical Advisory Committees with Fraternal race of supermen

with drugs.

1927 - Enforcement of Wiley act moved from Bureau of Chemistry (USDA) Administration." Given further powers to ban "harmful additives." No real criteria for determination of what is harmful and what is not. Government has responsibility

1928 - duPont contributed major money to get Herbert Hoover elected president over Catholic liberal Al Smith.

1929 - "Great Depression" causes hundreds of suicides over financial losses. Finding Hemp is most efficient. Plans to build car from plant material, especially

1930 - Harry Anslinger, the nephew-in-law of Andrew Mellon, is appointed head of

1931 - Siler Commission report on soldier's use of Cannabis in Panama released. Claim of the drug (sic) is not widespread and...it's effects on military efficiency and for renewing the penalties formerly exacted." Anslinger attends the first international conference with Baron Von Rheinbaben, head of the German delegation. Von Rheinbaben worked for Intelligence in Lisbon, Portugal during the war. Anslinger kept in touch with him on very delicate matters."

1935 - Firearms tax act, legal precedent for Marijuana Tax Act. Avoided controversy by claiming something the government claimed was bad. Hemp decorticator developed.

1936 - Meetings between duPont and Treasury department. Formulation of

1937 - Marijuana Tax Act passed Congress, providing for required permits, etc. "Profitable and Desirable Crop" article in Mechanical Engineering magazine published. Nylon and sulfuric acid paper process both patented by duPont, after M. I. grow Hemp for fuel, plastics, etc.

1938 - "Billion Dollar Crop" article printed in "Popular Mechanics" magazine. Marijuana Tax Act of 1937. Federal Food, Drug and Cosmetic act passed. Shifted burden of

1940 - Standard Oil of New Jersey and I.G. Farben of Germany opens the slick road gasoline from coal. Hitler's government supplied Jews and political dissidents who were murdered. Perhaps the forerunner of the plan to imprison peaceful Marijuana

1941 - Popular Mechanics issue of December reports Ford Motor Company

fibers. More durable than steel, lighter weight, and furthers Ford's belief that

1944 - New York Mayor LaGuardia issues his report on Cannabis smoking. "Cannabis does not develop addiction or tolerance...and is not a direct causal factor in

1945 - War ends. Nazi war crimes trials are set up. U.S. Army and Navy set up the War Relocation Authority into American intelligence community. Up to 350 specialists approved by U.S. Army dependent on scientific knowledge over the Soviets, urges Nazi scientists be held in prison, starts anti-Soviet espionage unit with his former Nazi aides; assigned to the War Relocation Study Group." Prior to surrender to Americans, Gehlen buries microfilmed documents and turns over to interrogation center. Gens. Siebert, Smith, OSS leader Alan Dulles, and other units. Gehlen, 3 assistants sent to Washington for debriefing. Siebert given command of his own authority."

1949 - Law enforcement crack down on non-prescription barbiturates triggered

1956 - U.S. Narcotic Control Act provides death penalty for selling Heroin to

1962 - Congress passes legislation increasing F.D.A.'s ability to limit drug supply, curbing skyrocketing use by 1970.

1965 Amphetamine enforcement intensifies. Causes a "boom in Cocaine smuggling

1966 - Syva division of Syntex begins biochemical research to develop urine

1968 - Campaign against Cannabis use by soldiers in Vietnam results in increased support with the intent of implementing their tried and true Gestapo tactics of surveillance, indoctrination, dispersion and disruption under COINTELPRO. Anti-war, anti-nuclear, pro-environmentalists and others now suffer the same treatment as communists and blacks. Author Frankford writes that COINTELPRO was an undisguised assault by the self-appointed defenders of the status quo. The government, however, did not count on the dedication and tenacity of what was then a fringe attitude among many of the Hippies, the government has only limited success in targeting them; however, target the Students for a Democratic Society (SDS) and its military wing, the Weathermen, in a riot at the Chicago Democratic National Convention, SDS leaders Abbie Hoffman and Jerry Rubin were arrested. SDS survived for several years, but was severely weakened by the Chicago Police Riot and the Streets Act of 1968. This act authorized the federal courts to issue wiretaps on individuals if there is probable cause for belief that an individual is committing, has committed, or is about to commit crimes. The House Un-American Affairs Committee (HUAC) is dissolved and replaced by the Select Committee on Assassinations. This committee is established to keep an eye on organizations whose goal is to subvert the internal security of the United States." Just what constitutes a threat to "internal security" and "hiding of actions behind the catch-all phrase "National security" became entirely subjective. Actions of members of government or political parties. Has been used mostly

presidents since. The Gun Control Act of 1968 passes. It is directly written fi

1969 - New York City increases drug arrests by 9000. No impact on drug av
case that in a criminal proceeding, the court must be notified of evidence ov
evidence was illegally obtained, the defendant has the right to review the e
the entire case. A refusal by the government to reveal the surveillance, or it

1971 - Nixon declares drugs "Public Enemy Number One

1972 - Shafer commission report issued. Finds no reason that Cannabis sho
of calling for relegalization. Finds no physical, mental, or moral problems wi
refuses to accept findings. Nixon calls drugs "America's public enemy #1." (C
noted. By 1972 Communists were becoming an endangered species. Bureau
Left," such as Women's Liberation Movement, Gay movement, Anti-War Mov
for awhile) and Hemp (at that time Marijuana) Movement.

1973 - Nixon declares "We have turned the corner on drug addiction in Ame
New York. Little effect noted. Nixon's staff, upset by the counter demonstrat
foreign and communist money financed anti-Nixon efforts. The CIA is still ur
changes the story to mean "foreign support," a vague statement that, in rea
war either. Juan Peron briefly seizes power once again in Argentina. He dies
financed by his late wife Evita's fortune of Nazi money. Thanks to the Peron
firmly entrenched in not only Argentina, but all of South America.

1974 - Rubin, Comitas study "Ganja in Jamaica" released. Finds no long terr
Budget for drug enforcement reaches \$292 Million dollars. \$462 Million earr
400 page report claiming Marijuana traffic constitutes an unprecedented thi
country's morals. The report, as most are, is full of falsehoods and outright l
government or "communism" has anything to do with Marijuana or drug traf

1976 - F.D.A. powers expanded to control all "medical devices."

1980 - Costa Rica studies released on Cannabis. No distinguishable harm fo
developed. With aggressive marketting to industry, government, military, E
to nothing.

1981 - U.S. Military begins forced urine testing of military troops. Drug cont
\$1,531,000

1984 - Seal unloads a shipment of Cocaine in Nicaragua. He had picked up
Nicaragua. Seal had been arrested on drug charges in 1982, and beat the a

Medellin Cartel. The CIA had fitted Seal's plane with hidden cameras for the Cocaine being smuggled, which the Reagan Administration used to try and s DEA became upset that the CIA had co-opted its sting operation in favor of providing pro-Contra propaganda. Seal's cover was blo DEA. Seal was sent to prison for his drug conviction, but was shortly release gunmen." The CIA kept Seal's plane, "The Fat Lady" and pressed it into serv America and the U.S., much of it coming in through Mena, Arkansas. Pilot Eu Sandinistas in Nicaragua, and promptly claimed the protection of President

1985 - Milton, Wisconsin high school students forced to submit to weekly ur personnel, except union players, submit to urine tests. By 1990, even ball pla are encouraged by government to begin wholesale drug testing. Many comply.

1987 - Nearly half of all major American industry is now forcibly urine testin

1988 - U.S. Senate adds \$2.6 Billion to federal anti-drug efforts. Little effec requires annual "National Drug Control Strategies" be presented, complete Movement, now encompassing the industrial and medical benefits of the pla

1989 - Dr. John P. Morgan finds drug testing "...far from reliable...testing co testers are poorly trained, uncertified. Drug budget reaches \$6.7 Billion doll polls. President Bush institutes his first drug control strategy, which emphas Billion dollars.

1990 - Drug budget for this year is \$9.7 Billion dollars...and rising every year

1991 - NIDA reports drug testing more for surveillance than safety. Drug Bu

1992 - Bill Clinton elected President. Steps up "War on Drugs." Drug budget

1993 - Dr. Joycelyn Elders, U.S. Surgeon General, calls for discussion on rele Elders son is arrested and charged with possession of Cocaine. Drug budget

1994 - Secretary General of Interpol, Raymond Kendall, lends his voice to tl drugs," as unwinnable and too costly, proposes what he terms depenalizatio excise taxes as being in violation of double jeopardy points in Constitution. a year crop, while still illegal. Estimates of the nation's largest legal crop, cc run ads, otherwise encourage citizens to turn in drug users, with an emphas or prison for Cannabis related crimes, at a cost of \$25,000 to \$27,000 dollar history to ban firearms from citizen possession. Attempt at passing yet anot types of "assault" rifles. Would provide money for 100 thousand more police

nation's prison population are behind bars for Cannabis "crimes," and you are more likely to be arrested with Cannabis than for killing someone. Widespread police use of road block and stop-and-frisk tactics force driver's into consenting to vehicle searches. Police begin to use "Profiling," a method of finding drugs. Drug budget up to \$12,184,400,000

1995 - Drug budget: \$13.2 Billion dollars.

1996 - Clinton wins a second term as President. He names retired Army General Brent Scowcroft as his new drug Czar. California passes Proposition 215 under a doctor's order. Arizona passes Proposition 200 which allows a doctor to prescribe Marijuana. Attorney General Dan Lungren tries every stalling tactic possible until the U.S. Supreme Court charges. Lungren runs for Governor, loses. New California Attorney General Bill Lockyer allows citizens, with open-minded local governments do get needed medicine. Arizona passes Proposition 203 to the ballot box in 1997 and vote it back in. Drug budget: \$13.4 Billion dollars.

1997 - Nearly 642 thousand arrests are made in 1996 for Marijuana. 545 thousand arrests in the Clinton Administration is responsible for about 2.1 million Marijuana arrests. 545 thousand arrests on a Marijuana charge. The U.S. Supreme Court in April ruled a Georgia law requiring a urine test for drugs. According to the court, the law failed to override 4th Amendment provisions. Canadian authorities rule that bona fide medical use is not a crime. Clinton announces doctors who prescribe or recommend Marijuana will be prosecuted and lose their ability to write prescriptions. The U.S. Supreme Court rules that Marijuana cultivation books are not obscene. Federal agents seize 331 Marijuana plants and a Marijuana Buyers Club in San Francisco. An Australian study shows the health of long-term Marijuana smokers is no different that of the general population. "We don't see evidence of high psychological distress," says the study's lead investigator David Reilly. "The results are unremarkable; the exceptional thing is that they are not." Barney Frank introduces a Medical Marijuana Bill in the House. Bill is virtually ignored. U.S. government's opposition to Medical Marijuana "Misguided, heavy-handed, and hypocritical," and calls on the government to change Marijuana from a crime to a medicine. U.C.L.A. School of Medicine showing that no long term lung damage is evident in long-term Marijuana smokers. Investigation into the study conducted by Dr. Donald Tashkin. "Neither the current study nor any significantly different rates of decline in (lung function) as compared to the general population. A comprehensive, long-term study by Kaiser Permanente shows no substantiated health problems. Researchers conclude that Marijuana Prohibition causes much greater harm. Researchers find no health problems in patients who reported smoking Marijuana as compared to those who had never smoked. Drug budget: \$13.4 Billion dollars.

1998 - Marijuana becomes the nation's fourth largest crop, in spite of being prohibited. **Nearly 700 hundred thousand arrests for Marijuana were made on simple possession charges...the remaining 13% on sales or cultivation charges. Nearly 2.8 million Marijuana arrests have been made.** Yet another study shows that long-term Marijuana smokers are no more likely to have a heart attack or stroke than the general population. This one is from Australia. Clinton's tolerance of Marijuana in the Netherlands has had no effect on crime in that country. In fact, the Netherlands murder rate is 440% lower than the U.S. In fact, American kids are more likely to try Marijuana than American kids. The fact is that that 21% of American kids are more likely to try Marijuana during the same time period. It's not the first time McCaffery

New Scientist exposed a conspiracy from the World Health Organization with Marijuana. An unnamed National Institute on Drug Abuse (NIDA) and someone (sic) "warned the WHO that it would play into the hands of groups campaigning for Marijuana. Marijuana fared well in 5 of 7 long-term health comparisons. Further, the WHO found that Marijuana does not cause such conditions as blocked airways or emphysema, nor was it seriously addictive nor did it take student financial aid away from those caught with drugs. One time offenders for two years. Students are allowed eligibility in the participation tests. A coalition of Republican representatives on the House Judiciary Committee passed a resolution stating "Marijuana is a dangerous and addictive drug and should be eliminated from the workplace. Workplace drug testing has a negative impact on worker productivity. The study found that pre-employment and random testing procedures reduced productivity in all American companies have some sort of drug testing protocol. Urine tests are required. Congress approves 23 million dollars to develop a fungus that destroys Marijuana. The negative impact on the environment. Congress pushes the program anyway. NEVADA PASS MEDICAL MARIJUANA LEGAL REFORMS! The residents of Washington were denied because of a last-minute bill introduced by Rep. Bob Barr (R-Ga), no money was spent in American history, and with impunity, negated the results of an American court case. A judge ordered the ballot box sealed until the court could hear the case. It was rejected by the initiative by 62%. Nevertheless, Congress, which has financial control over the initiative from being put into law! As usual, nothing is done. Several public hearings are held on relegalizing for medicine. Most Medical Associations favor an end to Marijuana. The Mississippi legislature by Rep. Bobby Moak (R-Lincoln County) authorizes "The court imposed by the court for violations of the Controlled Substances law." Law Professor George A. Stone at Columbia University releases a study stating that Marijuana use in violent crime study showed less than one percent of persons who committed crimes were violent crime. Further, the study shows only between one and four percent of persons used Cocaine or Heroin during the commission of crime. U.S. House of Representatives member Tom Lantos criticizes the activity on the part of government in the War on Drugs. He urges Drug Czar Robert C. Anderson to end drug use in America. America spends on average of \$30 billion annually on the War on Drugs. Representative John Dingchich authored a bill calling for the death penalty for anyone caught importing or exporting Marijuana. That could include anyone carrying more than 50 grams of Marijuana over the border. Marijuana-like chemicals are produced naturally by the human body to combat pain. Anandamides, chemicals similar in structure to chemicals contained in Marijuana. Marijuana is an analgesic, according to Dr. John Morgan, a long time Marijuana researcher. \$15.9 Billion.

1999 - A U.S. Air Force directive in February forbids all personnel from using Marijuana. A pilot can not distinguish between legal Hemp products and Marijuana. It is revealed that a pilot employee testified to the environmental and human damage caused by the use of Marijuana. He had been in a helicopter involved in the CAMP program...would say "Yes, we have guidelines.) ...We got as close as we could to treetops to hover; we have local law enforcement, sheriff and CAMP officer Gary Holder. The hearings are part of a class action lawsuit filed by the American Farm Bureau Federation withdrew language from previous statement on Marijuana. The Farm Bureau says it dropped its opposition because farmers are making profits from Hemp go as high as \$141 per acre. The Institute of Medicine (IOM) study found that Marijuana has a low potential for abuse. IOM supports an administrative petition to legalize Marijuana. The study, commissioned by the Clinton Administration, also shows no significant health effects stronger drugs. "Except for the harms associated with smoking, the adverse effects of Marijuana are tolerated for other medications." Clinton, as Nixon before him in dealing with Marijuana.

study published in the February 4, 1999 issue of the New England Journal of use. Further, Marijuana shows "No reliable impact on birth size, length of ge according to Dr. John Morgan, of NORML. This year's drug war budget will co dollars more than President Clinton had requested. In December, a conferer massive protest of that body that seeks to control the commerce of the enti are likely causes of the trouble. Crowd is fired on with rubber bullets and "Fl weapons. Several hundred arrests are made. Evidence that police launched deny that they used this weapon. Many of the delegates refuse to agree on finally confirmed by some of America's allies. The system was first put into p The system is designed to spy on the citizens of several countries, including Some Drugs is rampant across the nation.

2000 - The annual budget for the War On Some Drugs request is the highest known as of this writing how much will actually be spent. As of this writing, dollars to arm the nation of Columbia in the War On Some Drugs. Many fear million people are behind bars in America. **With approximately 10% of th the world's prisoners. Of the two million, approximately 61% are ja approximately 82% are in on Marijuana charges. Of that subset, 65' surface on the overuse of drugs like Prozac and Ritalin on preschool children**

****FOREWORD**

What you are about to read is a compilation of history. R. William Davis and asking the question: "Why is Marijuana illegal?" Every time we found an answer, it led to several more questions. Randy had been looking into other concerning the Nazis of Germany. He soon drew a connection between the and members of the government and industries of The United States.

Much of politics of the first half of the 20th century centered around oil and available to those who transformed decayed plant material into gasoline for industry, home heating, lubrication and the new idea of synthetics...plastics Rockefellers were, and still are, at the top of the heap. Those who supported the Mellon banking family, also profited greatly. Andrew Mellon, who had in money in Rockefeller, wasn't going to lose the chance of becoming fabulous Mellon's, the duPont family, in addition to building companies like General M synthetic fibers and plastics from petroleum. Law firms like Brown Brothers work for these and others. Media giants like the Hearsts were more than ha filthy rich by putting out whatever their cronies said was news. These people for the health and well-being of society at large. Indeed, the less the average rich man. Strangely enough, it was many of these same people who were re of Hemp/Marijuana.

Hemp, the plant that humans have used for several millenia, and the indust cloth, rope and oil, was on hard times. Hemp, though growing luxuriously throughout America's farmland, was extremely labor-intensive. Until the ave Hemp had to be harvested in large part by hand. American industry needed

more than Hemp could produce in this way.

The Decorticator came on the scene in 1935. Hemp was on its way once again. The petroleum industry saw a problem: Fuel could be made from Hemp that would be more efficient, and with a greater supply than crude petroleum oil. Rudolf Diesel's engine intended it to burn vegetable oil, mainly Hemp. Hemp was already a viable fuel source, which was of importance to the young aviation industry. Hemp oil did not break apart chemically at high altitudes like petroleum did. Now with the Decorticator on its way...again.

Hemp, as I'm sure you know, is in the same family as Marijuana...the flower species of *Cannabis Sativa* L. It was smoked freely, in the form of Hashish, and was very popular in America's bigger cities. But Blacks and Hispanics were known to use the stems and leaves. Jazz musicians of the period were known smokers of "Reefer." The cronies found an excuse to drive Hemp away: Claim all sorts of bad things about it to create a distinction between Hemp and Marijuana so the average person who wouldn't know the difference would be taken away. Do this by playing on White America's racism. Scare tactics would drive you insane or lead you to more insidious drugs like Heroin and Cocaine. "Madness" was well played. Well played enough to cause Congress to pass the Marihuana Tax Act of 1937. Hemp was crippled. Big oil was safe.

Meanwhile, Adolph Hitler was building Germany into a war machine with the help of the industrialists that wanted to ban Hemp! Hitler had no oil. Rockefeller did. We know the rest of the Hitler story.

After World War II, our intelligence community turned its attention to the Soviet Union. It used former Nazi intelligence agents as well as other Nazis against the Russians. Thousands of former Nazis, many of them war criminals, were brought into the United States and placed in the Central Intelligence Agency. They brought their hatred, their inhuman experiences, and their desire to subjugate all for the greater good of National Socialism. With the help of American politicians, their policies became entrenched. Their policies still rule America today.

The prohibition of Hemp/Marijuana was fallout-part of a much bigger picture. Total control over what we read, see, hear, eat, and smoke. The policies that led to Marijuana prohibition are the same policies that have taken away the freedoms Americans hold dear.

This piece is a chronology of the events of the 20th century, into the first decade of the "War On (Some) Drugs" Americans now stand to lose all of our freedoms. It is a very complex concept. When you look at the inter-related events in context, you begin to see how and why the government we have now is bogged down.

If you wish to replicate or further investigate any of this, and I urge you to do so, please see the bibliography. Over the past seven years, I have checked and cross checked, researched and confirmed any and all available sources on this information. The information is too well protected for anyone to get at right now. Which in and of itself is a violation of a free society.

Neal Smith 3-12-00

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Multinational Corporations And The War On Drugs

by By Reverend Damuzi (11 Jan, 2000)

<http://www.cannabisculture.com/>

Free Trade is just another word for banning all your her

The War on Drugs is a trade war being fought by multinational pharmaceuticals, who want to ban all natural herbs and mono-synthetic drugs. Their strategy is now being copied by multinational corporations in other arenas.

The war on drugs has repeatedly been a justification for countries over-developed corporate sectors, like the United States and E

prey upon weaker countries, like those in South America. Some enemy has been opium, sometimes it has been marijuana, but have always been cut down alongside the plants and multinational corporations have always benefited as a result. The newest phrase to describe the benefits multinationals derive from such human "free trade."

Historical Drug Wars

Historically, wars for control of enlightening plants have provided justification for violence and warfare. The same cultural dominance control achieved by Spanish prohibition of morning glory among the Aztecs in the 1600's, and by British opium traders to China, is being achieved today by multinational corporations, which seek to prohibit natural unpatentable medicines and replace them with synthetic drugs: patented and highly profitable.

Morning Glory

In South America during the 1600's, Spanish priests branded the morning glory plant "evil" and soldiers set forth to burn "Satanic" villages and kill Amerindian shamans. Spanish invaders were doing what they believed was right and good when they roasted Amerindians alive for eating morning glory seeds. Dispirited South American Indians were rounded up and converted to Catholicism. Destitute societies were easy prey for further colonial expansion.

Natives were forced to give up ancient traditions and live the way Europeans did or be killed. Ancient shamanistic cultures stopped directly to the earth for what they needed, and started buying from European distributors. Once the old way of acquiring necessary goods was lost, Amerindians became wholly reliant upon European merchandise.

Opium War

An almost opposite situation occurred during the 1800's, when China refused to take any more English opium, Britain retaliated by instigating the "Opium War", destroying the Chinese navy and forcing China to import British opium. There were no English missionaries and no troops with sermons on the "evils" of drugs during the Opium War. The moral majority was conspicuously silent.

Both the South American natives and the Chinese were forced aspects of what we presently call "free trade". In 17th century America, an aggressively corporate country displaced the traditional non-corporate pattern of South American trade. A generally free market was eradicated in favour of a market of product control. Products were controlled by English manufacturers because the South American lacked the technology to reproduce products like metal kettles.

In 19th century China, national trade restrictions were rolled back by force of British naval superiority, allowing English drug producers unimpeded access to Asian markets.

A modern definition of "Free trade" would describe it as, essentially, a patent-oriented market of product control without national trade restrictions. The economic effects of the Opium War and the Spanish colonization of South America are much the same as the economic effects of free trade on nations today.

Pharmaceutical Companies Monopolize Drug Trade

For 100 years after the Opium War, western pharmaceutical companies continued to export shiploads of opium and opium products (lilium) to the east. While Britain slowed its drug exports to China, Switzerland and Dutch pharmaceutical companies took up the slack.

The shipments to China continued even despite the fact that China reasserted her sovereignty and made opium illegal again in the 1840s. What had begun as military protection of English economic interests had become an embarrassment to most European governments. The British mentality was not complimentary to their new stance that certain mood-altering drugs were "evil".

Concern over massive amounts of illicit trafficking by western pharmaceutical firms led to the 1924 Geneva Conference, also known as the "Opium Conference". The Chinese member of the Advisory Commission spoke in the opening talks by pointing out that Germany, Great Britain, Japan, Switzerland, and the United States were all turning out "...morphine by the ton, purchased by the smugglers by the ton."

IFPMA Takes Over

As a result of the conference, pharmaceutical companies were forced to give up trade in illicit drugs in exchange for a strong international

presence and governing capacity. The convention resulted in a countries estimated how much opium they would need for each year, and only that amount was permitted to enter the country. International Federation of Pharmaceutical Manufacturers' Ass (IFPMA) was formed to fulfil the regulatory needs.

Thus the "cleaning up" of multinational pharmaceutical compa to nothing less than putting a pharmaceutical monopoly on op The pharmaceutical companies had a monopoly, and the comp continues to be < killed or imprisoned. In no other sector of ind production been so closely controlled.

In a sense, this was the very first example of multinational free Regardless of the country, the pharmaceutical companies follo rules, which were enforced by an international body. Also typic present-day "free trade", the corporation was given license to itself. Delegates to the IFPMA were appointed solely by the pha companies.

Over the following decades, the reaches of the IFPMA continue it insinuated itself into circles of international power. The IFPM, admitted as a Non-Governmental Organization to the World He Organization (WHO) in January of 1971. It was also accepted in capacity to the UN Economic and Social Council (UNESCO) soo

Multinational Corporations Take Over Governments

The pharmaceutical companies were the first to take advantag international governmental organizations to further their trade Their accomplishment of working their way into international ir of power represented a shift in the paradigm of world trade.

Today, major multinationals have joined to further their own ag much the same way that the pharmaceuticals once did. Throug Paris-based Organization for Economic Cooperation and Develo they are attempting to enact what is known as the Multilateral Investment (MAI). MAI would create an atmosphere of "free tra the OECD countries. Members of the OECD include Canada, th Australia, New Zealand, and most of Europe.

MAI seeks to push back environmental protection laws, nationa programs, etc in favour of multinational corporate developmer national law restricts development, a corporation may sue the

for damages, regardless of public reaction. MAI is fundamental undemocratic. Under the force of world-wide opposition, MAI failed recent meetings in the Netherlands in May, and the Dutch, charged that no country presently sign the document. MAI will likely not be ratified for at least another year as a result.

David Rockefeller, a leading member of the Trilateralists* and the Chase Manhattan Bank in New York, commented on the changes that occurred since the 1960's. "Back then business leaders like myself were more or less sitting on the sidelines watching the negotiations, now we're sitting in the driver's seat and writing many of the documents ourselves."** And the documents they are writing are free-trade agreements.

Unfortunately, the trade will be anything but free. If the present regulatory tyranny of the pharmaceutical companies is any indication, we can look forward to an environment of harsh prohibitions, in which naturally grown products and synthetically produced alternatives will be increasingly restricted and prohibited. Multi-national corporations will have the capital and political influence to push their synthetic, patentable products through the expensive and arbitrary food and drug approval processes.

Corporate Wealth vs National Wealth

Free trade seeks to create multinational, corporate wealth < as opposed to the national wealth created by plant-drug production. Free trade seeks to undermine economies based on unpatentable items, like plant remedies, and create economies based on patents and market monopolies. Free trade seeks to make it even easier for corporations to extract wealth from a country, and does away with national regulations on in-house production and job creation.

This new paradigm already functions within smaller free trade agreements like NAFTA (the North American Free Trade Agreement, including Canada and Mexico). Should MAI fail for some reason, it is likely that similar agreements like NAFTA and the Treaty of Maastricht (the foundation of the European Union) will continue to proliferate, to the advantage of multinational corporations.

The laws of individual countries are also directly under attack by multinational groups with free trade agendas. In 1995, The UN commission on world investment which found that between 1991 and 1994 there were 100 pieces of legislation introduced world-wide to do away with regulations on foreign investment.

the way corporations conduct their business. 369 of these 374 legislative acts were intended to give corporations the capacity to break through national boundaries, paving the way for multinational free trade.

Laws being rolled back typically include those designed to protect the environment, health, jobs and standards of living.

The UN, WHO and OECD Are All In Bed Together

The Paris-based Organization for Economic Cooperation and Development (OECD), the UN and the World Health Organization (WHO) are three organizations which exist, theoretically, as autonomous from one another. In practice however, the three organizations meet behind closed doors to plan how to package and distribute the drug war as an international commodity, while promoting free trade as a replacement for drug trade.

Free trade, in particular, is the focus of the OECD. The UN finds its focus in encouraging international support for the war on drugs, through the United Nations Drug Control Program (UNDCP) and the International Narcotics Control Board (INCB), two organizations which cooperate closely in the international war on drugs. The WHO finds its focus in the legitimization of the drug war and free trade, by preparing various "health reports" which promote the drug war as a necessary evil for world health.

The relationship between WHO and the UNDCP manifests itself in a joint venture called the "UNDCP/WHO Global Initiative on Primary Prevention of Substance Abuse", which promotes the worldwide drug war as a necessary evil for world health.

The Economic and Social Council of the United Nations (UNESCO) is responsible for promoting industrial development worldwide. A 1994 report by the Director-General of UNESCO partially summarizes their position: "Development is hampered by mounting barriers to market access." Exactly the same barriers which worldwide free trade (in the form of MAI) seeks to bring down.

It should be no surprise that the UN's Economic and Social Council is exclusively responsible for electing the 13 members of the UN Drug Control Program or that the Economic and Social Council administers the UNDCP reports and advisories from and generally cooperates with the International Narcotics Control Board. The Economic and Social Council also cooperates with the OECD, which is responsible for the worldwide free-trade agreement known as MAI.

The public is left to speculate as to whether the relationship between the Economic and Social Council (free trade agenda) and the Drug Control Program (war on drugs agenda) has anything to do with the role of the International Pharmaceutical Manufacturers' Association, an advising non-governmental organization to the Economic and Social Council. It seems that the multinational pharmaceutical companies have been hiding in the shadows, pushing magic "free-trade" pills to third world countries.

WHO Suppresses The Truth About Cannabis

The UN/OECD/WHO team also justifies its murderous drug-war by suppressing truth.

The branch of WHO responsible for determining which substances should be placed under international control is the Expert Committee on Narcotic Drugs. The members of the Expert Committee are appointed by the health ministries of the various countries that are members of WHO, including the US and Canada, and they are not appointed through any electoral process.

The Expert Committee has a long history of truth distortion. Because of the in the wake of US drug-war activity, the Expert Committee claimed that cannabis should definitely be defined as an addiction-producing drug without any real evidence to back up their claims. By 1957, the committee distinguished between habituation and addiction, and was forced to admit that cannabis was not an addictive drug at all, but no changes were made to international controls of the harmless herb.

More recently, in 1995, WHO suppressed a report comparing cannabis and alcohol. The report found that tobacco and alcohol were more harmful than marijuana. Sources within WHO leaked the document to mainstream media after being told to bury it. WHO sources also admitted that the US National Institute on Drug Abuse and the UN International Drug Control Programme had pressured WHO to suppress the report. The WHO has repeatedly stalled on carrying through with a planned report on the highly successful Swiss harm-reduction experiment.

Because of WHO's manipulations, cannabis has remained prohibited under international treaties, a prime target in the worldwide war on drugs. Further showing the duplicity of their organization, many of the people who work for WHO (and other UN drug war institutions) go on to manage multinational pharmaceutical companies.

Former Chief of the WHO Drug Dependence Unit, Hans Halbach, left the Swiss pharmaceutical company Hoffman La Roche. Former UN Division of Narcotic Drugs, Gilbert Yates, became the Director of the Association of British Pharmaceutical Industries. Former Secretary of the International Narcotics Control Board, Adolf Lande, was taken in by the American Pharmaceutical Manufacturers' Association.

The Prohibitionist Multinational Corporate Agenda

The war on drugs is a trade war, but it is also more than that. It is not restricted to military or economic aggressions to open up markets. Drug war attacks not only countries and organizations that profit from it, it also goes after consumers. Millions have been imprisoned or killed because they have no place in the prohibitionist multinational agenda.

On Cognitive Liberty (Part I)

By Richard Glen Boire, Esq.

Thoughts are free and are subject to no rule.

Ñ Paracelsus¹

As we frantically race into the third millennium with microprocessors becoming faster, cheaper, and smaller, with surveillance cameras proliferating in public spaces, with the human genome program about to issue its first draft² of the human DNA sequence, and an out-of-control Frankensteinian machine nation at War on Drugs, all awirl in the ocean of information day culture, it is imperative that we, as a society, expressly acknowledge the func

human right to cognitive liberty and imm begin to define its contours.

Encroachments on cognitive liberty can various forms. New technologies such biogenetic modification, human-com interfacing, brain-scanning, nanotechn neural-networking, so-called "neuro-thera new pharmaceuticals, raise exciting possi for human "evolution." But, if not develo used responsibly, they and the legislatio spawn, could also pose new threats to co freedom.² The trend of technology is to c the limitations of the human body. And, has been characterized as a virtual colle consciousness and unconsciousness. Wh implications for mental autonomy when computers become wet-wired to our ov and memory is augmented by a high-spe connection to the Web? Similarly, advan biotechnology and drug-design increasing legal and ethical questions related to cog liberty, including what rights people will to access these and other technologies, a rights we will have to avoid them.

Calibrating Cognitive Liberty

Part of elucidating a theory of cognitive lib is simply recognizing when free cognit being infringed. Restrictions on phys liberty, for all their pain and terror, at lea have the benefit of being relatively eas recognize and call attention to. During Wo

II, the Nazi concentration camps for Jews and the American internment camps for Japanese-Americans, were marked by the machinations of physical control: fences, barbed wire, and watchtowers. Similarly, from 1961 to 1989, a concrete and barbed wire wall overseen by 116 guard dogs divided the city of Berlin. Anyone who tried to cross that wall without a special authorization risked a bullet in the back of his or her skull. In contrast to the usual visibility of government restraints on physical liberty, restraints on cognitive liberty are most often difficult to recognize, if not invisible.

Consciousness is so complex and multifaceted that it may never be understood. Unfortunately, our inability to understand consciousness does not equate to an inability for others to control our minds. How then can we recognize nefarious attempts at mind control? In one respect, a complete control of one's own consciousness is an impossibility. While each of us carries our brain in our own skull, the process of consciousness itself is interactive. All our senses continuously feed data into our brain, producing a dance of cognition that perpetually swirls the exterior world with the interior world, creating a seamless, edgeless, apperceptive feedback loop. Our minds are continually changing, continually interfacing with the world and other. Cognitive liberty clearly cannot exist in a state of cognitive isolation.

Mind control, like most everything else, comes in degrees. A discussion with a friend may not change your opinion on a topic, it may

change your life, but does that amount to control? Was your cognitive liberty violated? Over \$US200 billion dollars is spent each year by advertising companies unabashedly striving to manipulate our desires, to literally make us want their products. If you see an advertisement (or many) for a product and that advertisement, replete with the imagery of the good life, causes you to purchase the product, have you been the victim of mind control? Has your cognitive liberty been violated?

What if the advertisement is embedded in a television program, with auditory or visual subliminal messages? What if the advertisement is embedded in prime time television programs, passing as program content rather than demarked as a commercial? Suppose you are a 12-year-old placed on Prozac or Ritalin largely because your school doctor has diagnosed you as depressed or suffering from Attention Deficit Disorder. Has your cognitive liberty been violated?

The answers to the above questions depend on how finely one calibrates cognitive liberty. In some scenarios, some infringements on cognitive liberty and autonomy, are crystal clear and ought to be limited. In other cases where general policies and specific rules emerge in high-definition clarity. Even in so-called limit cases, the US government, including its legal system, has often acted inconsistently.

A (Very) Brief History of US Government Mind Control

In 1969, Justice Marshall wrote, without more words, "Our whole constitutional heritage rests at the thought of giving government the power to control men's minds."⁴ Yet, contrary to Marshall's strong pronouncement, the government has not consistently respected cognitive liberty. Indeed, some government's offenses seem to come directly from the pages of a dystopian novel like George Orwell's *Nineteen Eighty-Four*.⁵

Imagine, for example, if the government passed a law mandating that all citizens receive mandatory injections of time-release sedatives, justified in the name of "public health." Grounds: sedated people are more productive at repetitive tasks, are less violent, and are not a drain on public resources. What if those who did not voluntarily report at the time and those appointed for their injection were rounded up by the police, and forcefully lobotomized? Can anyone doubt that such a law infringed not only on one's physical freedom but also on one's cognitive freedom? It's not exactly an unthinkable scenario. From the 1920s to 1970, pursuant to the laws of at least 32 states, more than 60,000 people were deemed "unfit." Many of these people were involuntarily sterilized, in part because of low scores on intelligence tests.⁶ When one of these laws was challenged, and the case reached the United States Supreme Court, it was upheld—with Oliver Wendell Holmes smugly proclaiming, "generations of imbeciles are enough."⁷

Until 1973, "homosexuality" was listed

psychiatric disorder in the Diagnostic Statistical Manual of Mental Disorders (DSM). People who admitted being homosexual, or "accused" of being gay or lesbian, were sent to involuntary confinement under mental health laws, and subjected to "reparative therapy" or "conversion therapy" designed to convert them into heterosexuals. "Treatment," in addition to counseling, included penile plethysmography (electronic shock triggered by penile erection), electroconvulsive drugging, and hypnosis. Even though homosexuality was deleted from the DSM in 1973, it was not until December 1998 that the American Psychiatric Association finally disapproved of "reparative" or "conversion" therapy.⁸

In the 1950s, 60s, and early 70s, the US government illegally and unethically drugged unwitting US citizens with psychoactive substances, including LSD, as part of projects like bluebird, artichoke, and mkultra, all in an attempt to develop techniques of mind control. Richard Helms, the chief planner of mkultra, wrote in a planning memorandum that the project was designed in part to:

Investigate the development of chemical material which causes a reversible non-toxic aberrant mental state, the specific nature of which can be reasonably well predicted for each individual. This material could potentially aid in discrediting individuals, eliciting information, and implanting suggestions and other forms of mental control.⁹

While the MKUltra program began with tests in a laboratory on willing volunteers, the CIA quickly saw the need to expand the testing to determine what the effects of drugs such as LSD would be on unsuspecting people. Thus, in 1953, the CIA turned its mind control program into the street in the United States and began the "covert testing" of mind-altering materials on unwitting US citizens.

In subsequent installments of this essay, you will see how the US Government continues to justify certain policies that, while cloaked in "public health" or "public safety" justifications, amount to an impermissible government action of thought policing and interfering with the natural processes of citizens.

Freedom's Invisible Landscape

The right to control one's own consciousness is the quintessence of freedom. If freedom means anything, it must mean that each person has an inviolable right to think for him or herself. It must mean, at a minimum, that each person is free to direct one's own consciousness; control one's underlying mental processes, and one's own opinions, and worldview. This is self-evident and axiomatic.

In assessing what rights are fundamental and entitled to the most stringent legal protection, the US Supreme Court has stated that, for the sake of the liberties we cherish, "the liberties are those 'implicit in the concept of ordered liberty,' such that 'neither liberty nor justice would exist if [they] were sacrificed'."

Under another test, fundamental liberties are characterized by the Court as those liberties that are "deeply rooted in this Nation's history and tradition."¹²

Slightly over seventy years ago, Justice Brandeis acknowledged in a landmark privacy case that cognitive freedom was one of the primary protections designed into the Constitution.

The makers of our Constitution undertook to secure conditions favorable to the pursuit of happiness. They recognized the significance of man's spiritual nature, of his feelings and of his intellect. They knew that only a part of the pain, pleasure and satisfactions of life are to be found in material things. They sought to protect Americans in their beliefs, their thoughts, their emotions and their sensations. They conferred, as against the Government, the right to be let alone—the most comprehensive of rights and the right most valued by civilized man.¹³

But, while certain justices have, at times pointedly acknowledged the fundamental cognitive freedom and the nefarious nature of government (or other "outside") interference with the intellect, this important freedom remains only obliquely defined within the US legal system. Ironically, the lack of a comprehensive treatment may be because cognitive freedom is self-evidently a basic human right. What

reason, without a coherent cognitive liberty jurisprudence, present and future infringement on cognitive liberty risk passing unnoticed and unremedied. In the next installment of this essay, we will begin to dig deep into privacy, due process, and First Amendment case law to attempt to excavate a theoretical scaffolding for cognitive liberty. As I believe the cases show, cognitive liberty is the invisible landscape from which springs some of our most cherished and protected freedoms.

Notes

1 J. Jacobi, ed., *Selected Writings* (New York: Pantheon Books, 1951).

2 One example of fiction-like technology just over the horizon was recently discussed by MIT-educated futurist Ray Kurzweil, who forecasted the coming of nanobot brain scans. These nanobots would be blood-cell-size devices that travel through capillaries in the brain to take high-resolution scans of the neural features. These bots would be tied together via a wireless LAN, and comprise a distributed computing system with the same power as the brain that was scanned. (See *The Story of the 21st Century*, *Technology Review* Jan./Feb. 2000, 82-83.

Kurzweil says that every aspect of this scenario is feasible today—except for size and cost—more of Kurzweil's ideas, see his book *The Spiritual Machines: When Computers Experience*

Intelligence (New York: Viking, 199

3 See "Big Brother Puts a New Twist on the Telescreen," *infra*, 60.

4 *Stanley v. Georgia* (1969) 394 U.S. 55

5 G. Orwell, *Nineteen Eighty-Four* (New York: Harcourt, Brace & Co., Inc., 1949).

6 J. Robitscher, ed., *Eugenic Sterilization* (Springfield, Ill: Charles C. Thomas, 1911) 118-119 [listing sterilization data for many states]; E. Brantlinger, *Sterilization of People with Mental Disabilities: Issues, Perspectives, and Cases* (Westport, Conn.: Auburn House, 1992) 25; E.J. Larson & L. Nelson III, "Involuntary Sexual Sterilization of Incompetents in Alabama: Past, Present, and Future," 43 *Alabama Law Review* 399 (1992), 407.

7 *Buck v. Bell* (1927) 274 US 200, 207. The use of sterilization, including the Norplan contraceptive device, will be further discussed in subsequent installments of this essay.

8 "American Psychiatric Association Opposes Reparative Therapy," Press Release No. 98-12, December 14, 1998. Viewable online at http://www.psych.org/news_stand/rep_the [Accessed: 23 January 2000.]

Alan Turing, one of the founding fathers of artificial intelligence theory, was arrested in 1952 after he admitted having a homosexual relationship with a man, violating the British homosexuality statute of 1953.

affair. Believing that his sexual orientation was a personal matter, neither a sin nor a crime, he presented no defense at his trial, which occurred on 31 March 1952. In lieu of prison, he was ordered to submit to estrogen injections every year. Following a period of depression, in the result of the injections, he committed suicide on June 7, 1954.

9 Memorandum from ADDP items to LHM dated 4/3/53¹⁰ quoted in *The Mind Manipulators* (Paddington Press, 1978), 132.

10 Inspector General's Report on mkultra programs (14, 1963), 7, quoted in *The Mind Manipulators* supra, 133.

For more details on the government's brainwashing, artichoke, and mkultra programs (at least some details not lost forever when Richard Helms ordered the destruction of all records relating to the projects in January 1973) see A. Scheffer and E. Opton, "Tampering With The Mind (I)", in *The Mind Manipulators*, supra, (1978), 134-135.

11 In *Palko v. Connecticut* (1937) 302 U.S. 319, 325, 326.

12 *Moore v. East Cleveland* (1977) 431 U.S. 491, 503 (opinion of Powell, J.).

13 *Olmstead v. United States* (1928) 277 U.S. 478 (Brandies, J., dissenting).

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On Cognitive Liberty (Part 2)

By Richard Glen Boire, Esq.

*Éwithout freedom of thought
there can be no free society.*

--U.S. Supreme Court Justice Felix Frankfurter

An Introductory Note on Banned Books and other Controlled

As you read this sentence you are receiving information. Words are carriers of thought, whether spoken from mouth to ear, digitized and passed electronically, or downloaded in ink and passed on paper across time and space. Because words are vehicles for thoughts, words can change your opinion, give you new ideas, reform your worldview, and even foment a revolution.

Attempts to control the written word date from at least AD 325 when the Council of Nicaea ruled that Christ was 100 per cent divine and forbade the dissemination of contrary beliefs. Since the invention of the printing press in 1452, governments have struggled to control the printed word. Presses were initially licensed and registered. Only certain people were permitted to own or control a printing press and only certain things could be printed or copied. (This was the origin of today's copyright rules.) Works printed without authorization were gathered up and destroyed, and the authors and printers imprisoned.

Scholars disagree as to the exact date, but some time around 1560, Pope Paul IV promulgated the Index Librorum Prohibitorum, a list of forbidden books (i.e., controlled substances) enforced by the Roman government. The Index was (finally) abandoned in 1966 and listed over 4,000 forbidden books, including works by such people as Galileo, Kant, Pascal, Spinoza and John Locke.² The history of censorship has been extensively recorded by others. My point is simply the obvious: that efforts to prohibit heterodox texts are an attempt to make criminals out of those who "manufacture" such texts, were not so interested in controlling ink patterns on paper, as in controlling the ideas encoded in printed words.

I submit that in the same way, the so-called "war on drugs" is not a war on pills, powder, plants, and potions, it is war on mental states — a war on consciousness itself. For as much as we are permitted to experience it, and who gets to control it, the government-termed "war on drugs" is a strategic decoy label; a slight-of-hand ruse.

by the government to redirect attention from what lies at ground zero of the war to each individual's fundamental right to control his or her own consciousness.

Entheogenic Oldspeak v. Drug War I

In George Orwell's dystopian novel *Nineteen Eighty-Four*, the Oceania government diligently worked to establish "Newspeak," a carefully crafted language designed by the government for the purpose of making unapproved "modes of thought impossible." Prior to Newspeak, the people of Oceania communicated with "Oldspeak," an authentic natural language capable of expressing nuanced emotions and multiple points of view. By controlling language through the imposition of Newspeak — by "eliminating undesirable words" — the government of Oceania was able to control and, in some cases, completely extinguish certain thoughts. As a character in *Nineteen Eighty-Four* explained to Winston Smith, "you see that the whole aim of Newspeak is to narrow the range of thought? — Every year, and fewer words, and the range of consciousness always a little smaller. Those people raised with Newspeak, who have never known the wider-range of Oldspeak, might fail to notice, indeed, might be unable to even perceive, that the Government is limiting consciousness."

In 1970, just four years after the Catholic Church finally abandoned the *Index Librorum Prohibitorum*, the United States government produced its own index of forbidden thought catalysts: the federal schedule of controlled substances. Included on the initial list of Schedule I substances were seven substances denoted as "hallucinogens," declared to have "a high potential for abuse."

abuse," "no currently accepted medical use in the USA, and "a lack of accepted safety even under medical supervision. Among the list of outlawed "hallucinogens" were psilocybin and psilocin, the active principles of *Psilocybe* mushrooms; dimethyltryptamine (DMT), the active principle in ayahuasca and many vision-inducing snuffs; ibogaine, mescaline, peyote, and LSD.⁵ The experience elicited by these substances in their chemical or natural forms is the par excellence of "Oldspeakers' cognitive modality dating from pre-historic times.

Archeological evidence suggests that humans have communed with visionary plant substances for thousands of years. Peyote, for example, has been used for over 10,000 years. Lysergic acid diethylamide (LSD) was discovered by Dr. Albert Hofmann, a chemist employed at Sandoz Laboratories in Basel, Switzerland, in 1938. Dr. Hofmann synthesized LSD from a fungus commonly found in rye seeds. Its effect on consciousness remained undiscovered until April 16, 1943, when Dr. Hofmann accidentally ingested a minute amount of the substance and experienced a strange inebriation in which "the external world became changed as in a dream." Several years later, Hofmann discovered that the chemical structure of LSD is nearly identical to that of the sacred entheogen ololiuhqui, prepared from morning glory seeds and used ritually by the Aztecs for thousands of years.

Mushrooms, of the genus *Psilocybe*, were used to produce visionary states at least as early as 4000 B.C. The *Psilocybe* mushroom was used in religious ceremonies long before the Aztec civilization. It was named *teonanācatl*, meaning "sacred mushroom." In 1957, LSD was synthesized with mushrooms obtained by R. Gordon Wasson from the now famous curandera Maria Sabal.

Dr. Hofmann isolated and later synthesized two active substances derived from *Psilocybe* mushroom. He named these substances psilocybin and psilocin. In 1962, Dr. Hofmann traveled to Mexico and met with Maria Sabá. During a night ceremony, she ingested 10 milligrams of the synthetic psilocybin. Hofmann later said the effect was indistinguishable from that elicited with the sacred mushrooms themselves.

Another substance placed on the government's 1970 list of criminalized "hallucinogens" is N,N-dimethyltryptamine (DMT). This substance was first synthesized in 1931, but its entheogenic properties were not discovered until 1956. It was subsequently learned that DMT is the principal active ingredient in numerous snuffs and brews long-used by various South American Indians during religious ceremonies. The DMT-containing plant *Psychotria viridis* is a well-known admixture to the entheogenic brew known as ayahuasca or yajé, which archeological evidence suggests dates back as many as ten thousand years.⁶

Some who ingest visionary plants believe that the plants talk to them and open up channels of communication with animals and spirits or entities. Mazatec eaters of *Psilocybe* mushrooms, for example, are adamant that mushrooms speak to them:

The Mazatecs say that the mushrooms speak to you. If you ask a shaman where his imagery comes from, he is likely to reply: "I didn't say it, the mushrooms did." He who eats the mushrooms, if he is a man of language, becomes endowed with an inspired capacity to speak. The spontaneity they liberate is not only perceptual, but linguistic, the spontaneity of speech, of fervent, lucid

discourse, of the logos in activity. For the shaman it is as if existence were uttering itself through him—words are materializations of consciousness; language is a privileged vehicle of our relation to reality.⁷

Just as Newspeak was intended to make Old(speak) thoughts literally unthinkable, the War on Entheogens makes certain cognition and awareness all but inaccessible. Religious scholar Peter Lamborn Wilson aptly framed the War on Entheogens as a battle over the nature of thought itself:

The War on Drugs is a war on cognition itself, about thought itself as the human condition. Is thought this dualist Cartesian reason? Or is cognition this mysterious, complex, organic, magical thing with little mushroom elves dancing around. Which will be?⁸

In Orwell's vision of 1984, Newspeak to control and limit thought depended in part, upon the passing of time and the rise of new generations that never knew Old(speak). As explained by Orwell in the Appendix to Nineteen Eighty-Four, "It was intended that when Newspeak had been adopted once and for all and Oldspeak forgotten, a heretical thought—that is a thought diverging from the principles of Ingsoc—should be literally unthinkable, at least so far as thought is dependant on words."⁹

Just as Newspeak depended in part upon the eradicating knowledge of Oldspeak, the War on Entheogens is sustainable, in part, because the current generation of young adults (those 21 - 30 years old) have never known a time when most entheogens were illicit. Those who have never experienced mental states that are now prohibited c

realize what the laws are denying them, as if nothing is being taken away, at least nothing noticeable, nothing that is missing. As pointed out by the authors of a law review article on how mandatory schooling raises issues of mass-consciousness control: "The more the government regulates formal beliefs so as to interfere with personal consciousness, the fewer people can voice dissenting ideas or perceive contradictions between self-interest and government-sustained ideological orthodoxy." 10

Because of the personal experiential nature of entheogen-elicited cognition, only those who have been initiated into the modern Mysteries — those who have tasted forbidden fruit from the visionary plants, gained knowledge and have not fallen victim to the stigmatizing psycho-impact of "being a user" — are acutely aware of the gravitas of what is being prohibited: powerful models for thinking, perceiving, and experiencing.

The very best argument for the potential value of entheogen-elicited mind states is the entheogenic experience itself; an experience that has, in almost every country, been outlawed. That is the dilemma of entheogen policy reformation. The advantage for entheogenic consciousness is left in an even worse position than the proverbial sighted man who must describe colors to a blind person. With regard to entheogen policy, the position is worse because the "blind" are in power and have declared it a crime to see colors.

Left with the impossible task of saying the unsayable, of describing the indescribable, those who have tasted the forbidden fruit must plead their case on the fundamental philosophical and political level of what

means to be truly free. They must state appeal on the ground that, with respect to the inner-workings of each person's mind, values of tolerance and respect are weightier and far more conducive to the principles of democracy, than is the chillingly named "zero-tolerance" policy is currently in vogue. This brings us, once again, to cognitive liberty as an essential substrate of freedom.

Free Thought and the First Amendment

Benjamin Cardozo, one of the most respected and influential American legal scholars of the last century and a former Justice of the U.S. Supreme Court, affirmed cognitive liberty as central to most every other freedom:

...freedom of thought is the matrix, the indispensable condition, of nearly every other form of freedom. With rare aberrations a pervasive recognition of this truth can be traced in our history, political and legal. 11

Cognitive liberty jurisprudence must begin, then, with an effort to distill the legal principles that support some of our most cherished and well-established freedoms. Then, over time, crystallize these principles into the foundation for a coherent legal scheme governing issues related to individual's right to control his or her own consciousness.

Given the importance of the First Amendment to U.S. and even international law, we begin by examining how courts have construed the First Amendment—searching for evidence that the right of each person to autonomy over his or her own mind and thought

processes is central to First Amendment jurisprudence.

Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances. (The First Amendment.)¹²

The First Amendment's guarantees were designed to bar the government from controlling or prohibiting the dissemination of unpopular or dissenting ideas. Central to all five guarantees is the acknowledgment that people must be treated by the government as ends not means; each person free to develop his or her mind and own belief system, and encouraged to express his or her thoughts in the so-called "marketplace of ideas."¹³ As U.S. Supreme Court Justice Brandeis emphasized in 1949, the freedom of expression guaranteed by the First Amendment guards against "thought being checked and atrophied."¹⁴

Free speech, free exercise, free association, a free press and the right to assemble, are all moot if the thought that underlies the actions has already been constrained by government. If the government is permitted to prohibit the experiencing of certain thought processes, or otherwise manipulate consciousness at its very roots—via drug prohibitions, religious indoctrination, monopolizing media, or any number of methods—it need not even worry about controlling the expression of such thoughts. By prohibiting the very formation of mind states—by strangling the free mind itself—free expression is made meaningless.

Thus, in order to prevent the erosion of the First Amendment's protection of expression, the Amendment must also provide at least a strong protection for the underlying consciousness that forms the ideas that are later expressed. Indeed, the First Amendment was infused with the principle that each individual—not the government—ought to have control over his or her own mind, to think what he or she wants to think, and to freely form and express opinions and beliefs based on all the information at his or her disposal. The First Amendment, in other words, embraces cognitive liberty not simply as the desired outcome of the articulated guarantees (i.e., a right to express one's ideas), but also as a necessary precondition to those guaranteed freedoms (i.e., a right to form one's own ideas).

Mother May I Control My Own Consciousness

In (the apropos year of) 1984, the Tenth Circuit Court of Appeal issued an opinion in a case involving a man who was involuntarily drugged with the "antipsychotic drug" thiorazine while he was being held for trial on murder charges.¹⁵ The threshold issue was whether pretrial detainees have a fundamental right to refuse treatment with anti-psychotic drugs. To answer this question, the Tenth Circuit analogized to a 1982 case in which the U.S. Supreme Court held that "freedom from bodily restraint always has been recognized as the core of the liberty protected by the Due Process Clause from arbitrary governmental action."¹⁶ The Circuit reasoned that if freedom from bodily restraints is a fundamental right, then individuals must also have a liberty interest in freedom from "mental restraint of the type potentially imposed by antipsychotic

drugs."17

Thus, the Tenth Circuit found that freedom from government imposed mental restraints just as fundamental as freedom from government imposed physical restraints were protected by the Due Process Clause. Furthermore, the Tenth Circuit found that the First Amendment was also implicated when government attempts to involuntarily psycho-medicate a person awaiting trial. In unequivocal language, the Tenth Circuit explained "[t]he First Amendment protects communication of ideas, which itself implies protection of the capacity to produce ideas."18

As professor Laurence Tribe of Harvard Law School has cautioned:

In a society whose whole constitutional heritage rebels at the thought of giving government the power to control men's minds, the governing institutions, and especially the courts, must not only reject direct attempts to exercise forbidden domination over mental processes; they strictly examine as well oblique intrusions likely to produce or designed to produce same result."19

Prohibiting an otherwise law-abiding person from using entheogens is more than mere "oblique intrusion" on the right to control one's own mental processes, or a slight trespass on the "protected capacity to produce ideas" – it is a direct frontal attack. Under the recently released National Drug Control Strategy 2000, the federal government will spend just shy of \$20 billion (\$20,000,000,000) on an all out attempt to keep people from evoking alternative states of consciousness by the use of controlled

substances.²⁰

As I will show in the next installment of this essay, the government's War on Unapproved Mental States, besides violating core principles of the First Amendment, also violates the very essence of the right to privacy.

Notes

1 Kovacs v. Cooper (1949) 336 U.S. 77, 9 (concurring opinion of J. Frankfurter)

2 For a fascinating survey of suppressed literature, see the multi-volume set *Banned Books*, published by Facts on File, which covers literature suppressed on religious, social, sexual, and political grounds.

3 George Orwell, *Nineteen Eighty-Four* (New York: Harcourt, Brace & Co., Inc., 1949), Appendix "The Principles of Newspeak" 2

4 *Ibid.*, 46.

5 The substances initially listed in Schedule I as "hallucinogenic substances" were: (1) 3,4-methylenedioxy amphetamine; (2) 5-methoxy-3,4-methylenedioxy amphetamine; (3) 3,4,5-trimethoxy amphetamine; (4) Bufotenine; (5) Diethyltryptamine; (6) Dimethyltryptamine; (7) 4-methyl-2,5-dimethoxyamphetamine; (8) Ibogaine; (9) Lysergic acid diethylamide; (10) Marihuana; (11) Mescaline; (12) Peyote; (13) N-ethyl-3-piperidyl nezilate; (14) N-methyl-3-piperidyl benzilate; (15) Psilocybin; (16) Psilocyn; (17) Tetrahydrocannabinols. (PL 91-513, Oct. 1970; 21 U.S.C. sec. 812, subd. (b) (1970)

The list of Schedule I "hallucinogenic substances" now numbers 31 items. (21 CFR 1308.11(d) (April 1999)).

6 For more on the historic and pre-historic use of entheogens, see Peter Furst, *Hallucinogens and Culture* (Novato, CA: Chandler & Sharp Publishers, Inc., 1976); R.E. Schultes, and A. Hofmann, *The Botanical Chemistry of Hallucinogenic Plants* (Springfield, IL: Charles C. Thomas, 1973).

7 H. Munn, in *Hallucinogens and Shamanism*, ed. M. Harner (New York: Oxford University Press, 1973), 88-89.

Philosopher and ethnobotanist Terence McKenna suggested that early man's ingestion of visionary plants may have been the very catalyst that led to the sudden expansion of human brain size between three and six million years ago, and the event which spawned the subsequent emergence of man himself. (See Terence McKenna, *Food of the Gods* (New York: Bantam Books, 1993), 2).

8 Peter Lamborn Wilson, "Neurospace," in *Neurospace* (Newark, NJ: Gordon and Breach Publishers, 1996), (3)32.

9 George Orwell, *Nineteen Eighty Four*, s Appendix: "The Principles of Newspeak,"

10 Stephen Arons and Charles Lawrence, "Manipulation of Consciousness: A First Amendment Critique of Schooling" in *150th Anniversary of the First Amendment*, Harvard Civil Rights-Civil Liberties Law Review 309-361 (Fall 1980), 312.

11 *Palko v. Connecticut* (1937) 302 U.S. 319-327.

12 Although the First Amendment only mentions "Congress," the U.S. Supreme Court has held that the Fourteenth Amendment's Due Process Clause incorporates the First Amendment guarantees and thus makes those guarantees applicable to State governments as well as Congress. (See *Gitlow v. New York* (1925) 252 U.S. 652, 666; *Board of Education v. Pico* (1981) 457 U.S. 853, 855, fn. 1.)

13 The concept of a laissez faire marketplace where ideas compete for buyers appears to date from 1919 when U.S. Supreme Court Justice Holmes wrote in *Abrams v. United States* (1919) 250 U.S. 616, 630 "[T]he ultimate good desired is better reached by free trade in ideas ... the best test of truth is the power of the thought to get itself accepted in the competition of the market") (Holmes, J., dissenting).

Using a "marketplace" analogy for the interaction and acceptance or rejection of ideas is problematic.

Using market mechanisms to determine the logic or merit of ideas reduces ideas to commodities. When this happens the circulation of ideas is determined by the sales profiles. The "consumer" is described as voting for the products of the Consciousness Industry [a term coined by Magnus Enzensberger in his 1974 collection of essays of the same name] with his or her dollars (consumer sovereignty). Such metaphors suggest democracy and free choice. They deflect attention away from the tightly controlled decision-making processes that actually determine what ideas will gain entry into the commodity system. That is, they render the control system of the capitalistic consciousness industry invisible and thereby permit subterranean censor

based upon both market and political considerations. In sum, they permit elite rule but preserve the semiotics of democracy (Sue Curry Jansen, *Censorship: The Knot Binds Power and Knowledge* (New York; Oxford University Press, 1988), 134.)

14 *Kovacs v. Cooper*, *supra*, at p. 95

15 *Bee v. Greaves* (10th Cir. 1984) 744 F.2d 1387, 1393, cert. denied, (1985) 469 U.S. 1214.

16 *Youngberg v. Romeo* (1982) 457 U.S.

316

17 *Bee v. Greaves*, *supra*, at p. 1393.

18 *Ibid.*, 1393-1394; Accord, *Rogers v. O* (D.Mass. 1979) 478 F.Supp. 1342, 1366- Other courts have held that inmates in n hospitals have a constitutional "liberty interest" in maintaining the autonomy of their own minds in the face of doctors who want to involuntarily medicate them. (See e.g., *United States v. Charters* (4th Cir.1988) (en banc) 863 F.2d 302, 305 (antipsychotic drugs intrude sufficiently upon "bodily security" to implicate a "protectable liberty interest"); And, still other courts have held that there is a constitutional "privacy protection" that encompasses "the right to protect one's mental processes from governmental interference." See, e.g., *Rennie v. Klein* (D.N.J. 1978) 462 F. Supp. 1131, 1144 ("the right of privacy is broad enough to include the right to protect one's mental processes from governmental interference").

For a comprehensive survey of forced mental treatment cases, see Bruce J. Winick, "The Right to Refuse Mental Health Treatment"

First Amendment Perspective," *University of Miami Law Review* (September 1989), 44:1-103.

19 L. Tribe, *American Constitutional Law* 15-5, at p. 889 (1978) (quoting *Stanley v Georgia* (1969) 394 U.S. 557, 565.)

20 The National Drug Control Strategy 2000 can be read online via the Alchemind Society's Drug Law Library at www.cognitiveliberty.org/links.htm [Accessed May 17, 2000.]

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Disquisition on the Drug War

The Marijuana-Marlboro™ Paradox

Comments on FDA v. Brown & Williamson Tobacco

*Tobaccos tabu and toboggan's a back seat.
Secret satieties and ononymous letters
make the great unwatched as bad as their bett*

Finnegans Wake

In a landmark drug case decided on March 23, 2005, the United States Supreme Court ruled that the Food and Drug Administration (FDA) does not have authority to regulate tobacco products and, hence, has no authority to regulate cigarettes, including advertising to minors. The Court's opinion shines a light on the dumbfounding contradictions in our national drug policy, which drastically distinguishes (like alcohol) from drugs such as nicotine and alcohol, from drugs like marijuana on which we've declared "war."

The Supreme Court's ruling stemmed from

in which the FDA, for the first time, declared nicotine is "drug" and that cigarettes and tobacco are "drug delivery devices," which gave the FDA the power to regulate. According to the 1996 decision, nicotine is a "drug" under the agency's power because it "exerts psychoactive, or mood-altering effects on the brain" and these effects are "intended to produce a specific effect in the user" by those who manufacture tobacco products. The agency, it could regulate tobacco products so immediately by limiting promotion, limiting the selling of tobacco products to minors. And the tobacco manufacturers, retailers, and advertisers challenged the FDA, asserting that nicotine is not a "drug" and that the FDA, therefore, lacked jurisdiction to regulate tobacco products.

In order to understand the FDA's 1996 decision, it is necessary to know a bit about its tobacco jurisdiction until that time. Prior to 1996, the FDA consistently held that it lacked jurisdiction over tobacco, an understanding affirmed by Congress. Over the years, rejected several bills that would have explicitly given the FDA jurisdiction over tobacco products. Thus, up until 1996, tobacco products were exclusively regulated by Congress. In 1984, for example, it was Congress, not the FDA, that required all cigarettes packs to carry the warning "Cigarette Smoking May be Dangerous to Your Health." Similarly, in 1969 it was Congress, not the FDA, that banned all radio and television advertising for cigarettes.

Indeed, prior to its 1996 about-face, the FDA consistently held that cigarettes were not "drugs" within its purview, unless the manufacturers made specific therapeutic claims—something that not even the tobacco companies were ready to assert.³ In 1996, to the surprise of many, the FDA reversed its position and declared nicotine is a "drug." To justify its change in position, the FDA extensively documented the health risks associated with tobacco products, noting that more than 400,000 people die each year from tobacco-related illnesses, such as cancer, respiratory illness,

heart disease, often suffering long and painful deaths," and that "[t]obacco kills more people each year in the United States than acquired immunodeficiency syndrome (AIDS), cocaine, alcohol, homicides, illegal drugs, suicides, combined."⁴

The FDA recognized, however, that it was in a paradoxical position. The FDA's core mission is to ensure that any product within its regulatory jurisdiction is "safe and effective." Given that it had just declared the dangers associated with tobacco use, how could it possibly declare cigarettes and other tobacco products safe? It seemed that if the FDA claimed jurisdiction over tobacco products it would have to ban them altogether. Yet, a little-known provision prevents such a ban, largely for economic reasons.

[t]he marketing of tobacco constitutes one of the greatest basic industries of the United States, and the ramifying activities which directly affect interstate and foreign commerce at every point, and the conditions therein are necessary to the general welfare. ⁵

The only way out of the paradox was for cigarettes to be both dangerous "drugs" (thereby giving the FDA jurisdiction over them) yet also "safe" (so that the FDA would not be forced to ban them). This was the solution that rose to the occasion.

The FDA lawyers realized that everything hinged on the meaning of "safe." Cigarettes, said the FDA, were "unsafe, as that term is conventionally understood," but were indeed "safe" when an outright ban were considered.⁶ According to the FDA, in determining whether a drug delivery device or cigarette is "safe" under the Food, Drug, and Cosmetic Act, the agency must consider "not only the benefits presented by a product but also any countervailing effects of use of the product and the consequences of not permitting the product to be marketed." ⁷ As summarized by the Supreme Court:

Éthe FDA found that, because of the high addiction among tobacco users, a ban would be "dangerous." É In particular, current tobacco users could suffer from extreme withdrawal, the current medical system and available pharmaceuticals might not be able to meet the treatment demands of those who experience withdrawal, and a black market offering counterfeit cigarettes more dangerous than those currently sold could likely develop. É The FDA therefore concluded that while taking cigarettes and smokeless tobacco off the market could prevent some people from becoming addicted and reduce death and disease for others, the act does not establish that such a ban is the appropriate health response under the act. 8

Thus, in 1996, the FDA ruled that cigarette and tobacco products, despite being addictive and dangerous, were "safe" when compared to the greater dangers associated with prohibiting their sale. The FDA could have its cake and eat it too; cigarettes and "drugs" within its jurisdiction, yet "safe," so long as they were not prohibited.

On March 21, 2000, in an opinion written by Justice Stevens, the Supreme Court found contradictions when tobacco policy is compared to the national War on Drugs, the Supreme Court ruled that the FDA does not have jurisdiction over nicotine and tobacco. Congress, not the FDA, said the words "deemed to be" in charge of regulating tobacco products. The Supreme Court refused to let the FDA escape this ruling. According to the Supreme Court, either cigarettes and unsafe drugs within the FDA's jurisdiction are safe, or they must be banned, or they were never there at all. The Supreme Court chose the latter.

As the Supreme Court explained:

Éwere the FDA to regulate cigarettes and tobacco, the [Food, Drug, and Cosmetic] Act would require the agency to ban them. In fact, É the FDA itself has taken the position that if tobacco products were within its jurisdiction, Óthey would have

removed from the market because it would have to prove that they were safe for their intended use.

As a recent examination of national drug control policy, the Supreme Court's opinion strips the enforcement of the law of its clothes, and the process as well as the results are as embarrassing to look at. On the one hand, the government permits adults to use nicotine and alcohol, while on the other hand, it makes them criminals if they use marijuana - even for medicinal reasons.

A study by the U.S. Department of Health and Human Services, Public Health Service, in 1983 concluded that cigarette smoking is "the most widespread drug dependence in our country," and that it "affect the chemistry of the brain and the nervous system." 10 Five years later the Surgeon General's Report used even harsher language, concluding that tobacco products "are addicting" and that nicotine is "psychoactive" and "causes physical dependence characterized by a withdrawal symptom" in the same way as heroin and cocaine. 11

Marijuana, in stark contrast, causes no dependence. In fact, in 1989 the District of Columbia administrative law judge, Francis L. Young, concluded that marijuana is "one of the safest therapeutic substances known to man." 12 Yet, despite the fact that you can walk down to the corner store and buy a pack of cigarettes, marijuana (even for medical use) is a Schedule I substance - illegal to possess or use for any reason under federal law.

Likewise, the cognitive enhancing drug MDMA is extremely popular right now, yet because the government has declared it illegal, users are forced to purchase it on the black-market. MDMA users are often told for sure if the drug they are buying is indeed MDMA or some other drug or combination of potent drugs. Additionally, because MDMA is a Schedule I drug, the price of the drug is artificially inflated to thousands of dollars (according to the government) or

getting involved in its distribution. Prohibiting alcohol and marijuana produces all the same problems we saw 70 years ago during alcohol Prohibition. The problems that are much greater than the problems caused by the drugs themselves.

As discussed earlier, the FDA's decision in 1996 declassifying cigarettes would actually increase health and social harm rather than reducing it. The same reasoning should be applied to other drugs (including MDMA and marijuana) that the government is waging a full-scale war on.

It's clear to any reasonable person who examines the nation's drug policy, that it is riddled with contradictions and outright hypocrisy. The central problem of the so-called Drug War conundrum is that it is imposed on society-at-large, and legislators in particular, are unable to adopt a more mature view of drugs. Government prohibition of drugs is infantile. A national policy of intolerance (i.e., "zero-tolerance") rather than respect for individual choice is the root of all our drug problems < both legal and illegal. Rather than cower in the shadows of fear and "no" propaganda and hypocritically proclaiming that a dangerous drug that threatens to destroy lives is necessary while simultaneously employing contortions to keep cigarettes on the market, we should recognize that people have a natural drive to experiment with various modes of consciousness. The government should accept this as a fact and begin designing drug policies that make drug use as safe as possible. If Justice Brennan wrote in his dissenting opinion in *Reich v. Greenwald* (1975 case), tobacco policy should "take into account the realities of human behavior," why should drug policy with respect to other drugs be any different?

Adults ought to have the right, after all, to control their own bodies and minds < and our drug policy should respect an adult's autonomy over her own body and mind. Some may choose to smoke cigarettes, while others will choose to smoke marijuana. Smoking one plant versus another should not be a crime. No one should be made a criminal

his or her mind state. All should be permitted as the person does not harm others. Any policy built on intolerance and disrespect is destined to lead to a host of and negative social consequences such as over-crowding, unjust sentences, misdirection away from schools in order to build more property forfeiture, kids dying of adulterated "market" drugs, organized crime, sick people, medicine, helicopters hovering overhead, bashing down the doors of decent people, cops. These problems are produced not themselves, but by our immature decisions.

Making an adult a felon for taking a hit of rather than smoking a Marlboro is irrational. The issue of the matter is that millions of people use psychoactive drugs such as nicotine, alcohol, marijuana and MDMA. The government should stop the business of telling adults what they can do in their mouths, or declaring, under threat of imprisonment, loss of property and heavy fines, it's okay to operate your mind with the brain but not another. What goes on inside a person's body and mind ought to be none of your business but that person's.

Lets replace the value of intolerance with respect, and instead of demanding that people "do no harm," acknowledge that adults have the basic right to control their own bodies and minds, so long as they do not harm others.

Prohibition is not only a bad idea, it's also a bad

Notes

1 James Joyce, Finnegans Wake (1939) Episode:13, Page:429.

2 Pub. L. 89-92, Sec. 4, 79 Stat. 283.

3 See Cigarette Labeling and Advertising Act, 15 U.S.C. § 1333.

on H.R. 2248 before the House Committee on Commerce and Foreign Affairs, 89th Cong., 1st Sess. (1966); Letter to Directors of Bureaus, Divisions and Offices of Districts, from FDA Bureau of Enforcement (1963), in 1972 Hearings 240 ["[T]obacco chewing or smoking without accompanying health claims, does not meet the definitions in the Food, Drug, and Cosmetic Act for food, drug, or cosmetic"].

4 61 Fed. Reg. 44412, 44398 (1996).

5 7 USC Sec. 1311(a).

6 61 Fed. Reg. 44412 (1996).

7 *Ibid.*, 44412-44413.

8 *FDA v. Brown & Williamson Tobacco Co.*, 2000 WL 1500000 (D.C. 2000), <http://supct.law.cornell.edu/supct/html/98-1500000.html> [Accessed May 23, 2000].

9 *Ibid.*

10 U.S. Department of Health and Human Services, "Why People Smoke Cigarettes," in Smoking Prevention Education Act, Hearings 1824 before the Subcommittee on Health and Environment of the House Committee on Commerce, 98th Cong., 1st Sess., 32 (1984).

11 U.S. Dept. of Health and Human Services, Health Service, The Health Consequences of Nicotine Addiction 6-9, 14-15, 145-239 (1984).

12 In the Matter of Marijuana Rescheduling, 86-22, Opinion, Recommended Ruling, Final Conclusions of Law, and Decision of Administrative Law Judge, Washington, DC: Drug Enforcement Administration (6 September 1988).

Seedbank Update July/29/00

Greetings growers this is for medical marijuana users and those who can use the information. First news and growing tips.

This is a weekly report on which seedbanks are reliable and give good service. I also list seedbanks are welcome. That's what this is based on, reports from people like you. You get it. Sometimes posts don't show up on my newsserver. If you send a report please state I'd like to know if the packaging was stealthy (well hidden) and what method used and if it slow. A complete breakdown on the ratings is found at <http://www.suresite.com/ca/s/sys>

I have a system of additional ratings. They are a one (1) for accepting payment by money two (2) will be given for free stealth shipping. A three (3) will be given for accepting credit privacy on request. A five (5) indicates they take Western Union. An example of the new takes money orders with no extra charge.

This group I've heard good things about. Those with four stars or more are the most reliable

World wide shipping. Those with 4 stars or more are most reliable

Amsterdam Aloha: (S***)

[Dr. Greenthms \(F****+\) \(1,2\)](#)

[Heavens Stairway: \(F*****\) \(1,2\)](#)

Marc Emery Direct (**) (1)**

H.D. Seeds (**1/2) (1,2,3)

Hempseed Cybershop: (F**1/2) (4)**

Tambu (**1/3)

bluenose (**1/2) (2)

Seeds Direct (1/2) (1,5)**

These ship to a limited area

Dr Hermans (***) (1,3)

High Land: (**)

Seed and Read: (**+)

White Widow Web (**1/2)

Paradise (***)

These are seed breeders and wholesalers primarily. While they have a good reputation,

Bros. Grimm

Dutch Passion: <http://www.dutch-passion.nl>

Homegrown Fantaseed

BCGA

Sensi Seed: <http://www.lycaeum.org/~sky/data/sensi.html>

This is the rip-off section. The following seedbanks I've heard many bad things about. The product. N means sending non viable seeds (non sprouting seeds)

A-1 Seedbank (X,N)

Beeoo (X)

Fairlight (X,N)

Gangaland (Bonhommes) (X,M) Software Services aka Cannabis4u aka medical hemp aka

Pot a Gold (X)

Richies Seedshack (X)

Weedseed (X)

These seedbanks are not recommended due to excessive complaints. This is a judgement follows: 10 = non delivery, 11 = very poor customer service, 12 = inferior quality or mis

Bullmall aka Bull-electrical.com (10, 11)

Greater Harmony (10)

Laughing Moon (10, 11)

Seedbank Co uk (10, 12)

Stinkey's (10,11)

Here are some good websites for cultivation and general info:

This is NPKaye's site, <http://www.lycaeum.org/%7Enpkaye/cultivation.html>

These are very good sites as well, check them out. Here are the plans for a home built o

Here is an archive of a recent seedbank update. <http://www.overgrow.com/su>

For info on how to post anonymously to a newsgroup or to send anonymous mail to some

Thanks to all who have contributed. Next week, I should have another update for you pe

peace

green man

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by any means without permission of the author.

Cannabis growing guide

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OVERVIEW

There are few things in life as good as your own herb, grown by yourself at home out in the garden. Mint will take over the whole yard if you let it. Fresh mint and celantro are incredible in salads and soups. Mint is a great healer and teacher to those that know it well.

Most people think of gardens as a seasonal, yearly project, but it's actually less time consuming a year round, indoor gardening techniques will be needed at least during winter to keep the garden alive. In the winter and spring, it requires less space, and once established, requires only minimal attention.

The best part of being a gardener is it connects you to the earth. It connects you with nature, and the energy at them every time you visit them. I find this helps me as much as it helps them; my plants are happy.

GENETICS AND THE PLANT

It's very important to start with good genetics. You should attempt to find seeds from local gardeners. Look for seeds that have a strong aroma, fast growth, early maturation, resistance to fungus and pests. All of these factors are considered good genetics. They will get you started on the journey that never ends...

Attempt to find an Indica/Sativa hybrid if possible, as this will have the best high and good characteristics. Indica plants are hard to grow indoors due to high light requirements, and late flowering. Sativa plants have the early maturation tendencies of the Indica plant.

The Indica plant is easily recognized by its extremely broad leaves that are very rounded on the sides. Sativa plants have thin, pointed leaves and have leaves that are a cross of these two types, thinner than an Indica, but much broader than a Sativa. Look for these characteristics when you are looking for seeds.

Look for seeds that are dark brown or light grey. Some may have dark lines inset into these colors.

INDOORS & OUTDOORS - CONSTANT HARVEST STRATEGY

One of the best solutions to energy verses output for most home gardeners is to use outdoor light. This will take advantage of the natural light/dark cycle and cut your energy use in half compared to sheets that is innocuous and looks much like a storage shed or tool shed so it's not likely to raise :

In fact, a large shed of metal or plywood can be modified with a luminous roof of PVC, glass, fiber grow well. Such a shed will discourage fly-by sightings and keep your business your own! It also locked up. It will also give you an opportunity to actually plant in the ground if you desire, and this bigger harvests.

In winter, indoor space is used to start new seedlings or cuttings to be placed outside in the spring outdoor/greenhouse harvests per year. If more space is available to constantly be starting indoors areas, with a small indoor harvest in the winter as a possibility as well.

The basic strategy of year round production is to understand the plant has two growth cycles. At light you can give it. This means there is no dark cycle required. The plant will photosynthesis con during dark periods and the plant uses sugars produced to build during the evening. This is not a (constant light).

Once the plant is 12-18" tall, weather permitting, it can be forced to start flowering by placing it o lengthened in the greenhouse to "force" the plants to flower. See FLOWERING chapter.)

Moving the plants to 10-13 hour light periods (moving it outside) with uninterrupted darkness (no to harvest. When a plant is moved from continuous indoor light to a 10-13 hour day outside, it will March 1st, will be ripe by May 1. Vegetative starts moved outside on May 1 will be ripe by July 1. S indoors and a crop is planted for seed in anticipation of planting outdoors the next summer, or jus

Keep in mind that the "man" is looking for plants in the Sept./Oct./Nov. time-frame, and may neve May, not October!

PLANTING INDOORS

A small indoor space should be found that can be used to germinate seeds; these vegetative start closet, a section of a bedroom, a basement area, an attic or unused bathroom. Some people devo

The space must be light leak proofed, so that no suspicious light is seen from outside the house. T

The space should be vented. Opening the door of a closet can be enough ventilation if the space i are best. One at the top of the room to exhaust air into the attic or out the roof, and one to bring i cabinets, available from electronic liquidators for \$5 each. Dimmer swithes can be used to regulat a round hole cut in the floor and ceilings. Use lots of silicon to damp the fans vibrations, so that th

Line the walls with aluminum foil, dull side out to diffuse the light and prevent hot-spots, or paint feet of a 4' wide roll.) Mirrors are not good to use, since the glass eats light!

Line the floor with plastic in case of water spills, etc. Set up a voltage interrupt socket and be sure HID lamps on a shelf, so they are above floor level, in case of water spills. Spacers place on the fl

A shelf above the main grow area can be used to clone cuttings and germinate seedlings. It will al food, spray bottles and other gardening supplies. This area stays very warm, and no germination

Hang a light proof curtain to separate this shelf from the main area when used for flowering. This be used to keep the curtain in place and ties can be used to roll it up when tending the garden. Bl

Now you need light. A couple of shop lights will be fine if you just want to start plants inside and then move them outside for about \$10 each, or without bulbs for around \$8. Try to find them on sale. Use one Cool White and one Warm White for growth. Do not use expensive Grow Lux type bulbs, as they do not put out as much light, and they are hard to find, or afford, use them. They work fine, and are by far the cheapest. (About \$1-2 each.)

SHELF GROWING

Shelf gardening with fluorescents may be the trend of the future, since the materials are so inexpensive. Many shelves can be placed, one above the other, and fluorescent lamps are used on each shelf. Closets are best, perhaps with one other devoted to cloning and germination of seed.

Shelf gardening assumes your going to keep all plants 3' or shorter at maturity, so all shelves are to mature early.

One drawback to a shelf garden like this is that it is very time consuming to adjust the lamp height as the plants grow. This applies mostly to the vegetative stage, when plants are growing as much as an inch per day.

Normally, the lamps should be kept within 2 inches of the tops of the plants, with the plants arranged so that they are within this 2" range. This is an ideal however, and if you do go on vacation, adjust the lamps to a safe distance. If enough fluorescents are used to completely saturate the shelf with light, the spacing issue is not as important. Very close to them.

An alternative is to use fluorescent lamps for cloning, germination and early seedling growth on the shelves, and HPS for flowering in the main closet area.

Position the HPS such that it won't need adjustment, at the top most possible point in the closet or closet area. Hang the lamp to the underside of shelf or ceiling as high as possible, and if you want to get a few plants close to the light, use a reflector.

A shelf is all that is necessary with this type of setup, preferably at least 18" wide, up to about 24" high. Use aluminum foil, dull side out to reflect light back to the plants. (Dull side out prevents hot-spots; diffuses light evenly.) Use silver surface material. Do not use mirrors, as the glass soaks up light.

Hang shop lamps from chains and make sure you can adjust them with hooks or some other type of hardware. If the lamps are too far from the plants, the plants could grow long, spindly stems trying to reach the light. This is the length of stem between each set of leaves. If it is shorter, there can be a problem with space at harvest time.

Shelf gardening is sometimes referred to as Sea of Green, because many plants are grown close together. A crop is started and growing concurrently in a separate area of continuous light. Clones are raised on the shelves, one hour per day shelf to flower.

LIGHT

Indoors, 2000 lumens per sq. ft. is about as low as you want to go indoors. If you get under this minimum, the plants will increase. Also, light distance to plants will be much more critical. Daily adjustments to the lamp height are necessary.

2500 lumens psf should be a good target, and 3000 is optimal if your going to inject or enrich CO2.

High Intensity Discharge lamps are the best solution for most indoor growers. HID lamps come in two types. Metal Halide is an improved spectrum, higher intensity Mercury Vapor design. HPS is a yellowish spectrum.

HPS lamps can be used to grow a crop from start to finish. Tests show that the HPS crop will mature faster than the other. It will wait the extra week.

The easiest HID to buy, and least expensive initially are the fluorescent and mercury vapor lamps. 15k lumens, so HPS is almost twice as efficient. But the color spectrum from MV lamp output is not as good as Metal Halide. Metal Halide is rich in blues, needed for the best vegetative growth. Unfortunately, MV lamps provide the recommended spectrum, unless you find them free, and even then, the electricity/efficiency issues outweigh the benefits.

400 watt HPS will output around 45k lumens. For every 500 watts of continuous use, you use about 1000 kWh. The same lumens (or twice the lumens at the same power level) will pay for itself in a year or so, and in an operating costs calculation, and does not take into account the faster growth and increased yield. In a yield calculation the HPS lamp will pay for itself with the first crop, when compared to MV or fluorescent lamps.

Lamp Type	Watts	Lumens per bulb	Total efficiency
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Fluorescent Bulb	40	3000	400 watts = 30k lumens
Mercury Vapor	175	8000	400 watts = 20k lumens
Metal Halide	400	36000	400 watts = 36k lumens
High P. Sodium	400	45000	400 watts = 45k lumens

Notice the Mercury Vapor lamps are less efficient than the fluorescent (FL), and can not be positioned for indoor gardening. The light distribution is not as good either. MV lamps simply are not suitable for indoor gardening, and not very much light for the wattage they use, and are also not recommended, even though they are cheap.

There is a new type of HPS lamp called Son Agro, and it is available in a 250, 1000, and 400 watt size. It is a very bright lamp (53k lumens) and is made for greenhouse use. These bulbs can be purchased at a very low price. The beauty of this bulb is that you do not give up most of the advantages of MH lamps, such as minimum energy use. It has all the advantages of a HPS lamp. One bulb does it all.

Internodal length of plants grown with the Son Agro are the shortest ever seen with any type of lamp. Son Agro bulbs however, do not last as long as normal HPS bulbs. There is something like a 25% difference in life.

Metal Halide (MH) is another option, and is available in both a 36k and 40k lumen bulbs for the 400 watt size. I think the Super Bulb may last longer; if so, that makes it the way to go. Halide light is more efficient than HPS. It is possible to purchase conversion bulbs for a MH lamp that convert it to HPS, but the conversion is not perfect, so I would recommend just buying the Son Agro HPS. Even though it costs more initially, you get more light for your money.

If you have a MH 36k lumen lamp burning at 400 watts and a 53k lumen HPS burning at 430 watts, the HPS is more efficient. Son Agro HPS, but of course, the initial cost is higher. Actually, the ballast will add about 10% to these costs.

The Son Agro bulb will prove much better than the MH for any purpose. The MH bulb does not last as long as the Son Agro bulb. Add \$15 for the Son Agro HPS. The HPS bulb life is twice as long. 10k hours vs. 21k hours. This is a big difference for your energy dollar long term.

Horizontal mounting of any HID is a good idea, as this will boost by 30% the amount of light that a plant receives. This is a significant increase in light for a horizontal mounting arrangement.

HPS is much less expensive to operate than any other type of lamp, but comes in the 70 watt size. Two 70 watt HPS lamps would be 140 watts. They are very efficient, so they might be an alternative to FL for very small operations, like 9 sq. feet or less. Consider using two of them. 70 watt HPS lamps cost about \$40 each, complete. Two lamps would be 140 watts. They output about 18k lumens, the bulb life is longer, bulbs are cheaper and the lamp more efficient to operate. They are as expensive to buy as the larger 400's. For this reason, if you have room for the larger lamp, buy the larger lamp. It is better light distribution from two 400's rather than one large lamp. Of course, the two smaller lamps are better for bigger operations.

Heat buildup in the room is a factor with HID lamps, and just how much light the plants can use is big of a lamp for a space will make constant venting necessary, and then there is no way to enrich

Bulb Costs: the bulb cost on the 70 watt HPS is \$24, the 150 is only \$30, and the 400 is only \$40. watt HPS. (Go figure.) Add that up with the lower resale value on the 70's (practically nothing) and becomes evident that \$189 for a 250 HPS lamp, or \$219 for a 400, might just be worth the price. 1 20k lumens more light than the smaller lamp. Not a bad deal!

Here is the breakdown on prices (from memory):

Type	Complete Cost	Bulb Cost	Bulb Life	Lumens
HPS 400	\$219	\$40	18k hours	50k
MH 400	\$175	\$37	10k hours	36k
Son Agro400	\$235	\$55	15k hours	53k
Super MH400	\$190	\$45	??	40k
MH 250	\$149	\$32	??	21k
HPS 250	\$165	\$36	??	27k
HPS agro250	\$180	\$53	??	30k
MH 150	\$139	\$25	??	14k
HPS 175	\$150	\$30	??	17k

If your looking for these types of lamps, look in the Yellow Pages under gardening, nurseries, and

SEA OF GREEN

Sea of Green (SOG) is the theory of harvesting lots of small plants, matured early to get the fastest time, in the same space many smaller plants are grown that mature faster and in less time. Thus, comes each month. One crop can be started while another is maturing, and a continuous harvest, plant per square foot will allow plenty of room for each plant to grow a large top cola, but will not always shaded anyway, and will not grow very well unless given additional light and space. The in bottom to make the extra growing time used worth while. An exception to this rule would be if it is light/shading issue will not be a factor at that point.

The plants, if started at the same time, should create what is called a "green canopy" that traps n the plants are so close together. The gardener is attempting to concentrate on the top of the plan poultry fence or similar trellising laid out over the green canopy will support the plants as they sta easy to install for plants in the middle and back of the room, where reach is more difficult.

It's easy to want big plants, since they will produce more yield per plant, but it's usually better wit Sea of Green was developed in Holland. Instead of fitting 4 large plants in that small room, fit 12 s mature from germination to ripe buds, and harvesting takes place constantly, since there is both i

It's not the size of the plant, but the maturity and quality of the product that counts. Twice as mar almost twice as often. Get good at picking early flowering plants, and propagate only those that a

6" square containers will allow for 4 plants per square foot. You may also gauge by the size of you Planted 4 per square foot, (for vegetative seedlings) a 12 sq. ft. closet will hold 48 seedlings on or pan. I can get 5 pans onto a 12 sq. ft. closet upper shelf, so that is 60 seedlings on one small shel

For flowering indoors, 1 plant per sq. ft. is a good rule of thumb for SOG. If less plants are grown i time will be used to create the same amount of product. If more than one plant p.s.f. is attempted the total harvest may be reduced, so be cautious.

It's good to avoid "topping" your plants if you want them to grow as fast as possible. It's better just to let them grow in space. Also, "training" plants with twist-ties is a great way to get them to bush out a bit. Just take the top of the plant over until the top is bent over 90-180 degrees and then attach this to the main stem lower on the plant. Plants trained in this fashion take less vertical space and grow bushier, to fill the grow space and for the advantage of the fact that if the top is pulled over, it creates a hormonal condition in the plant that encourages branching.

Sea of Green entails growing to harvest the main cola (top) of the plant. Bottom branches are trimmed and discarded, as they are the easiest part of the plant to root. It's also the fastest part of the plant to root.

GERMINATION

Germinate seeds in sterile soil (for planting outdoors) or a hydroponic medium of rockwool or vermiculite. My experience shows these peat cubes do not work well and stunt the plants' growth. Planting in vermiculite, and the plants look large 1 week after germination!

Keep them moist at all times, by placing seeds in vermiculite filled 16oz cups with holes in the bottom. Water them extremely well. When the seed sprouts, place the rockwool cubes into larger rockwool cubes. No more water.

You can germinate seeds in a paper towel. This method is tricky; it's easy to ruin roots if they dry out. Place a paper towel in a bowl, saturated with weak nutrient solution (not too much!), and cover with plastic. Place in a heater closet, or above warm lamps. Cover with black paper to keep out light. Check every 12 hours. Harvest as soon as the root coming out of the seed is 1/16" or longer. Use tweezers, and don't touch the root.

Transplant as little as possible by germinating in the same container you intend to grow the plant in. I was amazed at the results! 90% germination is common with this method, as compared to 50% or less with other methods.

Use 5-55-17 plant food such as Peter's Professional will stimulate root growth of the germinating seed. Keep temperatures between 72-80 degrees. Warm temperatures are very important. A heating pad set to low or medium may be necessary, or a shelf constantly warmed by a light may be necessary and may slow germination. Cover germinating seeds with black paper to keep out light.

Plan on transplanting only once or twice before harvest. Use the biggest containers possible for the plants. Transplant and delay harvesting. You will suffer too, from too much work! Use 13 2-liter plastic soda bottles for transplanting for the first harvest, if you intend to grow hydroponically. Transplant them for a second harvest.

Cut holes in the bottom of containers and fill the last few inches at the top with vermiculite only, to keep the water well, but does not hold too much water, roots always have lots of oxygen, even if they are submerged. The oxygen to the plants when the pans are kept continuously full. The water can be allowed to recede somewhat, and make sure they are getting enough oxygen.

Use SuperSoil brand potting soil, as it is excellent and sterilized. If you insist on using dirt from the outdoors, (NOT RECOMMENDED) Sterilize the containers with a bleach solution, especially if they have been used previously.

VEGETATIVE GROWTH

Once sprouted, the plant starts vegetative growth. This means the plant will be photosynthesizing. The top of the plant is the part that can be cloned or propagated asexually. They are located at the top of the plant. If you top each of these, you will have 4 grow tips at the top of the plant. (Since it takes time for the plants to grow and not top them at all. Or grow 2 plants, and "train" them to fill the same space. Most growers top their plants.)

All plants have a vegetative stage where they are growing as fast as possible after the plant first sprouts. The speed at which they grow by 15-30%. Plants can be grown vegetatively indefinitely. It is up to the grower to decide when to top before being forced to flower, so there is a lot of latitude here for each gardener to manage the growth.

A solution of 20-20-20 with trace minerals is used for both hydroponic and soil gardening when grown for this. A high P plant food such as Peter's 5-50-17 food is used for blooming and fruiting plants with magnesium and sulfur minerals. Trace minerals are needed too, if your food does not include them.

Keep lights on continuously for sprouts, since they require no darkness period like older plants. You can do this day. Try to light the plants for 18 or more hours, or continuously at this point.

Bend a young plant's stem back and forth to force it to be very thick and strong. Spindly stems cause the leaves' stomata and improve the stem strength as well. The importance of internal air circulation while reducing many hazards that could ruin your crop.

HYDROPONIC VEGETATIVE SOLUTION, per gallon:

Miracle Grow Patio (contains trace elements) 1 teaspoon

Epsom salts 1/2 teaspoon

Human Urine (OPTIONAL - may create odors indoors.) 1/4 cup

Oxygen Plus Plant Food (OPTIONAL) 1 teaspoon

This mixture will insure your plants are getting all major and minor nutrients in solution, and will add good burning qualities. Another good GROWTH PHASE mix is 1/4 tsp Peter's 20/20/20 fertilizer per emulsion is great in the greenhouse or outdoors, where smells are not an issue, but is not recommended.

FLOWERING

The plant will be induced to fruit or flower with dark cycles of 11-13 hours that simulate the outdoors. Indoors to have two separate areas; one that is used for the initial vegetative state and one that is used for flowering very dark with no light interruptions, as this can stall flowering by days or weeks.

Once a plant is big enough to mature (12" or over), dark periods are required for most plants to flower. In the greenhouse, the same effect can be created in the schedule of covering the plants at 8pm and uncovering them at 8am for 2 weeks will start your plants to flower. It will still be necessary to continue this routine for the plants to completely flower without reverting back to vegetative.

Outdoors, Spring and Fall, the nights are sufficiently long to induce flowering at all times. Merely by the natural cycle. In late Summer, with Fall approaching, it may be necessary only to force flowering the first time.

Give flowering plants high P plant food and keep them on a strict light regimen of 12 hours, with no interruptions. This will increase flower size while still allowing the plant to go into the flowering mode. Use longer dark periods (8-10 days) This will however, reduce total yield.

Two shelves can be used, one identical to the other, if strictly indoor gardening is desired. One shelf is under continuous light, and are moved to the other shelf to flower to maturity after several weeks. This method can accommodate larger plants. Or, some plants can be taken outside if there is not enough space on the shelves.

A light tight curtain can be made from black vinyl, or other opaque material, with a reflective material on the inside. When rolled up to work on the garden, and can be velcroed down in place to make sure no light leaks into any room. Visitors will never notice it unless you point it out to them, since it is above eye level, and is not in the way.

Flowering plants like very high P level foods, such as 5-50-17, but 10-20-10 should be adequate. Most plants will flower with 10-20-10.

Trace elements are necessary too; try to find foods that include these, so you don't have to use a separate trace element solution.

rich in iron for lawn deficiencies, and these can be adapted for use in cultivating the herb. Prices for hydroponic fertilizers sold in indoor gardening shops, and seem to work just fine.

HYDROPONIC FLOWERING SOLUTION, per gallon:

1 tspn high P plant food, such as 15-30-15, or 5-50-17, etc.

1/2 tspn epsom salts

1 tspn Oxygen Plus Plant Food (Optional)

1 tspn Trace Element food

I cannot stress enough that during the FLOWERING PHASE, the dark period should not be violated to light. If you must work on the plants during this time, allow only as much light as a VERY pale night during the FLOWERING PHASE.

A green light can be used to work on the garden during the dark period with no negative reactions. OK. It is best to keep the dark hours a time when you would normally not wish to visit the garden. at night after work and in the morning before work, and all day long, while I'm too busy to worry a

Flowering plants should not be sprayed often as this will promote mold and rot. Keep humidity level in regard.

Early flowering is noticed 1-2 weeks after turning back the lights to 12 hour days. Look for 2 white pistils on the female. You can not tell a male from a female by height, or bushiness.

3-6 weeks after turning back the lights, your plants will be covered with these white pistils emerging from the mature flowers, as they continue to grow and cover the plant. Some plants will do this indefinitely. When the existing flowers become ripe (you feel the plant has enough flowers), turn the lights back to 8-10 hours a day for 2 weeks. The alternative, is to allow the plant to ripen with whatever natural day length is available which may increase yield, but takes longer.

Plants can be flowered in the final stages outdoors, even if the days are too long for normal flowering. The plants will go back to vegetative growth, and final flowering will occur regardless. This will free

Look for the white hairs to turn red, orange or brown, and the false seed pods (you did pull the male flowers are ripe to harvest.

Don't touch those buds! Touch only the large fan leaves if you want to inspect the buds, as the TH

HYDROPONICS

Most growers report that a hydroponic system will grow plants faster than a soil medium, given the more control of nutrients, and more access to oxygen. The plants can breathe easier, and therefore, hydroponic plants started 2 weeks later!

Fast growth allows for earlier maturation and shorter total growing time per crop. Also, with soil provides even, rapid growth with no pauses for transplant shock and eliminates the labor/material

By far the easiest hydroponic systems to use are the wick and reservoir systems. These are referred to as passive systems (no pump, drain, flow meter and path). The basis of these systems is that water w

The wick system is more involved than the reservoir system, since the wicks must be cut and plac

the plants up above the water reservoir below. This can be as simple as two buckets, one fit inside the other, with the plants in the top bucket and the water reservoir in the bottom bucket. The plants sit in a nutrient solution.

I find the wick setup to be more work than the reservoir system. Initial setup is a pain with wicks, and the plants may not be very stable compared to a reservoir system, and a knocked over plant will never recover.

The reservoir system needs only a good medium suited to the task, and a pan to sit a pot in. If roots spread out in a very desirable horizontal fashion and have a lot of room to grow. Plants grown with reservoir hydroponics grow at about the same rate as wicks or other active hydroponic methods. Plants can be watered and fed by merely pouring solution into the reservoir and moving around.

In a traditional hydroponic method, pots are filled with lava/ vermiculite mix of 4 to 1. Dolomite Lime water, but has excellent drainage and air storage capacity as well. It is however, not very reusable and rinse the dust off it, over and over, until most of it is gone. Wet the vermiculite (dangerous dust) settle to bottom after repeated watering from the top, so only water from the top occasionally to fill holes in the bottom of the pots, and add water to the pan. It will be wicked up to the roots and the

The reservoir is filled with 1 1/2 - 3 inches of water and allowed to recede between waterings. Water is replaced faster over time. If you go away on vacation, simply fill the reservoirs full to the top, and the plants will survive.

One really great hydroponic medium is Oasis floral foam. Stick lots of holes into it to open it up a little for growth stages. Many prefer floral foam, as it is inert, and adds no PH factors. It's expensive though a popular item at the indoor gardening centers.

Planting can be made easier with hydroponic mediums that require little setup such as rockwool. Some advantages of rockwool are that it is impossible to over water and there is no transplanting time.

Some find it best to save money by not buying rockwool and spending time planting in soil or hydroponics. Perlite can be used instead of or in addition to lava, which must be rinsed and is much heavier.

But rockwool has many advantages that are not appreciated until you spend hours repotting; take perlite, which crunches and powders easily. Rockwool holds 10 times more water than soil, yet is inert and there is no transplanting; just place a starter cube into a rockwool grow cube, and when the plant is ready to transplant and over, the cost is divided by 3 or 4 crops, and ends up costing no more than vermiculite and lava. Rockwool. Vermiculite is also very dangerous when dry, and ends up getting in the carpet and into the lungs. For this reason, I do not recommend vermiculite indoors.

Rockwool's disadvantages are relatively few. It is alkaline PH, so you must use something in the range of 6.5 (vinegar works great.) And it is irritating to the skin when dry, but is not a problem when wet.

To pre-treat rockwool for planting, soak it in a solution of fish emulsion, trace mineral solution and a pH adjuster. PH worries later on, as it buffers the rockwool PH to be fairly neutral.

Hydroponics should be used indoors or in greenhouses to speed the growth of plants, so you have a controlled environment and speed growth. The main difference between hydroponics and soil growing is that the hydroponic system avoids over-watering problems associated with continuous watering. Also, hydroponically grown plants do not suffer from mineral buildup in soil, and lack of oxygen to suffocating roots.

Hydroponics allows you to use smaller containers for the same given size plant, when compared to soil growing. This would be difficult to do in soil, since nutrients are soon used up and roots become crowded. Hydroponics occurs nearly as quickly for hydroponic plants, since the roots can still take up nutrients from the reservoir. In soil, the roots become bound in the small container.

Plant food is administered with most waterings, and allows the gardener to strictly control what nutrients are provided. It is not automated to some degree with simple and cheap drip system apparatus, so take advantage of that.

Hydroponics will hasten growing time, so it takes less time to harvest after planting. It makes sense to grow indoors, but it is more desirable if your growing outdoors, unless you have a greenhouse.

CAUTION: it is necessary to keep close watch of plants to be sure they are never allowed to dry too long. If you do not tend to the garden every day, be sure the pans are filled enough to last until next time you return.

More traditional hydroponic methods (active) are not discussed here. I don't see any point in making a reservoir system if you are circulating it with a pump, but the reservoir system does away with this problem. Just rinse the pot or rockwool cube with pure water. Change plant foods often to avoid deficiencies in the plants to lessen chances of any type of deficiency.

Change the solution more often if you notice the PH is going down quickly (too acid). Due to cation exchange, nutrients become unavailable to the plants. Check PH of the medium every time you water to be sure no PH problems occur.

Algae will tend to grow on the medium with higher humidities in hydroponics. It will turn a slab of rockwool into a mat. Cover rockwool slab tops, with holes cut for the plants to stick out of it. It's easy to cut a packaged slab. Now have two pieces of slab, each covered with plastic except on the very ends. Now cut 2 or 3 4' pieces. Now you're ready to treat the rockwool as described above in anticipation of planting.

If growing in pots, a layer of gravel at the top of a pot may help reduce algae growth, since it will prevent water from standing on the plants.

RECYCLING

Use pots made from squarish containers such as plastic water jugs, etc. More plants will fit in less space, and saves you tons of money.

2-liter soda bottles work great, but are not square. 13 will fit in a kitty litter box, and these will take up less space. You can grow 52 plants like this vegetatively. Spread them out more for flowering.

Old buckets, plastic 3-5 gallon containers (food and paint industries, try painters' and restaurant dumpsters) have all been used successfully by growers.

Do not use paper milk cartons and juice cartons for reservoir hydroponics, since these are difficult to clean. Clear plastic is best.

Be sure to sterilize all containers before each planting with a chlorine bleach solution of 2 tbspn. of bleach per gallon of water for several hours in the solution before rinsing thoroughly.

PLANTING OUTDOORS

Outdoor growing is the best. Outdoor pot by far is the strongest, since it gets more light, it's natural, and it's free. No electricity bills. Sunlight tends to reach more of the plant, if you're growing in the dirt. The top of the plant is the best.

Outdoors, outside of a greenhouse, there are many factors that can kill your crop. Deer will try to eat your little buds to pieces if they are exposed to strong storms. For this reason, indoor pot can be a good idea; nothing beats the sun.

Put up a fence and make sure it stays up. Visit your plot at least once every two weeks, and prefer

It's a good idea to use soil if you don't have a green house, since hydroponics will be less reliable

Light exposure is all important when locating a site for a greenhouse or outdoor plot. A backyard (or other) location will enter in as well. Try to find an innocuous spot that gets full winter sun from mid morning to mid afternoon. A north-south lot if you live north of 30 degrees latitude since days are short in winter. Since most gardeners will use a north-south orientation as an indicator of good spring and fall lighting exposures. Usually the south side of a hill gets the most good southern exposures. East and West exposures can be good if they get the full morning/afternoon sun, versus afternoon-only sun, so if you have to choose between the two, morning

Disguise your greenhouse as a tool shed, or similar structure, by using only one wall and a roof of the shed, or painting it white or silvery, to look like metal. Try to make it appear as if it has a roof that is allowing sun to reach it.

Filon (corrugated fiberglass) or PVC plastic sheets can be used outside to cover young plants grown in pots. Wash (made from lime) or epoxy resin tinted white or grey and painted on in a thin layer. This will preserve the Filon for many more seasons than it would otherwise last. It will also allow you to disguise the greenhouse as light grey. Paint will work as well, but may not protect as much. Be careful to use only as much as

Dig a big hole, don't depend on the plant to be able to penetrate the clay and rubble unless your soil is loose. A back yard may not. This alone can make the difference between an average 5' tall plant, and a 10' tall plant. A plant will never become root bound in the ground. Plants grown in the ground should grow much larger, once they're in!

You may want to keep outdoor plants in pots so they can be easily moved. A big hole will allow them to be moved. Many growers find pots have saved a crop that had to be moved for some unexpected reason (replanting, etc.)

It's always best to put a roof over your plants outdoors. When I was a lad, we had plants growing outdoors. A cop saw us hauling wood, thought we were stealing it (which we were not) and looked over the shed roof instead, there would never have been a problem. Moral of the Story: build the roof BEHIND the plants. Learn...

When growing away from the house, in the wild, water is the biggest determining factor, after security. Water is heavy and this is very hard work. Try to find an area close to a source of water if possible.

A novel idea in this regard is to find high water in the mountains, at altitude, and then route it down to a drip system that feeds water to your plants continuously. Take a 5 gallon gas can, and route the hose to a river or stream under rocks, so that it is hidden and submerged. Bury the hose coming out of the can, and this rig can be used year after year.

GUERRILLA FARMING

Guerrilla farming refers to farming away from your own property, or in a remote location of your property. The reason or another are not easily accessible or are privately owned.

Try to grow off your property, on adjacent property, so that if your plot is found, it will not be traced back to you. There is no physical evidence of your presence (footprints, fingerprints, trails, hair, etc.), then it is assumed to belong to the landowner.

Never admit to growing, to anyone. Your best defence is that you're just passing thru the area, and claim fishing or bird watching.

Never tell anyone but a partner where the plants are located. Do not bring visitors to see them, unless you are sure they are trustworthy.

Make sure your plants are out of sight. Take a different route to get to them if they are not in a safe cut backs in the trail, so that people on the main trail will tend to miss the cut-back to the grow area by people that pass on the road. Have a safe house in the area if you are not planting close to home. Your claim believable.

Briar and poison oak patches are perfect if you can cut through it. Poison Oak must be washed away and deactivate poison oak before it has time to create a reaction. Apply Teknu immediately after contact.

Try to plant under trees, next to bushes and keep only a few plants in any one spot. Train or top the most plants left to grow untrained. Tying the top down to the ground will make the plants branch out. Plants can be grown under trees if the sun comes in at an angle and lights the area for several hours of indirect light. Use shoes that you can dispose of later and cover your foot prints. Use surgical gloves if your plot is discovered by passers by.

Put up a fence, or the chipmunks, squirrels and deer will nibble on your babies until there is nothing around trees to create a strong barrier. Always check it and repair every visit you make to the garden. Your crop.

Gopher Granola is available for areas such as the N. CA mountains, where wood rats and gophers keep rats away from your plants! Do not use soap to keep deer away, it will attract rats! (The fat in the soap enters, so that birds and deer can't eat it. Set out poison early, before actual planting. The rats must find it's easier to grow in a greenhouse shed in your own backyard rather than try to keep the rats away.

When growing away from the house, in the wild, water is the biggest determining factor, after seeds you must pack-in water, carry it in a backpack in case you are seen in-route to your garden; you will appear to be carrying a backpack.

Transporting vegetative starts to the growing area is a most tricky aspect of growing outdoors. Use the grow site once they are firmly established. It may be desirable to first detect and separate the plants from the area where they were incurred.

One suggestion is to use 3" rockwool cubes to start seedlings in, then put 20 of them in a litter pack and directly into soil. If spotted inroute to the grow area, burying a dead cat may be a good excuse for the litter pack.

One outdoor grower we know has given up on seeds. He has several strains he likes to clone, so he clones. No males, no differentiation, no weeding, no germinating seeds, no genetic uncertainties, no crop loss, no pollination nightmares, no wasted effort!

SOIL GROWING

Use Super Soil brand in California, as this is the only known soil on the West Coast that is guaranteed to provide all the nutrients, are too moist, etc. Add vermiculite, perlite or sand to Super Soil to increase its drainage.

Organic gardeners use their own compost prepared from a mixture of chicken, cow or other manure, including urine, which is high in nitrogen. Dog hair is not recommended for guerilla gardeners plant in the ground. Dog's hair!

Use P4 water crystals in the soil to give the plants a few days worth of emergency water reserves. Use a small amount if harsh drought makes constant watering necessary. Go real easy on this stuff though, it stunts the plant. Use in extreme moderation, let it swell up for at least an hour before mixing with soil.

Plant size in soil is directly related to pot size. If you want the plant to grow bigger, put it in a bigger pot. A minimum of a 3 gallon pot. Remember, square containers have more volume in a square space (like a 3x3x3 pot).

Planting in the ground is always preferable when growing in soil. The plants can then grow to any size.

Bat Guano, chicken manure, or worm castings can all be used to fertilize organically in soil. Manure breaks down over several weeks. Sea weed is available to provide a rich trace mineral source that breaks down slowly.

If growing outdoors in available soil, look around for leaves and other natural sources of nitrogen (e.g., alfalfa) as fertilizer. Even small amounts of plant food such as Miracle Grow can be added to soil at this time (this is the commercial fertilizer production.) Mulch can be made from leaves and spread out over the garden.

SECURITY

It's interesting that pot plants really do blend in with other plants to the point that they are unidentifiable. I once showed me his corn in the garden and I was standing 3' away from several pot plants before I recognized them.

Plants started outdoors late in the season never get very big and never attract the least bit of attention. Several trees will be almost invisible in their camouflage.

Outdoors the object is to control access to an area, and not to arouse suspicion. Tuck them here and there in a landscape such that they get full sun, but they're hidden or blend in. Fence lines and groups of shrubs can be used to direct nitrogen to your plants if they need to be greener to blend in. Some growers even use plastic red mulch.

Visit the plants at night on full moons, and if your visible to neighbors, appear to be pruning a tree.

Dig a hole and put a potted plant in it. The plant's height will be reduced by at least a foot.

Some growers top the plant when it is 12" high, and grow the 2 tops horizontally along a trellis. This type of plant can even be grown in your yard in full view. Many stories abound of having the neighbor's plants.

PLANT FOOD AND NUTRIENTS

Plant foods have 3 main ingredients that will be the mainstay of the garden, Nitrogen, Phosphorus and Potassium, in the order of N-P-K. A 20-20-20 plant food has a Nitrogen level of 20%.

Secondary nutrients are Calcium, Sulphur and Magnesium. In trace quantities, boron, copper, molybdenum, and zinc are also important.

Depending on stage of growth, different nutrients are needed at different times. For rooting and growth, a lot of N, and human urine is one of the better sources, (mix 8 ounces to 1 gallon water), although it's not as good as Miracle Grow Patio food. Watch for calcium, magnesium, sulfur and iron levels too. These are important in a hydroponic medium when a hydroponic medium is first brought on-line, to provide nitrogen, calcium and magnesium.

Tobacco grown with potassium nitrate burns better. Plant foods with PN (P2N3) are foods such as those used for flowering cycle as well. Consider however, potassium nitrate is also known as Salt Peter, and is used for certain plants are destined for cooking, you might use Fish Emulsion or some other totally organic fertilizer.

Most hydroponic solutions should be in the range of 150-600 parts per million in dissolved solids. 300-400 ppm is a good range. Use a conductivity meter if your unsure of what your giving your plants.

Keep in mind most dissolved solids readings are usually on the low side, and actual nutrient levels are usually higher. After several feedings, to the point the medium is over saturated in nutrients. Just feed straight water next time.

Pumping is when you use more waterings to make the plants grow faster. This is dangerous if you do it too often and slowly and watch the plants daily and even hourly at first to be sure your not over-watering the plants. It's better to leach once a month and running straight water through the plants at least every other time you water.

Use of light strength Oxygen Plus plant food (or Food Grade Hydrogen Peroxide) allows the roots to breathe. There are no PH anomalies that might be due to Hydrogen Peroxide in the solution. (One experienced grower has reported that PH anomalies do not seem to be a problem if you are checking PH and correcting for it in watering solutions.)

Be sure your medium has good drainage. At this point, if you are watering soil based plants once a week, you should be watering them more often. Pearlite or lava rock will greatly increase the drainage of the medium and make watering easier. The enhanced oxygen to the roots. Make sure the plant medium is almost dry before watering again.

An alternative is to use a standard plant food mixture (stronger) once every 3 waterings. The nutrients are washed out by 2 straight waterings afterward and there is no salts build up in the soil. (Does not apply to hydroponics.)

Stop all plant food 2 weeks before harvesting, so that the plants don't taste like plant food. (This applies to soil based plants.)

WARNING: Do not over-fertilize. It will kill your plants. Always read the instructions for the fertilizer you are using. Build up slowly to higher concentrations. Salts build up over time to higher levels of dissolved solids. Use straight water for one feeding in hydroponics every month. If your plants look REALLY green, withhold food for a while to be sure they are not being over-fertilized.

PH AND FERTILIZERS

PH can make or break your nutrient solution. 6.7-6.2 is best to ensure there is no nutrient lock-up. Phosphoric acid can make the PH go down; lime or potash can take it up. Use a pH meter in your medium to make sure you are not going alkaline or acid over time. Most neutral mediums can use a pH of 6.5-6.8.

Most fertilizers cause a pH change in the soil. Adding fertilizer to the soil almost always results in a pH change.

As time goes on, the amount of salts produced by the breakdown of fertilizers in the soil causes the soil to become more saline. This will stunt the plant and cause browning out of the foliage. Also, as the plant gets older its roots die back. To ensure that your plant is getting all of the food it needs you can begin leaf feeding and spray the mixture directly onto the foliage. The leaves absorb the fertilizer into their veins. If you overdo it, you can overdose your plants.

FOLIAR FEEDING

Foliar feeding seems to be one of the easiest ways of increasing yield, growth speed, and quality in hydroponics. Use fish castings, fish emulsion, bat guano, or most any other plant food right for the job and feed in vegetable form. Stop foliar feeding 2-3 weeks before harvesting. Wash off the leaves after feeding. Feed daily or every other day.

Best times of day to Foliar feed are 7-10Am and after 5 in the evening. This is because the stomata are open at these times. If the temperature is over 80 degrees, and over 80, they may not be open at all. So find the cooler part of the day if it's hot, and the coolest time available. The sprayer used should atomize the solution to a very fine mist; find your own sprayer. Use vinegar to make the solution higher PH, and vinegar to make the solution lower PH. It's better to spray more often than to spray once. Prevent the water from beading up, and thereby burning the leaves as they act as small prisms. Most plants will not be damaged by a fine mist of water.

Perhaps the best foliar feeding includes using seltzer water and plant food at the same time. This is because the carbon dioxide in the seltzer water helps the plant absorb the nutrients.

Foliar feeding is recognized in most of the literature as being a good way to get nutrients to the plant.

WARNING!: It is important to wash leaves that are harvested before they are dried, if you intend to eat them.

NOTE: One grower who reviewed this document comments: "Fish emulsion smells. Bat guano could be used instead. Nitrate salts (The "N" in NPK) are unhealthy to smoke. Personally, I never found a good way to use them."

Above is a great comment, and there is great wisdom in an organic, non-toxic garden. Personally, not seem to be necessary when using hydroponics.

CO2

Elevating carbon dioxide levels can increase growth speed a great deal, perhaps even double it. It times what they are today. The plant uses CO2 for photosynthesis to create sugars it uses to build sugars and plant growth rate is enhanced considerably.

CO2 can be a pain to manufacture safely, cheaply, and/or conveniently, and is expensive to set up. plant is most dense and has the hardest time circulating air around its leaves. If your strictly grow be a major concern unless you have a sealed greenhouse, closet or bedroom, and wish to increase

For a medium sized indoor operation, one approach is to use CO2 canisters from welding supply systems are good only if your area is not too big or too small.

The basic CO2 tank system looks like this:

20 lb tank \$100

Regulator \$159

Timer or controller \$10-125

Fill up \$15-20

Worst case = \$395 for CO2 tank setup synced to a exhaust fan with a thermostat.

CO2 is cheaply produced by burning Natural Gas. However, heat and Carbon Monoxide must be vented from welding supply houses. If asked, you can say you have an old mig welder at home and need to pay

For a small closet, one tank could last 2 months, but it depends on how much is released, how often methods. This method may be overkill for your small closet.

It is generally viewed as good to have a small constant flow of CO2 over the plants at all times the

Opportunities exist to conserve CO2, but this can cost money. When the light is off you don't need setup to your light timer. When the fan is on for venting, CO2 is shut off as well. This may be up to gas actually dispensed.

Environmentally, using bottled gas is better, since manufacturing it adds to greenhouse effect, and then recycled. Fermenting, CO2 generators, and baking soda and vinegar methods all generate ne

CO2 generation from fermentation and generators is possible. A simple CO2 generator would be a area, and a fan is used to keep the hot CO2 (that will rise) circulating and available below at the p vented 50% of the time to rid the environment of heat from a lamp and heater will not receive as generators are the only way to go for large operations.

Fermentation or vinegar over baking soda will work if you don't have many vent cycles, but if you impractical. Just pour the vinegar on baking soda and close the door, (you lose your CO2 as soon as to regulate automatically, and requires daily attention. It is possible however, to create CO2 by fe cost-effective setup for most closet growers, for whom \$400 in CO2 equipment is a bit much to sw

In fermentation, yeast is constantly killing itself; it takes a lot of space. You need a big bin to cons

yeast. Sugar is used quickly this way, and a 10 pound sack will run \$3.50 or so and last about 2-3 releases. A tube out the top going into a jar of water will bubble and demonstrate the amount of CO₂ released.

Try sodium bicarbonate mixed with vinegar, 1 tsp: ~30cc- this will gush up all frothy as it releases CO₂. Provide CO₂ is 2 Oz sugar in 2 liters of water in a bottle [sterilized 1st with bleach and water, then a CO₂ supplier. Add a brewing yeast, shake up and keep at 25 deg celsius[~70 F] . Over next 2 weeks or so, starting a new one every 3 days or so. With added CO₂ growth is phenomenal!!! I personally have mounted.

A good container is a 1 gallon plastic milk jug, with a pin-hole in the cap. Also, the air-lock from a CO₂ demonstrate the fermentation is working.

A variation is to spray seltzer water on the plants twice a day. This is not recommended by some growers. It stands to reason this would work for only a small unvented closet, but may be right for some situations since it contains less sodium that could clog the plants stomata. Wash your plants with straight water that's good! Remember, being with the plants is a beautiful experience, and brings you closer to your plants (Lucky's @ .79 for a 2 liter bottle). Club soda will work if seltzer water is not available; but it has to be used on the plant at the same time. One factor of using seltzer water is it raises humidity levels. Make sure to monitor internode length.

CAUTION: Don't spray too close to a hot bulb! Spray downward only, or turn off the lamp first.

Even though CO₂ enrichment can mean 30-100% yield increases, the hassle, expense, space, danger to enrichment. As long as the plant has the opportunity to take in new CO₂ at all times, from air through the window. Most closets will need new CO₂ coming in every two or three hours, minimum. Most cities' will have unnecessary in these circumstances.

Some growers have reported to High Times that high CO₂ levels in the grow room near harvest time.

VENTING

You have to vent a lot with a HID lamp, less so for fluorescents. Also, humidity build up requires that you vent quickly, the best vent would be one that cleared the room in 5 minutes, then would stop for 25 minutes. A trick is to find a timer that will do this sort of thing. Not easy to find and not cheap. Once you need a CO₂ controller.

Alternatives are a thermostat that turns on a fan when a certain temperature is reached, and turn off when the temperature drops, since you don't know when the fan goes on. \$39 for this thermostat, but to sync it to CO₂ with a controller at \$100 is cheaper. All you really want is a fan that clears the air in a few minutes, a thermostat that turns on the fan when the CO₂ is low. If you can vent the room really quick and the heat does not build up too quickly, the CO₂ controller is an occasional quick exhaust cycles.

Two timers synced can be used, but the only ones cheaply available are the 30 min interval, 48 timer. You can sync it to the light so that I don't vent when the lamp is off. I can sync this to an identical timer that turns on the fan. It's difficult to sync them closer than 5-10 mins, but at least there would be a possible inexpensive solution.

Fans are expensive to buy for venting, but I just go down to the local electronic parts liquidators and buy a fan that is cost new at the indoor garden stores. A good vent fan will keep the humidity and temperature down.

Internal air movement is very necessary as well. An oscillating fan should be used to circulate air in the closet, allowing the air to absorb more moisture, and reduce risk of fungus. A wall mount oscillating fan will help with air circulation.

TEMPERATURE

Proper temperature is one highly variable factor. Most books state optimum grow temperature to be higher. Assuming genetics is not a factor, plants seem to be able to absorb more light at higher temperatures. 95 degrees for increased growth speed.* An optimum of 95 degrees is new data that assumes very low humidity. It is not clear if these temperatures will reduce potency in flowers. It may be a good idea to reduce growth speed. But higher temperatures will make plants grow vegetatively much faster, if light is available, and humidity is not allowed to get too high.

With normal levels of CO₂, in a well vented space, 90 degrees would seem to be the absolute maximum. The room temperature get over 35 C (95 F) as this hurts growth. Optimal temperature is 27-30 C (80-86 F) is cold for good growth.

Low temperatures at night are OK down to about 60 degrees outdoors, then start to effect the growth. Repeated exposure. Keep your plants warm, especially the roots. Elevate pots if you think the ground is cold floor.

As temperature goes up, so does the ability of the air to hold water, thus reducing humidity, so a

Contrary to many reports, high humidity is not good for plants except during germination and root flowering.

Studies indicate the potency of buds goes down as the temperature goes up, so it is important to

* D. Gold: CO₂, Temperature and Humidity, 1991 Edited by E. Rosenthal.

PESTS

You really have to watch pests, or all your efforts could result in little or nothing in return. Mites are a long term. Pyrethrum bombs can start you with a clean slate in the room, and then homemade or commercial pyrethrum every broad leaf top and bottom and the soil too. Then watch them closely for a week. Pyrethrum should do the trick for a month or two, long enough it won't be an issue before harvesting.

Fungus is another obstacle in the path of a successful growing season. When the flowers are rough growing conditions for the fungus are best when temperatures are between 60 and 80 degrees and high humidity. A type of fungus that travels to other buds via the wind so it is impossible to prevent or stop if you have your plants, you must remove it immediately or it will spread to other areas of the plant or plants.

Some growers will remove just the section of the bud that is infected whereas other growers will remove the bud totally re- moved, and also enables the grower to sample the crop a few weeks ahead of time.

Fungi can wipe your crop quick, so invest in some SAFE fungicide and spray down the plants just before flowering. I have never had problems with fungus before. Keep humidity down, circulate air like crazy in the grow room until after flowering, since it's not a good idea to apply the fungicide directly to flowers. Instead, fl

Most fungicides are very nasty, and you won't want to ingest them, so it is necessary to use one that is safe in nurseries; it contains only sulfur in solution.

Use soap solution like Safer Insecticidal Soap to get rid of most aphid problems. Use some tobacco extract with some dish detergent in a spray bottle if you want to save money.

Pyrethrum should only be used in extreme circumstances directly on plants, but can be used in a grow room a week to non-toxic elements, and can be washed from a plant with detergent solutions and then cleaned up young plants up to early flowering. Into later flowering, the tobacco and pepper/soap solution is y

Spider mites are by far the worst offender in my garden. I have finally learned not to bring plants infect the entire indoor grow space. It is much more practical to work WITH the seasons and regenerate under constant light. Start a plant indoors, take it outside in Spring to flower. Take a harvest or two in Fall.

Once a plant has been taken outside, leave it outside.

TRANSPLANTING

There will be little or no shock if you are quick and tender in your handling of the plants. Make sure you follow the growth cycle. Transplanting slows you down. It takes time, it's tricky, it's hard work, and threatens your cups work OK, and 2 litter soda bottles cut down may be big enough for the first harvest when grown too.

Or start seeds and rooted cuttings in 16oz plastic cups. It's better to have less seedlings than it is more space, and allow you to transplant only one time before harvesting the first crop. Transplant and regenerate this plant after harvesting, transplant it into a larger pot after it goes into vegetative growth. A 2-3 gallon container would make this plant's 2nd harvest better than the first, given enough vegetative growth.

One more tip:

A Russian study showed that seedlings with at least 4" of soil to grow the tap root were more likely to have female/male ratios as great as 80%/20%."

EARLY SEXING

It's possible to tell the sex of a plant early, and thus move male plants out of the main growing area and into a light vegetative state. Use a black paper bag or equivalent to allow for air flow while keeping out light. If you reach them during the dark period, they may not indicate early at all.

Use a magnifying glass to look at the early flowers sex type. A male plant will have a small club (pistil) single or double pistil, white and wispy, emerging from an immature calyx.

Some people like to pre-force plants when they are 8" tall, in order to weed out the males. When you have a lot of plants. Just put the plants on a 12 hours light cycle for 2 weeks, separate the females from the males. Keep in mind, this is a time consuming process and can put the plants back 2 weeks in growth. Use a plant with black paper (light tight, breaths air) 12 hours every day under constant light to force pre-flowering.

REGENERATION

It is possible to harvest plants and then rejuvenate them vegetatively for a 2nd and even 3rd harvest. Once roots are already formed, the plant can produce a second, even third harvest of buds in a little more time. Leave most healthy fan leaves in the middle of the plant, cutting buds off branches carefully from each branch. These will be the part of the plant that is regenerated. The more buds you leave on the plant, the more nitrogen plant food immediately after harvest. When you intend to regenerate a plant, make sure your plant will not have enough leaves to live after being harvested.

Harvested plants can come inside for rejuvenation under continuous light or are left outside in Sun. If you grow vegetatively when regenerating a plant. As stated before, and in contrast to normal growth patterns, let the plant grow little vegetatively, then take outside again to reflower. Or keep inside for vegetative cuttings. You can harvest more often. But you will now be harvesting twice as often. As often as every 30 days, since you have new clones flowering too.

Regenerating indoors can create problems if your plants are infected with pests. It may be best to

An alternative to regenerating indoors is to regenerate outdoors in the Summer. Just take a harvest leaving the middle 1/3rd of the plant's leaves at harvest. Feed it nitrogen, and make sure it gets light to flower again naturally.

PRUNING

Plants that are regenerated, cloned and even grown from seed will need to be pruned at some point. Lower limbs creates more air-flow under the plants in an indoor situation and creates cuttings for clones and yields.

Plants that are regenerated need to have minor growth clipped so that the main regenerated growth gets lots of growth, the lower limbs that will be shaded or are not robust should go. The growth must be

Once nice aspect of regenerating plants is that some small buds left on the plant in anticipation of a new harvest provide much smokable material if it is caught before all the old flowers dry up and die with the new

Try to trim a regenerated plant twice. Once as it is starting to regenerate, collect any bud that is ready to clone and thin the upper growth so that larger buds will be produced.

If a regenerated plant is not pruned at all, the resulting plant is very stemmy, does not create large

HARVESTING AND DRYING

Harvesting is the reaping of the bounty, and is the most enjoyable time you will spend with your grow

Plants are harvested when the flowers are ripe. Generally, ripeness is defined as when the white pistils are gone. The seed pods swell with resins usually reserved for seed production, and we have ripe since buds

It is interesting that the time of harvest controls the "high" of the buds. If harvested "early" with only THC, you will have less THC that has turned to CBD and CBN's. The lesser psychoactive substances will create a milder high with the high. A pure THC content is very cerebral, while high THC, high CBD, CBN content will make you feel more relaxed. You will normally have these higher CBN, CBD levels and may not be what you prefer once you try different strains based on what you come to like yourself.

Keep in mind, a bud weighs more when fully ripe. It is what most growers like to sell, but take some for yourself. Grow the rest to full maturity if you plan to sell it.

Most new growers want to pick early, because they are impatient. That's OK! Just take buds from the top of the plants will be ripe first. Harvest them and let the rest of the plant continue to ripen. You will notice more light available to the bottom portion of the plant now, the plant yields more this way over time, the

Use a magnifier and try to see the capitated stalked trichomes (little THC crystals on the buds). If they are all turning brownish in color, the THC levels are dropping and the flower is past optimum potency, but

Don't harvest too late! It's easy to be too careful and harvest late enough potency has declined. Watch

Do not cure pot in the sun, it reduces potency. Slow cure hanging buds upside down in a ventilated area and may be much more convenient. Bud tastes great when slow dried over the course of a week (or

If your in a hurry, it's OK to dry a small amount in-between paper sheets or a paper bag in a microwave. It's slower, better drying. It will be harsh smoking this way though.

A food dehydrator or food preserver will dry your pot in a few hours, but it will not taste the same (it's a bit nerve-wracking, with all this pot hanging around drying.)

Dry buds until the stems are brittle enough to snap, then cure them in a sealed tupperware container.

Once experienced grower told me to dry in an uninsulated area of the house (like the garage) so that as if it were still alive, it will use some of its chlorophyll while it is drying, and the smoke will be less harsh.

CLONING

Cloning is asexual reproduction. Cuttings are taken from a mother plant in vegetative growth, and new plants that are identical to the parent plant.

Cloning preserves the character of your favorite plant. Cloning can make an ocean of green out of a single plant quickly with your favorite genetics. When you find the plant you want to be your "buddy" for the rest of your life, pass it on to your children's children. Propagate and share it with others, to keep a copy, should your own die. Don't worry about myths of reduced vigor. Many reports indicate it's not a problem.

Cloning will open you to the risk of a fungus or pests wiping out the whole crop, so it's important to choose a plant that will be the most reliable to reproduce in large scale, based on health, growth rate, resistance to pests, and other important determining factors.

Take cuttings for clones before you move plants from vegetative grow area to the flowering area. Old clones are moved to the vegetative growth area, and new clones are started in the cloning area using the same method. Clones can be constantly be growing in 3 stages, and harvesting every 6-8 weeks.

Some types of plants are more difficult to clone than others. Big Bud is reported to not clone very well. It is hard as hell to clone. What a challenge! I noticed other varieties that were rooting much quicker than Big Bud. Some Indica/Sativa hybrids, you never want to smoke a pure Indica again. Indica is hard to clone.

If a plant is harvested, you can sample it, and decide if you want to clone it. Pick your favorite 2 or 3 plants you want to clone can be regenerated by putting them in constant light. In a few weeks, you will have new plants. Always keep a mother plant in vegetative mode for any strain you want to keep alive. If you have a plant devoted to being a mother. I killed off a sacred strain accidentally this way; my harvested plants from that strain were given to my friends to grow it as well. I was in luck, and a buddy set me up with another clone of this strain to start a new mother.

After two months, any marijuana plant can be cloned. Flowering plants can be cloned, but the process is more difficult than cloning plants that have been harvested. A single regenerated/harvested plant can generate hundreds of cuttings. Clones should not be extremely green, as this will make rooting take longer. Take cuttings from the bottom 1/3 of the stem of a mature plant 3-5 inches long with a stem diameter 1/5-1/10 inch. Cut with a sterile razor blade or sharp scissors. Dip the bottom 1/2 inch in a cloning solution mixed with 1/4 tspn Peters 5-50-17 per gallon. Next, cut the bottom .2 inch off the end while it is still in the cloning solution following instructions on the label. Dust with RootToneF and place in cloning tray. Cloning in a cloning solution has a high success rate.

Cloning goes quickest with the liquid rooting solutions, in a warmed, aerated tray, with subdued light. Cloning in a cloning solution works great too. In a closet, you can make space above the grow area so that the heat of the lamp or heater (\$24) or agricultural heating pad w/ thermostat (pricey). A double 4" fluorescent lamp will work.

I found only one liquid rooting hormone solution that was not over \$10. (Olivia's Gel was \$12 for a 16oz bottle) I considered myself lucky, and got a tray and clear cover for \$7. A clear tray cover or greenhouse effect seems to be much more effective than powders. Some types available are Olivia's, Wood's, and others.

Mix a weak cloning solution of high P plant food (such as Peter's 5-50-17), trace elements, and epiphytic nutrients. Above nutrients should be added in extremely small amounts, 25% of what would normally be used. Sucrose syrup has been reported to supplement the sugars needed by the plant during cloning, since it can be used in a cloning solution.

Use a powder fungicide too, like RoottoneF to be sure you don't spoil the clones with fungus. This rooting:

mild light, 72-80 degrees, high humidity

In rockwool, there is no need for airating the solution, just keep the cubes in 1/4" of solution so they can be changed with water once a day to keep them moist and fresh. Pull out clones if they are diseased and dying.

Another method is to float cuttings in a tray full of solution on polystyrene disposable plates, or styrofoam, out of the water. Take off all large leaves, leaving only smaller top leaves to reduce demand on the solution at 72-80 degrees for best results. Change the solution daily if not using an air stone and pump. Remove large leaves from cuttings to reduce water demands as the cuttings start to root.

Buy a tray with a clear cover made for rooting at an indoor gardening supply house. You must keep the top covered and a light shining down if you don't want to pay for the grow tray and cover.

It's also possible to directly place a dipped cutting in a moist block of floral foam with holes punched in it. Peat cubes are not recommended, as published reports indicate results were not good for rooting. Keep the foam moist, not drenched, and not dry. After about 2-3 weeks, rootlets will appear at the bottom of the cuttings.

One grower writes us:

I have had virtually all attempted clones root with the following scheme:

0. Prep cutting by removing large leaves on tip to be cut, allow to heal.
1. While holding underwater, take final diagonal cut on stem to be rooted.
2. Dip in Rootone, then spear stem about 2" deep in 16 oz. cups of 1/2 vermiculite, 1/2 perlite, with nutrient solution.
4. Cover top of cooler with Saran Wrap, then punch holes for ventilation.
5. Keep cooler in relatively mild temps, low light, and spray cuttings daily.
6. Cuttings should root in about 3 weeks.

Cloning is not as easy as starting from seed. With seeds, you can have 18" tall plants in 6 weeks. Cloning is easily twice as fast if you have empty indoor space being wasted that needs to be put to use. In the time, you could get wiped out, and have nothing but your seeds left to start over.

Cloning in rockwool seems to work great, and no airpump is needed. I paid \$9 for 98 rockwool starter cubes to be held in a tray of nutrient solution. They are easily removed and placed in a larger rockwool cube.

BREEDING

It is possible to breed and select cuttings from plants that grow, flower, and mature faster. Some of the most potent plants to clone or breed, but the fastest growing/flowering plants as well. Find your fastest growing strains. Clone your fastest, best high plant for the quickest monocrop garden possible. Over time, you can select for the best.

When a male is starting to flower (2-4 weeks before the females) it should be removed from the female. A few hours of light per day will be adequate, including close to a window in a separate room in the house.

Keep a male alive indefinitely by bending its top severely and putting it in mild shock that delays its flowering. Place the plant on a plate of glass. Shake the branches every morning to release pollen onto the glass and then scrape the pollen. The plant will continue to produce flowers if it gets suitable dark periods. This is much better than putting the plant in a dark room.

Save pollen in an air tight bag in the freezer. It will be good for about a month. It may be several months before it is ready to act as a desecant.

A plant is ready to pollinate 2 weeks after the clusters of female flowers first appear. If you pollinate a plant when all white hairs are showing.

Turn off all fans. Use a paper bag to pollinate a branch of a female plant. Use different pollen from one plant to pollinate the branch. Shake the branch vigorously. Wet the paper bag after a few minutes with water. Place the male branch in the bag and shake the pollen loose. Carefully remove the bag and zip it up. It should be zippered up sideways around the stem so no pollen leaks out. Shake the bag and the stem at the same time. The branch is now well pollinated and should show signs of visible seed production in 2 weeks, with ripening of seeds, so it should not be necessary to pollinate more than one or two branches in many cases.

When crossing two different varieties, a third variety of plant will be created. If you know what characteristics you want from each parent, you can choose from in order to have the best chance of finding all the qualities desired. Sometimes, if the two plants are very different, you can get a plant you want from one single cross. In this case, it is necessary to interbreed two plants from the same cross until the desired characteristics become available, and the plant character you desire may only be possible in this manner.

Usually, it is desirable only to cross two strains that are very different. In this manner, one usually gets a plant that is more robust than either parent created by taking two very different strains and mating them. Less robust plants may be the result.

Hybrid offspring will all be very different from each other. Each plant grown from the same batch should be tested separately and decide its individual merits for yourself. If you find one that seems to be heading in the direction you want, clone the plant to clone and continue breeding.

In depth genetics is beyond the scope of this work. See Marijuana Botany; Smith, for more detailed information.

SINSEMILLIA

When the female plant is not allowed to pollinate, it grows full of resin that was intended to make buds. The resin is withdrawn into the pods. Then the plant is harvested.

Seeds are not part of the bud when the flowers mature. This is called Sinsemillia, and simply means no seeds.

SINSE SEEDS

It is possible to cross your favorite two female plants to create a new strain of seeds that will produce from the same mother's seeds.

This will create the best offspring, since it will not lead to inbreeding. It is easier to gauge the quality of the offspring. Plants from seeds created in this fashion will be all female plants since there will be no male flowers.

Use Gibberellic Acid on one branch of a female plant to induce male flowers. Gibberellic Acid is so easy to use that you can use it every day for 10 days with 100 ppm gibberellic acid. When the male flowers form, pollinate the female flowers. Unless you want lots of seeds!

Once the branch has male flowers, cut the branch and root it in water, with glass under it to catch the pollen solution. Collect the pollen with a plastic bag over the branch and shake it. Use a razor blade to scrape the pollen from the bag.

It is also possible to pollinate the flowers of the plant you create the male flowers on, crossing it with the female plant.

preserve the plants characteristics, but will not allow you to store seeds for use later. Crossing a p many cases.

I once tried using Gibberellic Acid, sprayed on a healthy female, every day for over a week. No ma

ODORS AND NEGATIVE IONS

Negative ion generators have been used for years now to cut down on odors in a grow room, but r No true evidence to support this, however it does make sense, due to the fact that people and ani better too. Try putting one in the grow room. You may notice the buds don't have as much scent v

A negative ion generator can be purchased for \$15 to \$100 depending on the type and power inv to use grounded aluminum foil on the wall and shelf where the ionizer sits, to collect these particl ground wire. If you don't cover the wall and shelf with paper or foil, the wall will turn dark with du

OXYGEN

O₂ to the roots is a big concern, since the plant requires this for nutrients to be available, and to r in the water to increase the availability of oxygen in the water. H₂O₂ has an extra oxygen atom th contains 25% hydrogen peroxide and is perfect for this use.

Using a planting medium that allows for plenty of aeration is also really important. Be sure you ha Don't use a medium that holds too much water, or you may significantly reduce the oxygen availa

Aerating the water before watering is also a good idea. In the case of soil potted plants, use an air container with a cap and shake it up real good before giving to the plants.

SAFETY AND PRIVACY

Utility companies can tell your bill is way off from the same time last year, and police are finding c up as a regular monthly increase in electricity use. You can claim space heaters, more people livir you (innocently). If the police knock and ask you about it, don't let them in, and move your plants

Upon moving into a new place, it may be desirable to immediately establish high electricity use, s

Light leaks, open windows, heat expelled from rooms that would normally be cool, and rip-offs are from the house. People are busted this way when the kids try to rip off the garden and the police r getting busted for a burglary...

Think ahead to any situation that will require outsiders to visit sensitive areas of the house. Repair and contingency plans made in advance.

DISTILLED WATER

Some growers report purified or distilled water helps their plants grow faster. Perhaps due to sodi water tends to build up alkaline salt deposits in soil that lockup trace minerals, and cause iron, co of minerals that could be causing salt buildup over an extended period of time.

Tap water comes in two flavors. Hot and cold. The cold pipe has less calcium and sodium buildup flow for 30 seconds. Hot water will have rust, lead deposits, and lots of sodium and calcium, so m water the correct temperature (70-80 F). Tap water filtered through a carbon (charcoal) filter will l sodium and heavy metals (lead, arsenic, nickel, etc.).

Purified bottled water will be either Reverse Osmosis or some form of carbon/sediment filtered wa

buying it. It could still have the same dissolved solids and heavy metals your tap water has.

BIRTH CONTROL PILLS

A solution of one pill to one gallon of water has been reported to cause increased growth speed in before flowering and one administered a few weeks before harvesting might help the plant mature.

One grower told a story of the same type of plants, one administered the estrogen grew to 20 feet. Report back to us on results.

SEED AND BUD STORAGE

Use a seal-a-meal to hermetically seal the bag with no air inside. Freeze or refrigerate, and bud and

Rap seeds in a paper towel to absorb moisture. Keep them in the freezer, and pull out only as many

A FINAL COMMENT

Good results can be had even in what appear to be rather marginal situations. (i.e.: a four inch pot, no ventilation, regular application of a complete fertilizer, pest control, and avoidance of detection, a grow guide. Please only use this limited information for a basic understanding of gardening. Some Grow Guide(Inside guide and Outdoor)" Marijuasna Chemistry". These are all excellent lore's of wisdom.

THE MARIJUANA GROWER'S GUIDE

by Mel Frank and Ed Rosenthal

Typed by Ben Dawson

Revised 1992

NOTE:- Footnotes have been placed in double brackets (()). Numbers throughout refer to bibliography and are sometimes in brackets, sometimes they aren't. All dates are for northern hemisphere only. Comments on pictures are in curly brackets {}. Please distribute this widely so we can all smoke better marijuana. Legalise marijuana.

4-Oct-96

Copying this book was a megamission that took about 3 weeks in the September of 1993. Everything in the book has been copied - even the bibliography. The

online version of this guide is available at:
<http://www.iinet.net.au/~ben/Guide> Ben Dawson
ben@iinet.net.au

Jan-98

Hyperlinks were added throughout the document for easy navigation. Also the text was formatted to be more readable. Alonso Acu-a.

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FOREWORD

Marijuana, or cannabis as it is known internationally, is a plant whose presence is almost universal in our world today. Conservative international reports estimate that there are now 300 million cannabis users. Recent reports indicate that 10 percent of the adult population in the United States are regular users, a figure which is probably similar for many

countries in Europe. Its use is also widespread in Africa, Asia, many Arab nations, parts of South America and the Caribbean, as well as Australia and New Zealand. In 1978, more than 5.2 million kilograms (12 million pounds) of cannabis were seized by police worldwide. Authorities estimated that this did not exceed 10 percent of the total traffic.

What has been the response of officials around the world to the use of this plant by its citizens? Regrettably, the climate has been one of almost universal repression, hostility and open violence. Despite gains made in the United States and Europe throughout the 1970's, a new wave of ignorance regarding the use of this plant seems to be sweeping the world. Predictably, the United States has sought to export this "neo-Reefer Madness" to other countries. A United Nations sub-commission of drug enforcement officials in the Far East released a report some time ago extremely critical of the efforts of some countries to decriminalize (i.e. remove criminal penalties for possession of a small amount) cannabis. The sub-commission stated that any such reduction of penalties would vastly increase use, and strongly urged that all countries continue to keep strict laws on the books even for possession of cannabis¹. Others requested that a publicity campaign be conducted in the media against cannabis, and that more funding be given to scientific work to prove that cannabis was harmful².

US officials, alarmed by reports of cannabis use among adolescents (which, although undesirably high, is in fact leveling off), and by political pressure from reactionary elements, have attempted to depict cannabis as the greatest threat since the atomic bomb. The results of this new hysteria have been great confusion among the public and a slowdown in the progress of cannabis law reform. The results have been predictable: in 1979, over 448,000 people were arrested in the USA for cannabis possession, 80 percent for simple possession. The estimated direct arrests cost to our increasingly debt-ridden government was over \$600 million. But no one has ever attempted to account for the total cost of the immense law enforcement efforts against cannabis: for the salaries of Drug Enforcement Administration agents and federal and state narcotics agents and support personnel, the cost of incarcerating the thousands of people sentenced to jail (estimated at 10 percent of the total arrests, or 48,000 people), the costs of the anti-cannabis media campaign, the secret grants from NSA/CIA for cannabis eradications, and the economic cost to society created by turning law-abiding citizens into criminals. When these factors are taken into consideration, the cost goes into the billions. By contrast, in the eleven states which have enacted decriminalization since 1972, millions of dollars and hundreds of thousands of court, police and administrative work-hours have been saved.

What can the concerned cannabis consumer do to end this climate of hysteria and ignorance? First, we must stress that cannabis legalisation would entail adult use only, and that social and legal restrictions on the use of cannabis would curtail, not increase, use by adolescents. Second, we must educate the public about the genuine effects of cannabis and stress moderate responsible use. This is what we stress about the user of society's legal drugs - alcohol, nicotine and caffeine, and we should take the same approach toward cannabis. Third, the public should be educated about the limits of the law and the rights of citizens; we should not seek to regulate private behaviour through the use of the criminal sanction. Laws protecting public

safety, such as driving while under the influence of any substance, would still be kept on the books.

However, as consumers we have an additional responsibility: we must begin to address the problems of supply and demand. It is essential that we take upon ourselves the task of proposing viable solutions to the current unworkable prohibition.

With this in mind, numerous cannabis reform organizations around the world have begun exploring models for the legalization of cannabis. Under the auspices of the International Cannabis Alliance for Reform (ICAR), an international organization of cannabis law-reform groups, many of these organizations met in Amsterdam, Holland in February, 1980, at the first International Cannabis Legalization Conference to discuss legalization plans and proposals. The many plans presented reflected the various backgrounds and interests of the countries they represented some called for a totally open-market system run by cooperatives, others employed elaborate organizational systems with varying degrees of governmental control, and still others called for total control by the private sector. Emphasis was placed on the need for all groups to develop legalization models suited to their own particular climate and country and that a single, monolithic legalization plan was neither feasible nor desirable.

However, virtually all the plans had one important element in common: every person would have the right to grow cannabis for his or her own personal use. This is the very minimum requirement upon which all legalization models are based, for this would allow the consumer the chance to remove himself or herself from the black market, whether it be licit or illicit.

This is an essential aspect of cannabis reform: to convince consumers to diversify their sources of supply by growing their own cannabis. Growing cannabis enables one to reduce drastically the costs and at the same time establish a closer relationship with the plant itself. Its amazing adaptability, acquired through centuries of travel to all four corners of the earth, users that it can grow and thrive anywhere there is sunlight and water. By learning the relatively simple techniques involved in cannabis horticulture, the consumer can avoid the illicit market with all its attendant problems, and concentrate on growing the plant itself, on producing and consuming the product of one's own labor, a product which is pure and can be produced at a cost of pennies per ounce.

We must take this step, for just as the nations of the world are seeking energy, self-sufficiency, so now must we seek cannabis self-sufficiency.

The willingness of consumers greatly to diversify their sources has caused tremendous changes in the manner in which cannabis is grown and marketed. Plagued by ridiculously high prices, dangers in purchasing, wild fluctuations in quantity and quality, impurities, and continual police harassment, consumers all over the world are discovering that anyone can grow good cannabis just about anywhere.

In Central and South America, production has increased so rapidly in the last few years that large quantities are now being exported to Europe. Arab countries, traditionally dependent on Lebanon and Syria, are now reporting

increasing domestic cultivation attempts. Many countries of Europe, especially the southern countries of Spain, Italy, Portugal and Greece, are reporting cultivation. India noted that both its legal (in the states of West Bengal, Orissa and Madhya Pradesh) and illegal (all other states) under a similar scheme. In the Near and Middle East, notably Nepal, Pakistan and Afghanistan, the people are continuing their traditional production of cannabis for local and export use.

Australia, a country whose huge size (roughly that of the US) and relatively sparse population make it virtually ideal for cultivation, reported widespread cultivation and seizures of over 70,000 kilos of cannabis, 2,500 kilos of hashish, and 850,000 plants uprooted in a two-year period between 1977 and 1978. Many people living on Pacific islands such as New Zealand, New Caledonia, Fiji, the Cook Islands and elsewhere have discovered that cannabis will grow very well in their environment; Jamaica and other islands in the Caribbean are also experiencing an increase in cultivation. Recent newspaper reports from that country indicate that as many as 1/2 million Jamaican farmers out of a total population of 2 million may be producing cannabis to satisfy domestic and export demand. The total gross income from the Jamaican cannabis business is estimated to exceed \$200 million a year³.

Virtually every country in South America reported at least some cannabis cultivations. In addition to increased production in Colombia, whose 1978 crop was estimated to be worth between \$1.5 and \$2 billion, other countries are experiencing an increase in cultivation. Over 50,000 acres of cannabis were discovered under cultivation in western Venezuela in 1978. In 1976 in Brazil, 271 kilos of cannabis were reported seized, but the next year increased to 91,207 kilos, and by 1978, authorities seized over 276,000 kilos. Cultivation was also reported in Argentina, Ecuador, Guyana, Surinam and Uruguay. Soviet officials go to inordinate lengths to deny that cannabis-use exists in their country though Russia is known to be a large cannabis producer, and not just for commercial purposes. (Soviet officials reported to the United Nations that they seized only 227 grams of cannabis in the entire country⁴ in 1978; the few offenders were immediately sent to psychiatric hospitals.) In several Eastern European countries the best hashish is known as "Tashkenti," named for the major city in south-central Russia. Tashkent is ethnically dominated by Turkic tribesmen and shares the Hindu Kush mountain range with Afghanistan.

The key to stability in the cannabis market is clearly domestic production, which offers many economic and social advantages over continued importation.

Domestic varieties offer ease of access and supply, and help to diversify the overall market by offering new products which compete in quality and price with the imported varieties. In addition, they serve to stimulate the local concentrating bulk of the profits in the region in which they were produced. This is a noticeable reversal of the previous consumer-producer relationship, where most of the profits were realized by exporters and middlepersons who operated outside the source country. Expanded domestic production would decrease the influence of these middlepersons and greatly strengthen the overall market.

This book was written to make the consumer aware of how easy (and important) it is to cultivate cannabis. In a clear and simply style, Mel Frank and Ed

Rosenthal describe everything you need to know about growing cannabis. By employing some of these simple methods you can greatly reduce your dependence on foreign products and at the same time gain a greater understanding of a plant whose relationship with humanity dates to prehistoric times.

Be fruitful, and multiply...

Bob Pisani Coordinator, International Cannabis Alliance for Reform
(ICAR) Philadelphia, PA

Preface

The purpose of this book is to show you how to grow enough marijuana to supply all your family's needs. It doesn't matter where you live, or even if you are growing your first plant, because all the information needed to become a master marijuana farmer in your own home, or in the field, is provided in these pages.

The world has seen an enormous increase in marijuana use in the past ten years. Consequently, many governments have sponsored research in order to understand the nature of the plant as well as its psychoactive compounds - substances that are being smoked or ingested by more than 400 million people all over the world. Before the recent interest, marijuanaphiles had only research papers (mostly on hemp varieties) to glean for information about the plants and their cultivation. Now there are thousands of papers dealing directly with the plants and their use as marijuana. This doesn't mean all is known about marijuana. In fact, much of what is discussed deals with unknown aspects of these ancient and mysterious plants. The mysteries, however, are beginning to unravel.

Our information resources include our personal experience with growing and the experience and knowledge shared with us by marijuana growers all across the country. We also rely on the professional research of many scientists (see the Bibliographic Notes). For the experienced growers, we've included the latest research on increasing potency, some ideas for improving yield and controlling flowering (time of harvest), and also procedures for breeding quality strains suited to a particular growing situation.

Some of the best grass in the world is grown right here in the United States (that is our very own stoned opinion of homegrown gratefully sampled from Hawaii to Maine). You can do it too - it's not magic, and it's not difficult to do. Highly potent plants can be grown indoors, as well as in gardens, fields, and the wilds. Indoor growers must create an environment, whereas outdoor gardeners work within the environment. Following these two approaches to cultivation, this book is divided into separate, parallel parts on indoor and outdoor sections, preceded by some background information on marijuana plants, and followed by general procedures for breeding, harvesting, etc., that are independent of the type of growing site.

Cultivation is not a complicated process, and we hope we don't make it

appear difficult. But even if you're a novice when you first sow your seeds, your questions on the plants and their cultivation will become more complex as you gain experience and insight. We hope we have anticipated your questions with solid and clearly stated answers; we intend this book to serve as a guide long after your first reading and harvest.

There are probably as many ways to grow marijuana as there are marijuana farmers. We hope to impart an understanding of the plants and their cultivation, so that you can adapt the knowledge to fit your particular situation - where you live, the land or space available, and the time, energy, and funds at your disposal.

Modest indoor gardens are quite simple to set up and care for. All the materials you'll need are available at nurseries, garden shops, and hardware and lighting stores, or they may be found around the house or streets. The cost will depend on how large and elaborate you make the garden and on whether you buy or scavenge your materials. With a little ingenuity, the cost can be negligible.

It takes about an hour every three or four days to water and tend to a medium-sized indoor garden.

Outdoors, a small patch in your summer garden can supply all your smoking needs with little or no expense. Generally, marijuana requires less care than most other crops, because of its natural tenacity and ability to compete with indigenous weeds. Hardy Cannabis resists mild frost, extreme heat, deluge, and drought. In this country, few diseases attack marijuana; once the plants are growing, they develop their own natural protection against most insects.

In some areas of the country, such as parts of the Midwest and East, the plants may require no more attention than sowing the seeds in spring and harvesting the plants in autumn. But if you're like most growers, you'll find yourself spending more and more time in your garden, watching the tiny sprouts emerge, then following their development into large, lush, and finally resinous, flowering plants.

Nurturing and watching these beautiful plants as they respond can be a humanising experience. Marijuana farmers know their plants as vital living organisms. If you already are a plant grower, you may understand. If not, read through this book, imagining the various decisions you, as grower, would be making to help your plants reach a full and potent maturity. Then make your plans and get started. There's just no reason to pay \$50 an ounce for superior smoke when it grows for free. Free, grass, free yourself.

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Chapter One

History and Taxonomy of Cannabis

1.2 CANNABIS AND ANCIENT HISTORY

The ancestors of Cannabis originated in Asia, possibly on the more gentle slopes of the Himalayas or the Altai Mountains to the north. The exact origin, obscured by Stone Age trails the cross the continent, is not known.

We don't know when Cannabis and humanity first met. Given the growth habit of the plant and the curiosity of humanity, such a meeting was inevitable. In the plant world, Cannabis is a coloniser. It establishes new territory when running water or seed-eating animals carry seed to cleared and fertile soil open to the sun. Fertile soil, clear of competing plants, is rare and short-lived in nature, and is commonly caused by catastrophe such as flood or earthslide. Natural dissemination is slow and the plants tend to grow in thick stands by dropping seed about the spread of their branches.

During the Neolithic era, some 10,000 years ago nomadic groups scavenged, hunted, fished, and gathered plants in an unending search for food. The search ended when they learned to plant the native grains (grasses) and developed agriculture. Agriculture requires a commitment to the land and grants a steady food supply which enables people to form permanent settlements. Cannabis and Neolithic bands probably came in contact often as the plants invaded the fertile clearings - the campsites, roadsides, fields and garbage heaps - that occur wherever people live.

In 1926 the Russian botanist Vavilov summarised the observations of his comrade, Sinkaia, on the domestication of hemp by peasants of the Altai Mountains: "1. wild hemp; 2. spreading of hemp from wild centers of distribution into populated areas (formation of weedy hemp); 3. utilisation of weedy hemp by the population; 4. cultivation of hemp."²⁴

The plants which people learn to use help define aspects of their way of life, including perceptions of the world, health, and the directions their technologies and economies flow. The plants you are about to grow are

descended from one of the ancient plants that made the transition to civilisation possible.

The earliest cultural evidence of Cannabis comes from the oldest known Neolithic culture in China, the Yang-shao, which appeared along the Yellow River valley about 6,500 years ago (*Cannabis is known to have been used in the Bylony culture of Central Europe (about 7,000 years ago).¹⁸⁴). The clothes the people wore, the nets they fished and hunted with, and the ropes they used in the earliest machines were all made of the long, strong, and durable fibre, hemp. This valuable fibre separates from the stem of Cannabis when the stem decays (rets).

In the early classics of the Chou dynasty, written over 3,000 years ago, mention is often made of "a prehistoric culture based on fishing and hunting, a culture without written language but which kept records by tying knots in ropes. Nets were used for fishing and hunting and the weaving of nets eventually developed into clothmaking."⁸ These references may well be to the Yang-shao people.

As their culture advanced, these prehistoric people replaced their animal skins with hemp cloth. At first, hemp cloth was worn only by the more prosperous, but when silk became available, hemp clothed the masses.

People in China relied on Cannabis for many more products than fibre. Cannabis seeds were one of the grains of early China along with river barley, millet, and soybeans. The seeds were ground into a meal, or roasted whole, or cooked in porridge. The ancient tombs of China had sacrificial vessels filled with hemp seed and other grains for the afterlife. From prehistoric times there is a continuous record of the importance of hemp seed for food until the first to second century BC when the seed had been replaced by more palatable cereal grains.⁷ (an interesting note from the Tung-kuan archives (28 AD) records that after a war-caused famine the people subsisted on "wild" Cannabis and soybean.⁸)

The effects of Cannabis' resinous leaves and flowers did not go unnoticed. The Oen-ts'ao Ching, the oldest pharmacopoeia known, states that the fruits (flowering tops) of hemp, "if taken in excess will produce hallucinations" (literally "seeing devils"). The ancient medical work also says, "If taken over a long term, it makes one communicate with spirits and lightens one's body."⁹ Marijuana, with a powerful effect on the psyche, must have been considered a magical herb at a time when medical concepts were just being formed. The P[e hat]n-ts'ao Ching, speaking for the legendary Emperor Sh[ehat]n-nung of about 2000 BC, prescribes marijuana preparations for "malaria, beriberi, constipation, rheumatic pains, absent-mindedness, and female disorders."¹⁵ Even the Cannabis root found its place in early medicine. Ground to form a paste, it was applied to relieve the pain of broken bones and surgery.

New uses were discovered for Cannabis as Chinese civilisation progressed and developed new technologies. The ancient Chinese learned to mill, heat, and then wedge-press Cannabis seeds to extract the valuable oil, a technique still used in the western world in the twentieth century. Pressed seeds yielded almost 20 percent oil by weight. Cannabis oil, much like linseed oil, could be used for cooking, to fuel lamps, for lubrication, and as the

base in paint, varnish, and soap making. After oil extraction, the residue or "hemp cake" still contained about 10 percent oil and 30 percent protein, a nutritious feed for domesticated animals.

Another advancement came with the Chinese invention of paper. Hemp fibres recycled from old rags and fish nets made a paper so durable that some was recently found in graves in the Shense province that predates 100 BC (9) Hemp paper is known for its longevity and resistance to tearing, and is presently used for paper money (Canada) and for fine Bibles.

The ancient Chinese learned to use virtually every part of the Cannabis plant: the root for medicine,; the stem for textiles, rope and paper making; the leaves and flowers for intoxication and medicine; and the seeds for food and oil. Some of the products fell into disuse only to be rediscovered by other people at other times.

While the Chinese were building their hemp culture, the cotton cultures of India and the linen (flax) cultures of the Mediterranean began to learn of Cannabis through expanding trade and from wandering tribes of Aryans, Mongols, and Scythians who had bordered China since Neolithic times.

The Aryans (Indo-Persians) brought Cannabis culture to India nearly 4,000 years ago. They worshipped the spirits of plants and animals, and marijuana played an active role in their rituals. In China, with the strong influence of philosophic and moralistic religions, use of marijuana all but disappeared. But in India, the Aryan religion grew through oral tradition, until it was recorded in the four Vedas, compiled between 1400 and 1000 BC. In that tradition, unlike the Chinese, marijuana was sacred, and the bhargas spirit was appealed to "for freedom of distress" and as a "reliever of anxiety" (from the Atharva Veda).¹ A gift from the gods, according to Indian mythology, the magical Cannabis "lowered fevers, fostered sleep, relieved dysentery, and cured sundry other ills; it also stimulated the appetite, prolonged life, quickened the mind, and improved the judgement."¹⁵

The Scythians brought Cannabis to Europe via a northern route where remnants of their campsites, from the Altai Mountains to Germany, date back 2,800 years. Seafaring Europe never smoked marijuana extensively, but hemp fibre became a major crop in the history of almost every European country. Pollen analysis dates the cultivation of Cannabis to 400 BC in Norway, although it is believed the plant was cultivated in the British Isles several centuries earlier.² The Greeks and Romans used hemp for rope and sail but imported the fibre from Sicily and Gaul. And it has been said the "Caesar invaded Gaul in order to tie up the Roman Empire," an allusion to the Romans' need for hemp.

Marijuana, from its stronghold in India, moved westward through Persia, Assyria and Arabs by 500 AD. With the rising power of Islam, marijuana flourished in a popular form as hashish. In 1378, the Emir Soudon Sheikhouni tried to end the use of Indian hashish by destroying all such plants, and imprisoning all users (first removing their teeth for good measure). Yet in a few years marijuana consumption had increased.¹

Islam had a strong influence on the use of marijuana in Africa. However, its use is so ingrained in some ancient cultures of the Zambezi Valley that its appearance clearly predated Islam. Tribes from the Congo, East Africa, Lake

Victoria, and South Africa smoke marijuana in ritual and leisure. The ancient Riamba cult is still practiced in the Congo. According to the Riamba beliefs, marijuana is a god, protector from physical and spiritual harm. Throughout Africa treaties and business transactions are sealed with a puff of smoke from a yard-long pipe.(15)

With increased travel and trade, Cannabis seed was brought to all parts of the known world by ships and caravans rigged with the fibre of its kind. And when the first settlers came to the Americas, they brought the seed with them.

1.3 CANNABIS AND AMERICAN HISTORY

Like their European forbears, Americans cultivated Cannabis primarily for hemp fibre. Hemp seed was planted in Chile in 1545,(64) Canada in 1606, Virginia in 1611, and in the Puritan settlements in Massachusetts in the 1630s(15). Hemp-fibre production was especially important to the embryonic colonies for homespun cloth and for ship rigging. In 1637, the General Court at Hartford ordered that "every family within this plantation shall procure and plant this present year one spoonful of English hemp seed in some soyle."(12)

Hemp growing was encouraged by the British parliament to meet the need for fibre to rig the British fleets. Partly to dissuade the colonists from growing only tobacco, bounties were paid for hemp and manuals on hemp cultivation were distributed. In 1762, that state of Virginia rewarded hemp growers and "imposed penalties upon those that did not produce it."(2)

The hemp industry started in Kentucky in 1775 and in Missouri some 50 years later. By 1860, hemp production in Kentucky alone exceeded 40,000 tons and the industry was second only to cotton in the South. The Civil War disrupted production and the industry never recovered, despite several attempts by the United States Department of Agriculture to stimulate cultivation by importing Chinese and Italian hemp seed to Illinois, Nebraska, and California. Competition from imported jute and "hemp" (Musa textiles) kept domestic production under 10,000 tons per year. In the early 1900s, a last effort by the USDA failed to offset the economic difficulties of a labour shortage and the lack of development of modern machinery for the hemp industry (64). However, it was legal force that would bring an end to US hemp production.

For thousands of years marijuana had been valued and respected for its medicinal and euphoric properties. The Encyclopaedia Britannica of 1894 estimated that 300 million people, mostly from Eastern countries, were regular marijuana users. Millions more in both the East and the West received prescription marijuana for such wide-ranging ills as hydrophobia and tetanus.

By the turn of the century, many doctors had dropped marijuana from the pharmacopoeias: drugs such as aspirin, though less safe (marijuana has never kill anyone), were more convenient, more predictable, and more specific to the condition being treated. Pill-popping would become an American institution.

Marijuana was not a legal issue in the United States until the turn of the twentieth century. Few Americans smoked marijuana, and those that did were mostly minority groups. According to author Michael Aldrich, (1) "The illegalisation of Cannabis came about because of who was using it" - Mexican labourers, southern blacks, and the newly subjugated Filipinos.

In states where there were large non-white populations, racist politicians created the myths that marijuana caused insanity, lust, violence and crime. One joint and you were addicted, and marijuana led the way to the use of equivalent drugs - cocaine, opium and heroin. These myths were promoted by ignorant politicians and journalists, who had neither experience nor knowledge of Cannabis, and grew into an anti-marijuana hysteria by the next generation.

For example, the first states to pass restriction on marijuana use were in the Southwest, where there were large populations of migrant workers from Mexico. One of the first states to act was California, which, "with its huge Chicano population and opium smoking Chinatowns, labelled marijuana 'poison' in 1907, prohibited its possession unless prescribed by a physician in 1915, and included it among hard narcotics, morphine and cocaine in 1929." (1)

In marijuana, the mainstream society found a defenceless scapegoat to cover the ills of poverty, racism, and cultural prejudice. San Franciscans "were frightened by the 'large influx of Hindoos ... demanding Cannabis indica' who were initiating 'the whites into their habit.'" (11) Editorials heightened public fears with nightmarish headlines of the "marijuana menace" and "killer weed," and fear of Cannabis gradually spread through the West. By 1929, 16 western states had passed punitive restrictions governing marijuana use.

{Figure 5. (Sample -- Warning card to be placed in R. R. Trains, Buses, Street Cars, etc.)

Beware! Young and Old - People in All Walks of Life!

This {joint} may be handed you by the friendly stranger.

It contains the Killer Drug "Marihuana" -- a powerful narcotic in which lurks Murder! Insanity! Death!

WARNING!

Dope peddlers are shrewd! They may put some of this drug in the {teapot} or in the {cocktail} or in the tobacco cigarette.

WRITE FOR DETAILED INFORMATION, ENCLOSING 12 CENTS IN POSTAGE -- MAILING COST

Address: THE INTER-STATE NARCOTIC ASSOCIATION

(Incorporated not for profit)

52W Jackson Blvd. Chicago, Illinois, U.S.A.

{'This may be handed you by the ...' is a mistake on the poster}}

Marijuana was not singled out by anti-drug campaigners. During this time, Congress not only banned "hard" narcotics, but also had prohibited alcohol and considered the prohibition of medical pain killers and even caffeine.

The Federal Bureau of Narcotics was established in 1930 with Harry Anslinger as its first commissioner. During the first few years of operation, the bureau minimised the marijuana problem, limited mostly to the Southwest and

certain ghettos in the big cities of the East. However, the bureau was besieged with pleas from local police and sheriffs to help with marijuana problems. The FBN continued to resist this pressure, because Commissioner Anslinger had serious doubts as to whether federal law restricting marijuana use could be sustained as constitutional. Further, FBN reports indicate that the bureau did not believe that the marijuana problem was as great as its public reputation. Control of the drug would also prove extremely difficult, for as Anslinger pointed out, the plant grew "like dandelions." (11)

The joblessness and misery of the depression added impetus to the anti-marijuana campaign. This came about indirectly, by way of focusing public sentiment against migrant and minority workers who were blamed for taking "American" jobs. Much of this sentiment grew out of cultural and racial prejudice and was supported by groups such as Key Men of America and the American Coalition. The goal of these groups was to "Keep America American."

However, by 1935 almost every state had restricted marijuana use, and local police and influential politicians had managed to pressure the FBN to seek a federal marijuana law. The constitutional question could be circumvented by cleverly tying restrictions to a transfer tax, effectively giving the federal government legal control of marijuana.

With this new tack, the FBN prepared for congressional hearings on the Marijuana Tax Act so that passage of the bill would be assured. Anslinger and politicians seeking to gain from this highly emotional issue railroaded the Marijuana Tax Act through the 1937 Congress. Anslinger made sure that

the only
information
that they
(the
congressme
n) has was
what we
would give
them at the
hearings.

(11) No
users were
allowed to
testify in
pot's

defence, and doctors and scientists were ridiculed for raising contrary views (16). The new federal law made both raising and use of the plant illegal without the purchase of a hard-to-acquire federal stamp. The FBN immediately intensified the propaganda campaign against marijuana and for the next generation, the propaganda continued unchallenged.

The marijuana hysteria also ended any hopes for a recovery of the hemp industry. What had been needed was a machine that would solve the age-old problem of separating the fibre from the plant stem, an effort which required considerable skilled labour. The machine that could have revolutionised hemp production was introduced to the American public in the February 1938 edition of Popular Mechanics. But the Marijuana Tax Act has been passed four months earlier, and the official attitude toward all

Cannabis is best illustrated by this quote from Harry J. Anslinger, commissioner of the Federal Bureau of Narcotics: "Now this (hemp) is the finest fibre known to man-kind, my God, if you ever have a shirt made of it, your grandchildren would never wear it out. You take Polish families. We'd go in and start to tear it up and the man came out with his shotgun yelling, 'These are my clothes for next winter!'" (2)

During the war years, after the Japanese had cut off America's supply of manila hemp, worried officials supplied hemp seed and growing information to Midwestern farmers. In Minnesota, Iowa, Illinois, and Wisconsin, hemp farmers showed their wartime spirit by producing over 63,000 tons of hemp fibre in 1943.

Unlike many of our ancient domesticated plants, Cannabis never lost its colonising tendencies or ability to survive without human help. Cannabis readily "escapes" cultivated fields and may flourish long after its cultivation is abandoned. However, Cannabis always keeps in contact by flourishing in our waste areas - our vacant fields and lots, along roads and drainage ditches, and in our rubbish and garbage heaps. Perhaps it awaits discovery by future generations. The cycle has been repeated many times.

States that once supported hemp industry are now dotted with stands of escaped weedy hemp. Weedy hemp grows across the country, except in the Southwest and parts of the Southeast. Distribution is centered heavily in the Midwest. Most of these plants are descended from Chinese and European hemp strains that were bred in Kentucky and the grown in Midwestern states during World War II. But some weed patches, such as in Kentucky and Missouri, go back perhaps to revolutionary times.

The Anslinger crusades that continued through the sixties are a fine example of government propaganda and control of individual lives and beliefs. We still feel the ramifications in our present laws and in the fear-response to marijuana harboured by many people who grew up with Anslingian concepts. Poor Cannabis, portrayed as a dangerous narcotic that would bring purgatory upon anyone who took a toke - violence, addiction, lust, insanity - you name it, and marijuana caused it. All it ever did to us was get us stoned ... things slowed down a bit ... enough to stop and look around.

{Figure 6. A weedy hemp stand in Nebraska.}

Hopefully, we are living in the last years of the era of illegal marijuana and the persecution of this plant. Cannabis is truly wondrous, having served human needs for, perhaps, 10,000 years. It deserves renewed attention not only for its chemical properties, but also as an ecologically sensible alternative for synthetic fibres in general and especially wood-pulp paper. May Cannabis be vindicated.

1.4 Cannabis: Species or Varieties

The 10,000-year co-evolution of Cannabis and humanity has had a profound impact on both plant and humans. Cannabis has affected our cultural evolution; we have affected the plant's biological evolution.

From small populations of ancient progenitors, hundreds of varieties or

strains of Cannabis have evolved. These variations can be traced to human acts, both planned and accidental.

Ancient farmers, knowing that like begets like, selected Cannabis for certain characteristics to better suit their needs. With the need for fibre, seeds from plants with longer stems and better fibres were cultivated. Gradually, their descendants became taller, straight-stemmed, and had a minimum of branches. Some farmers were interested in seed and oil. They developed large-seeded, bushy plants that could bear an abundance of seeds. Marijuana farmers interested in potency selected plants that flowered profusely with heavy resin and strong psychoactive properties.

The subsequent variations in Cannabis are striking. In Italy, where hemp fibre supports a major textile and paper industry, some fibre varieties grow 35 feet in a single season. Other Italian varieties may reach only five or six feet in height, but have slender, straight stems that yield a fibre of very fine quality. In Southeast Asia, some marijuana plants grow only four feet or less, yet these are densely foliated and heavy with resin. Other varieties of marijuana grow 15 to 20 feet in a season and yield over a pound of grass per plant.

Breeding plants is a conscious act. The plant's evolution, however, has also been affected by its introduction to lands and climates different from its original home. Whether plants are cultivated or weeds, they must adapt to their environment. Each new country and growing situation presented Cannabis with new circumstances and problems for survival. The plants have been so successful at adapting and harmonising with new environments that they are now considered the most widely distributed of cultivated plants. (45)

In French, Cannabis is sometimes called "Le Chanvre troumper" or "tricky hemp," a name coined to describe its highly adaptable nature. The word adaptable actually has two meanings. The first refers to how a population of plants (the generic pool) adjusts to the local environment over a period of generations. (The population is, in practice, each batch of seeds you have, or each existing stand or field.) For instance, a garden with some plants that flower late in the season will not have time to seed in the north. The next year's crop will come only from any early seeding plants. Most of them will be like their parents and will set seed early. (See section 18.)

Adaptable is a term that also applies to the individual living plant (phenotype) and, in practical terms, means that Cannabis is tenacious and hardy -- a survivor among plants. It thrives under a variety of environmental conditions, whether at 10,000 feet in the Himalayas, the tropical valleys of Colombia, or the cool and rainy New England coast.

Through breeding and natural selection, Cannabis has evolved in many directions. Botanically and historically, the genus is so diverse that many growers are confused by the mythology, exotic names, and seeming contradictions that surround the plants. Many inconsistencies are explained by understanding how variable Cannabis is. There are hundreds of wild, weedy, and cultivated varieties. Cultivated varieties may be useful for only hemp, oil, or marijuana. "Strains," "varieties," "cultivars," "chemovars," or "ecotypes" differ widely in almost every apparent characteristic. Varieties range from two to 35 feet tall; branching patterns run from dense

to quite loose, long (five or six feet) or short (a few inches). Various branching patterns form the plant into shapes ranging from cylindrical, to conical, to ovoid, to very sparse and gangly. The shape and colour of leaves and stems, seeds, and flowering clusters are all variable characteristics that differ among varieties. Life cycles may be as short as three months, or the plants may hang on to life for several years. Most importantly, different varieties provide great variations in the quality and quantity of resin they produce, and hence in their psychoactive properties and value as marijuana.

The taxonomy (ordering and naming) of Cannabis has never been adequately carried out. Early research placed the genus Cannabis within the Families of either the Moraceae (mulberry) or the Urticaceae (nettle). Now there is general agreement that the plant belongs in a separate family, the Cannabaceae, along with one other genus, Humulus, the hops plant. (See section on Grafting in section 18.)

A modern Scheme for the phylogeny of Cannabis would be:

Subdivision Angiospermae (flowering plants)
Class Dicotyledoneae (dicots)
Order Urticales (nettle order)
Family Cannabaceae (hemp family)
Genus Cannabis (hemp plant)

Below the genus level, there is no general agreement on how many species should be recognised within Cannabis. The Cannabis lineage has not been possible to trace after thousands of years of human intervention.

Most research refers to Cannabis as a single species - Cannabis sativa L. (The word Cannabis comes from ancient vernacular names for hemp, such as the Greek Kannabis; sativa means "cultivated" in Latin; L. stands for Linnaeus, the botanical author of the name.) But some botanists who are studying Cannabis believe there are more than one species within the genus.

Richard Schultes, for example, describes three separate species (see Box A) based on variations in characteristics believed not to be selected for by humans (natural variations) such as seed colour and abscission layer (scar tissue on the seed which indicates how it was attached to the stalk).

BOX A

Schultes' Key as it appears in Harvard Botanical
Museum Leaflets (45)

Cannabis Sativa

1. Plants usually tall (five to 18 feet), laxly branched; akenes ((Akene (or Achene) is the botanical name for the fruit of Cannabis. In Cannabis, the fruit is essentially the seed.)) smooth, usually lacking marbled pattern on outer coat, firmly attached to stalk and without definite articulation.

Cannabis Indica

1A. Plant usually small (four feet or less), not laxly branched; akenes usually strongly marbled on outer coat, with a definite

abscission layer, dropping off at maturity.

2. Plants very densely branched, more or less conical, usually four feet tall or less; abscission layer a simple articulation at base of akene.

Cannabis ruderalis ((Limited to parts of Asia.))

2A. Plants not branched or very sparsely so, usually one to two feet at maturity. Abscission layer forms a fleshy carbuncle-like growth at base of akene.

Ideally, the classification of living things follows a natural order, reflecting relationships as they occur in nature. Species are groups of organisms that are evolving as distinct units. Biologically, the evolutionary unit is the population, a population being a group of freely inbreeding organisms. Living things don't always fit neatly into scientific categories. And the meaning of species changes with our understanding of life and the evolutionary processes. Often, the definition of species will depend on the particular being studied.

A traditional way of defining separate species is that off-spring that result cannot reproduce successfully. As far as is known, all *Cannabis* plants can cross freely, resulting in fully fertile hybrids (107). But growth habit and actual gene exchange are important considerations in plant taxonomy. If different populations never come in contact, then there is no pressure for them to develop biological processes to prevent them mixing. *Cannabis* is pollinated by the wind. Although wind may carry pollen grains hundreds of miles, almost all pollen falls within a few feet of the parent plant. The chance of a pollen grain fertilising a tiny female flower more than 100 yards away is extremely small (201). Hence, separate stands or fields of *Cannabis* (populations) are quite naturally isolated. For *Cannabis*, the fact that populations are isolated by distance is not sufficient grounds for labelling them separate species, nor is successful hybridisation reason enough to group all populations as one species.

The species question and *Cannabis* mythology are complicated by the plant's ability to rapidly change form and growth habits. These changes can be measured in years and decades, rather than centuries or millennia.

The fact that a pollen grain does occasionally fertilise a distant flowers leads to a process called introgression. Introgression means that new genes (new variations and possible variations) are incorporated into the population via the foreign pollen. This crossing between populations leads to an increase in variation within the population, but a decrease in the differences between the populations. Although introgression confuses the species question, it also adds to the plant's adaptable nature by providing a resource for adaptive variations. In other words, *Cannabis* has been around. The plants have a rich and varied history of experience, which is reflected in their variety and adaptive nature.

If breeding barriers do not exist, species are often delimited by natural differences in morphology (structure or appearance). The natural variations on which Schultes' key is based are actually affected by contact with farmers. For instance, seeds which drop freely from the plant are less likely to be collected and sown by the farmer, so that cultivated *Cannabis*

may eventually develop a different type of abscission layer than when wild or weedy.

Seed colour and pattern are affected naturally by the need for camouflage. Under cultivation this natural selection pressure would not be the same. Many farmers select seeds by colour, believing the darkest are the best developed. In other words, there are serious problems with this limited approach to categorising species in Cannabis. This does not go unrecognised by Dr. Schultes, and the key represents a starting point. However, species should represent distinct groups within a genus, and populations with intermediate characteristics should be the exception. When you grow marijuana, you'll find that most varieties do not fit into any of these categories, but lie somewhere between. The majority of the marijuana from the Western Hemisphere would follow this description: plants tall (eight to 18 feet); well-branched; akenes usually strongly marbled; base of the seed sometimes slightly articulated.

Other characteristics, such as variations on wood anatomy (17) and leaf form (28), have been suggested for delimiting Cannabis species. However, wood anatomy, like stem anatomy, can be seriously affected by selection for hemp in particular, but also by selection for marijuana and seed. Wood anatomy also depends on the portion of the stem examined and on the arrangement of leaves (phyllotaxy), which, in turn, is influenced by light levels, photoperiod, and the physiological development of the plant.

Most Cannabis plants have compound leaves with seven to nine blades or leaflets per leaf. Occasionally, varieties are seen where all the leaves have only one to three blades (monophyllous). Such plants sometimes arise from varieties with compound leaves. The factor is genetic, but carries little weight for the separation of species.

Human selection for particular traits can powerfully alter plants. Sex vegetables - cabbage, cauliflower, brussels sprouts, broccoli, kale, and kohlrabi - are all descended from a single wild species of mustard herb, *Brassica oleracea* (216). Human preference for particular parts of the plant led to their development. All six are still considered one species.

Any classification of species in Cannabis, based solely on morphological grounds, will prove difficult to justify with our present knowledge of the plant. At this time it seems that all Cannabis should be considered one species, *Cannabis sativa* L.

{Figure 7. Common marijuana leaf with seven blades (Colombian)}

{Figure 8. Four leaf types from Colombian marijuana varieties}

{Figure 9. Leaf blades from Figure 8.}

The debate on whether there is more than one species has been intense, for the issue has legal implications. Many laws specifically prohibit only *Cannabis sativa*. Presumably other species would not be prohibited. However, in the United States, this argument was recently dismissed when tested in a California court. The court upheld the argument that the law's intent is clear, although it may be questionable botanically: under law all Cannabis are regarded alike.

Luckily, the controversy over the number of species is of no more than academic interest to the marijuana grower. The most important characteristic to enthusiasts is the quality or potency of the grass they'll grow.

Potency is mostly a factor of heredity. The quality of the grass you grow depends on how good its parents were, so choose seeds from the grass you like best.

The environment has an impact, too, but it can only work on what is contained in the seed. A potent harvest depends on an environment which encourages the seed to develop to a full and potent maturity. The way to begin is to find the most potent grass you can; then you will have taken the first step.

CHAPTER 2 CANNABINOIDS: THE ACTIVE INGREDIENTS OF MARIJUANA

Cannabis is unique in many ways. Of all plants, it is the only genus known to produce chemical substances known as cannabinoids. The cannabinoids are the psychoactive ingredients of marijuana; they are what get you high. By 1974, 37 naturally occurring cannabinoids had been discovered 115,118. Most of the cannabinoids appear in very small amounts (less than .01 percent of total cannabinoids) and are not considered psychoactive, or else not important to the high. Many are simply homologues or analogues (similar structure or function) to the few major cannabinoids which are listed.

1. (-)- Δ^9 -trans-tetrahydrocannabinol ((There are several numbering systems used for cannabinoids. The system in this book is most common in American publications and is based on formal chemical rules for numbering pyran compounds. Another common system is used more by Europeans and is based on a monoterpene system which is more useful considering the biogenesis of the compound.)) This (Δ^9 THC) is the main psychotomimetic (mindbending) ingredient of marijuana. Estimates state that 70 to 100 percent (121) of the marijuana high results from the Δ^9 THC present. It occurs in almost all Cannabis in concentration that vary from traces to about 95 percent of all the cannabinoids in the sample. In very potent varieties, carefully prepared marijuana can have up to 12 percent Δ^9 THC by dry weight of the sample (seeds and stems removed from flowering buds). ("Buds" of commercial marijuana is the popular name given to masses of female flowers that form distinct clusters.))

Δ^8 THC - This substance is reported in low concentration, less than one percent of the Δ^9 THC present. Its activity is slightly less than that of Δ^9 THC. It may be an artefact of the extraction/analysis process. Here we refer to Δ^9 THC and Δ^8 THC as THC.

2. Cannabidiol - CBD also occurs in almost all varieties. Concentration range from nil (119,138), to about 95 percent of the total cannabinoids present. THC and CBD are the two most abundant

naturally occurring cannabinoids. CBD is not psychotomimetic in the pure form (192), although it does have sedative, analgesic, and antibiotic properties. In order for CBD to affect the high, THC must be present in quantities ordinarily psychoactive. CBD can contribute to the high by interacting with THC to potentiate (enhance) or antagonise (interfere or lessen) certain qualities of the high. CBD appears to potentiate the depressant effects of THC and antagonise its excitatory effects (186). CBD also delays the onset of the high (183) but can make it last considerably longer (as much as twice as long). (The grass takes a while to come on but keeps coming on.) Opinions are conflicting as to whether it increases or decreases the intensity of the high, "intensity" and high" being difficult to define. Terms such as knock-out or sleepy, dreamlike, or melancholic are often used to describe the high from grass with sizeable proportions of CBD and THC. When only small amounts of THC are present with high proportions of CBD, the high is more of a buzz, and the mind feels dull and the body de-energised. {See Figure 11 to 16 for chemical structure in monochrome bitmap format.}

3. Cannabinol - CBN is not produced by the plant per se. It is the degradation (oxidative) product of THC. Fresh samples of marijuana contain very little CBN but curing, poor storage, or processing such as when making hashish, can cause much of the THC to be oxidised to CBN. Pure forms of CBN have at most 10 percent of the psychoactivity of THC (192). Like CBD, it is suspected of potentiating certain aspects of the high, although so far these effects appear to be slight (183,185). CBN seems to potentiate THC's disorienting qualities. One may feel more dizzy or drugged or generally untogether but not necessarily higher. In fact, with a high proportion of CBN, the high may start well but feels as if it never quite reaches its peak, and when coming down one feels tired or sleepy. High CBN in homegrown grass is not desirable since it represents a loss of 90 percent of the psychoactivity of its precursor THC.

4. Tetrahydrocannabivarin - THCV is the propyl homologue of THC. In the aromatic ring the usual five-carbon pentyl is replaced by a short three-carbon propyl chain. The propyl cannabinoids have so far been found in some varieties originating from Southeast and Central Asia and parts of Africa. What are considered some very potent marijuana varieties contain propyl cannabinoids. In one study, THCV made up to 48.23 percent (Afghanistan strain) and 53.69 percent (South Africa) of the cannabinoids found (136). We've seen no reports on its activity in humans. From animal studies it appears to be much faster in onset and quicker to dissipate than THC (181). It may be the constituent of one- or two-toke grass, but its activity appears to be somewhat less than that of THC.

The propyl cannabinoids are a series corresponding to the usual pentyl cannabinoids. The counterpart of CBD is CBDV; and of CBN, CBV. There are no reports on their activity and for now we can only speculate that they are similar to CBD and CBN. Unless noted

otherwise, in this book THC refers collectively to delta-9 THC, delta-8 THC, and THCV.

5. Cannabichromene - CBC is another major cannabinoid, although it is found in smaller concentrations than CBD and THC. It was previously believed that it was a minor constituent, but more exacting analysis showed that the compound often reported as CBD may actually be CBC (119,137). However, relative to THC and CBD, its concentration in the plants is low, probably not exceeding 20 percent of total cannabinoids. CBC is believed not to be psychotomimetic in humans (121); however, its presence in plants is purportedly very potent has led to the suspicion that it may be interacting with THC to enhance the high (137). Cannabicyclol (CBL) is a degradative product like CBN and CBV (123). During extraction, light converts CBC to CBL. There are no reports on its activity in humans, and it is found in small amounts, if at all, in fresh plant material.

2.2 Cannabinoids and the High

The marijuana high is a complex experience. It involves a wide range of psychological, physical, and emotional responses. The high is a subjective experience based in the individual - one's personality, mood, disposition, and experience with the drug. Given the person, the intensity of the high depends primarily on the amount of THC present in the marijuana. Delta-9 THC is the main ingredient of marijuana and must be present in sufficient quantities for a good marijuana high. People who smoke grass that has very little cannabinoids other than delta-9 THC usually report that the high is very intense. Most people will get high from a joint having delta-9 THC of .5 percent concentration to material. Grass having a THC concentration of three percent would be considered excellent quality by anyone's standards. In this book, for brevity, we use potency to mean the sum effects of the cannabinoids and the overall high induced.

Marijuana (plant material) is sometimes rated more potent than the content of delta-9 THC alone would suggest. It also elicits qualitatively different highs. The reasons for this have not been sorted out. Few clinical studies with known combinations of several cannabinoids have been undertaken with human subjects. This field is still in its infancy. So far, different highs and possibly higher potency seem to be due to the interaction of delta-9 THC and other cannabinoids (THCV, CBD, CBN, and possibly CBC). Except for THCV, in the pure form, these other cannabinoids do not have much psychoactivity.

Another possibility for higher potency is that homologues of delta-9 THC with longer side chains at C-3 (and higher activity) might be found in certain marijuana varieties. Compounds with longer side chains have been made in laboratories and their activity is sometimes much higher, with estimates over 500 times that of natural delta-9 THC (55,113,191). Compounds besides THCV with shorter chains (methyl (139) and butyl (118)) in this position have been found in small amounts in some marijuana samples, indicating that variations do exist. However, this is not a very likely explanation. More likely, THCV is more prevalent in marijuana than supposed

and probably had additive or synergistic effects with delta-9 THC.

The possibility that there are non-cannabinoids that are psychoactive or interacting with the cannabinoids has not been investigated in detail. Non-cannabinoids with biological activity have been isolated from the plants, but only in very small quantities (181). None are known to be psychotomimetic. However, they may contribute to the overall experience in non-mental ways, such as the stimulation of the appetite.

Different blends of cannabinoids account for high of different qualities. The intensity of the high depends primarily on the amount of delta-9 THC present and on the method of ingestion. A complex drug such as marijuana affects the mind and body in many ways. Sorting out what accounts for what response can become quite complex. The methodology to isolate and test the different cannabinoids now exists. The National Institute of Mental Health (NIMH) is funding research on the pharmacology of marijuana. However, such research is paltry, considering that over 30 million people in the United States use the crude drug. Much more research is needed before definite understanding of the cannabinoids and the high is attained.

When the legal restriction are removed, marijuana will probably be sold by particular blends of cannabinoids and standard amounts of delta-9 THC. Synthetic marijuana will probably be made with homologues of delta-9 THC that have much higher activity than the natural form. For now, without access to a lab, you must be satisfied with your own smoking evaluation (for research purposes only), ultimately the most important criterion any way.

2.3 Resin and Resin Glands

Many people consider potency and resin concentration synonymous. People hear of plants oozing or gushing with copious resin, and the image is of resin flowing in the plant like the latex of a rubber tree or the sap of a maple tree. But these visions are just pipe dreams.

It is quite possible to have a resinous plant with little potency or a plant with little apparent resin which is very potent. Potency depends primarily on the concentration of THC in the plant material. Many more substances besides the cannabinoids make up the crude resin of Cannabis. Preparations such as ghanja or hashish are roughly about one-third by weight non-psychoactive water-soluble substances and cellular debris. Another third is non-psychoactive resins such as phenoloic and terpenoid polymers, glycerides, and triterpenes. Only one-fourth to one-third is the cannabinoids. In many Cannabis plants, THC may be only a very small percentage of the total cannabinoids. ((These figures are very approximate. Actual percentages depend on sample material, processing, and extraction procedures. See Table 8 and 9 for percentages of THC in hashish.)) The remainder (5 to 10 percent) of the resin will be essential oils, sterols, fatty acids, and various hydrocarbons common to plants.

Table 8 - Seized Hashish (a)

COUNTRY IN WHICH SEIZED	Range of Percentage of	
	THC	CBD
Greece	1 - 15.8	1.4 - 11.1

Nepal	1.5 - 10.9	8.8 - 15.1
Afghanistan	1.7 - 15	1.8 - 10.3
Pakistan	2.3 - 8.7	6.8(b)

a Figures compiled from many sources.

b Only one figure reported

Table 9 - Relative Percentages of Major Cannabinoids from Hashish and Resin Preparations.

COUNTRY	Average Percentages of		
	THC	CBD	CBN
Afghanistan	52	36	12
Burma	15.7	16.3	68
Jamaica	77.5	9.1	13.4
Lebanon	32.2	62.5	5.3
Morocco	55	34.2	10.8
Nigeria	53.7	9.3	37
Pakistan	35.7	48.3	16.1
South Africa	75.6	8.4	16

a Each row sums to 100%

_TABLE 9

The cannabinoids basically do not flow in the plant, nor are they the plant's sap. About 80 to 90 percent of the cannabinoids are synthesised and stored in microscopic resin glands that appear on the outer surfaces of all plant parts except the root and seed. The arrangement and number (concentration) of resin glands vary somewhat with the particular strain examined. Marijuana varieties generally have more resin glands, and they are larger than resin glands on non-drug varieties.

Although resin glands are structurally diverse, they are of three basic types. The bulbous type is the smallest (15-30 um ((um is the symbol for a micrometer (or micron), equal to 1/1,000,000 of a meter, or approximately 1/25,000 of an inch.)) or about .0006 to .0012 inches). From one to four cells make up the "foot" and "stalk," and one to four cells make up the head of the gland (25). Head cells secrete a resin - presumably cannabinoids - oils, and related compounds which accumulate between the head cells and the outer membrane (cuticle). When the gland matures, a nipple-like outpocket may form on the membrane from the pressure of the accumulating resin. The bulbous glands are found scattered about the surfaces of the above-ground plant parts.

The second type of gland is much larger and more numerous than the bulbous glands. They are called "capitate," which means having a globular-shaped head. On immature plants, the heads lie flush or appear not to have a stalk and are called "capitate sessile." They actually have a stalk that is one cell high, although it may not be visible beneath the globular head. The head is composed of usually eight, but up to 16 cells, that form a convex rosette. These cells secrete a cannabinoid-rich resin which accumulates between the rosette and its outer membrane. This gives it a spherical shape, and the gland measures from 25 to 100 um across. In fresh plant material about 80 to 90 percent of their contents will be cannabinoids, the rest primarily essential oils (146).

During flowering the capitate glands that appear on the newly formed plant parts take on a third form. Some of the glands are raised to a height of 150 to 500 um when their stalks elongate, possibly due to their greater activity. The stalk is composed mostly of adjacent epidermal tissue. These capitate-stalked glands appear during flowering and form their densest cover on the female flower bracts. They are also highly concentrated on the small leaves that accompany the flowers of fine marijuana varieties. Highest concentration is along the veins of the lower leaf surface, although the glands may also be found on the upper leaf surface on some varieties. The male flowers have stalked glands on the sepals, but they are smaller and less concentrated than on the female bracts. Male flowers form a row of very large capitate glands along the opposite sides of anthers.

Capitate-stalked resin glands are the only ones visible without a microscope. To the naked eye, this covering of glands on the female flower bracts looks like talcum or dew sprinkled on a fuzzy surface. With a strong hand lens, the heads and stalks are distinct. Resin glands also can be seen on the anthers of the male flowers and on the undersides of the small leaves that intersperse the flower clusters.

{Figure 17. Upper surface of a small leaf, showing stalked glands.}

{Figure 18. Resin glands on a stem lie close to the surface beneath the cystolith hairs. Hairs always point in direction of growing shoots.}

Resin glands are not visible until flowers form. The more obvious covering of white hairs seen on stems, petioles, and leaves are not resin glands. They are cystolith hairs of carbonate and silicate which are common to many plants. These sharp-pointed hairs afford the plant some protection from insects and make it less palatable to larger, plant-eating animals.

In India, to make the finest quality hashish (nup), dried plants are thrashed over screens. Gland heads, stalks and trichomes collect in a white to golden powder which is then compressed into hashish (for hashmaking see section 21 for "hash").

Resin rarely accumulates in the copious quantities people would lead you to believe. Actually, the plants form a cover of resin glands rather than a coating of resin. Usually this is no more apparent than for the female flowers to glisten with pin-points of light and for the leaves and stems to feel a bit sticky when you run your fingers over them.

On some fine marijuana strains, resin may become obvious by the end of flowering and seed set. Resins occasionally secrete through pores in the membrane of gland heads. Usually secretion occurs many weeks after the stalked glands appear. The glands seem to empty their contents, leaving hollow spaces (vacuoles) in the stalk and head cells. After secretion, the glands cease to function and begin to degenerate. Gland heads, stalks, and trichomes become clumped together, and the whole flowering surface becomes a sticky mass. For reasons we'll go into later, this is not necessarily desirable. (see sections 20,21.)

Small quantities of cannabinoids are present in the internal tissues of the plant. The bulk is found in small single cells (non-articulated laticifers)

that elongate to form small, individual resin canals. The resin canals ramify the developing shoots, and penetrate the plant's conducting tissue (phloem). Minute clumps of resin found in the phloem are probably deposited by these resin canals. Other plant cells contain insignificant amounts of cannabinoids and probably a good 90 percent of the cannabinoids are localised in the resin glands.

Cannabinoid synthesis seems to occur primarily in the head and apex of the stalk cells of the resin glands (26). Laticifers and possibly other plant cells probably contribute by synthesising the simpler molecules that will eventually make up the cannabinoids. Biosynthesis (the way the plant makes the molecules) of the cannabinoids is believed to follow a scheme originally outlined by A.R. Todd in his paper "Hashish," published in 1946 (see Figure 19). In the 1960s the pathway was worked out by Raphael Mechoulam, and confirmed in 1975 by Dr. Shimomura and his associates.

{Figure 19. Possible biosynthesis of cannabinoids.}

Notice that all the cannabinoids are their acid forms with a (COOH) carboxyl group at C-2 in the aromatic ring. This group may also appear at C-4 and the compounds are called, for example, THC acid "A" and THC acid "B", respectively. The position of the carboxyl group does not affect the potency, but, in fact, in their acid forms the cannabinoids are not psychoactive. In fresh plant material, cannabinoids are almost entirely in their acid forms. The normal procedure of curing and smoking the grass (heat) removes the carboxyl group, forming the gas CO₂ and the psychoactive neutral cannabinoids. Removing the CO₂ is important only if you plan to eat the marijuana. It is then necessary to apply heat (baking in brownies, for example) for the cannabinoids to become psychoactive. Ten minutes of baking marijuana at 200F is enough to convert the THC acids to neutral THC.

The formation of CBG acid, from which all the other cannabinoids are formed, is initially made from much simpler compounds containing terpene units. The example here is olivetolic acid condensing with a terpene moiety called geranyl pyrophosphate. It is not known whether these are the actual or only precursors to CBG in the living plant.

Terpenes and related substances are quite light and some of them can be extracted by steam distillation to yield the "essential oil" of the plant (from essence - giving the flavour, aroma, character). Over 30 of these related oily substances have been identified from Cannabis (143). On exposure to light and air, some of the polymerise, forming resins and tars.

The cannabinoids are odourless; most of the sweet, distinctive, pleasant minty fragrance and taste of fresh marijuana comes from only five substances which make up only 5 to 10 percent of the essential oils: the mono- and sesqui-terpenes alpha- and beta-pinene, limonene, myrcene, and beta-phalandrene (144). These oily substances are volatile and enter the air quickly, dissipating with time. Subsequently, the marijuana loses much of its sweetness and minty bouquet.

The essential oils constitute about .1 to .3 percent of the dry weight of a fresh marijuana sample, or on the order of 10 percent of the weight of the cannabinoids. Essential oils are found within the heads of the resin glands

and make up about 10 to 20 percent of their contents in fresh material (146). They have also been detected in the resin canals (laticifers) (31).

Different samples of Cannabis have essential oils of different composition. This is not surprising given the variability of the plant. Since substances found in the essential oils are, or are related to, substances that are the precursors of the cannabinoids, there is some chance that a relationship exists between a particular bouquet and cannabinoids content. No such relationship is yet known, but it has only been studied superficially. When connoisseurs sample the bouquet of a grass sample, they are basically determining whether it is fresh. Fresh grass mean fresh cannabinoids and less of these are likely to have been degraded to non-psychoactive products.

2.4 Production of Cannabinoids by Cannabis

Why Cannabis produces cannabinoids and resins is a question probably every grower has wondered about. Supposedly, if you know, you could stimulate an environmental factor to increase cannabinoids production. Unfortunately, it does not follow that increasing a particular selective pressure will affect a plant's (phenotype) cannabinoids production. However, over a period of generations, it is possible that environmental manipulations can increase the overall cannabinoids concentrations in a population of plants. But even this procedure would work slowly compared to direct breeding by the farmer.

From the microstructure of the resin glands and the complexity of the resin, it is apparent that Cannabis invests considerable energy in making and storing the cannabinoids. Obviously, the cannabinoids are not a simple by-product or excretory product. No doubt the cannabinoids and resins serve the plant in many ways, but probably they have more to do with biotic factors (other living things) rather than abiotic factors (non-living environment such as sunlight, moisture, etc.).

The cannabinoids, resins, and related substances make up a complex and biologically highly active group of chemicals, a virtual chemical arsenal from which the plant draws its means for dealing with other organisms. This would apply especially to herbivores, pathogens, and competing plants. In the case of humans, the cannabinoids are an attractant. Some possible advantages to the plant are listed below, but no direct studies have been done on this question. Indeed, it is surprising that botanists have shown so little interest in this question; they have even gone out of their way to state their lack of interest.

Possible Advantages of Cannabinoid Production

1. Obviously the cannabinoids are psychoactive and physiologically active in many animals. This may dissuade plant-eating animals from eating the plant, especially the reproductive parts. Many birds enjoy Cannabis seeds. But in nature, birds will not bother young seeds, probably because they are encased in the cannabinoids-rich bracts. In wild or weedy plants, when the seed is mature it "shells out" and falls to the ground. Birds will eat the naked seeds. However, matured seeds are quite hard. Many will not be cracked and eventually will be dropped elsewhere, helping the plant to propagate. Bees and other insects are attracted to

the pollen. The cannabinoids and resins may deter insects from feeding on pollen and developing seeds. Resin glands reach their largest size on the anthers (which hold pollen) and bracts (which contain the seed). {See plates 6, 7, 10 and 11.} 2. Terpenoid and phenolic resins are known to inhibit germination of some seeds. Cannabis resins may help Cannabis seedlings compete with other seedlings by inhibiting their germination. 3. Many of the cannabinoids (CBD, CBG, CBC and their acids) are highly active antibiotics against a wide range of bacteria (almost all are gram +) (36,130,184). Crude resin extracts have been shown to be nematocidal (36). (However, fungicidal activity is low.)

Most of the explanations you've probably heard for resin production from both lore and scientists have to do with physical factors such as sunlight, heat, and dryness. Presumably the resin coats the plant, protecting it from drying out under physical extremes. These explanations make little sense in light of the resins' chemistry.

The physical qualities of the glands and resins probably aid the plant in some ways. The sticky nature of resin may help pollen grains to adhere to the flowering mass and stigmas, or simply make the plant parts less palatable. And gland heads do absorb and reflect considerable sunlight, and so possibly protect the developing seed. For instance, gland heads are at first colourless (i.e., they absorb ultraviolet light). This screening of ultraviolet light, a known mutagen, may lower possible deleterious mutations. But physical properties seem to be secondary to the resins' chemical properties as functional compounds to the plant.

2.5 Cannabis Chemotypes

All Cannabis plants produce some cannabinoids. Each strain produces characteristic amounts of particular cannabinoids. Strains differ in the total amounts they contain. Usually they average about three percent cannabinoids to dry weight, but concentrations range from about one to 12 percent cannabinoids in a cleaned (seeds and stems removed), dried bud. Strains also differ in which cannabinoids they produce. Based on which cannabinoids, Cannabis strains can be divided into five broad chemical groups. ((Chemical classification based on work by Small et al (51))) The general trend is for plants to have either THC or CBD as the main cannabinoid.

Type I

Strains are high in THC and low in CBD. This type represents some of the finest marijuana strains. They usually originate from tropical zones below 30 degrees latitude, which in the north runs through Houston and New Orleans to Morocco, North India, and Shanghai, and in the south through Rio de Janeiro, South Africa, and Australia. Most of the high-quality marijuana from Mexico, Jamaica, and Colombia sold in this country is this type; most of you will grow this type. As with all five chemical types, type I comes in different sizes and shapes. Most common are plants about 10 to 12 feet tall (outdoors), quite bushy, with branches that grow outward to form the plant into a cone (Christmas tree shape).

Other tall varieties (to 18 feet) have branches that grow upward (poplar-tree shaped - some Mexican, Southeast and Central Asian varieties). A less common short variety (up to eight feet) develops several main stems and the plants appear to sprawl (Mexico, India).

Type II

This is an intermediate group, with high CBD and moderate to high THC. They usually originate from countries bordering 30 degrees latitude, such as Morocco, Afghanistan and Pakistan. In this country, this type of grass usually comes from Afghani and Colombian varieties. Type II plants are quite variable in the intensity and quality of the high they produce, depending on the relative amounts of THC and CBD in the variety. Probably because of their high CBD and overall resin content, these plants are often used to prepare hashish and other concentrated forms of marijuana. The most common varieties grow to about eight to 12 feet and assume a poplar-tree shape with long branches that grow upward from the stem base and much shorter branches toward the top. They usually come from Turkey, Greece, and Central or Southeast Asia and occasionally from Colombia and Mexico. Some varieties are shorter, about four to eight feet at maturity, and very bushy with a luxuriant covering of leaves. These usually originate from Nepal, northern India, and other parts of Central Asia as well as North Africa. Other varieties appear remarkably like short (five to seven feet) hemp plants, with straight, slender stems and small, weakly developed branches (Vietnam). A common short variety, less than four feet tall (Lebanon, N. Africa), forms a continuous dense cluster of buds along its short stem. They appear remarkably like the upper half of more common marijuana plants.

{Figure 20. Left: This Pakistani variety ("indica") reaches a height of five feet (large leaves removed). Right: Flowering top two months later.}

Type III

Plants are high in CBD and low in THC. These are often cultivated for hemp fibre or oil seed. Usually they originate from countries north of 30 degrees latitude. As marijuana they yield a low-potency grass and are considered non-drug varieties. If you choose your seeds from potent grass, it will not be this type. An example of these plants are Midwestern weedy hems which are often collected and sold for low-grade domestic grass. The high CBD content can make you feel drowsy with a mild headache long before you feel high. These plants are very diverse morphologically even when categorised by cultivated types. Hemp plants are usually tall (eight to 20 feet) with an emphasis on stem development and minimal branching. Starting from the base, long, even internodes (stem portion from one set of leaves to the next pair) and opposite phyllotaxy (see 3.2) cover a good portion of the stem. Some varieties form long, sparse branches only on the upper portion of the stem (many Midwest weeds). Other varieties

(Kentucky hemp) are the familiar Christmas-tree shape.

Seed varieties are usually short (two to eight feet) and very bushy. Branches on some are short, grow outward and are all of approximately the same length, giving the plant a cylindrical shape. Some of the shorter (two to three feet) seed varieties have undeveloped branches, and almost all of the seeds collect in a massive cluster along the top portion of the stalk. Seed plants are often the most unusual-appearing of Cannabis plants, and you won't find them in the United States.

As expected, the figures for average THC in Midwestern weeds are quite low. This is consistent with their reputation for low potency. But the range of THC goes up to 2.37 percent in the Illinois study. This is comparable with some of the higher-quality imported marijuana and is consistent with some people's claims that Midwestern weeds provided them with great highs.

Type IV

Varieties that produce propyl cannabinoids in significant amounts (over five percent of total cannabinoids) form a fourth group from both type I and II plants. Testing for the propyl cannabinoids has been limited and most reports do not include them. They have been found in plants from South Africa, Nigeria, Afghanistan, India, Pakistan, and Nepal with THCV as high as 53.69 percent of total cannabinoids (136). They usually have moderate to high levels of both THC and CBD and hence have a complex cannabinoid chemistry. Type IV plants represent some of the world's more exotic marijuana varieties.

A fifth type, based on the production of CBGM, which is not psychoactive, is found in northeastern Asia, including Japan, Korea and China. This type is not relevant to us and will not be mentioned again.

There are many different techniques for sampling, extraction, and estimation of cannabinoids in plant material. To minimise differences among research groups, the above data (except for Midwestern weedy hems) are taken from studies at the University of Mississippi at Oxford (66,119,136).

Unfortunately, some of the best Colombian, Mexican and Thai varieties are not included in the data. Many of these have not been tested until recently, and the figures are not yet published. Under the system for testing at the University of Mississippi, the highest THC variety reached six to eight percent THC in a bud. These seeds originated from Mexico.

{See Table 01 to 10.}

These five chemical types are not distinct entities; that is, each type contains several quite different-appearing varieties. Actually, varieties of different types may look more similar than varieties from the same type. But the ability to produce characteristic amounts of particular cannabinoids is genetically based. This means the each type contains certain genes and gene combinations in common, and in biological terms, the plants are called

chemical genotypes.

These types may be from virtually any country simply because of the plant's past and ongoing history of movement. The first three can be found in most countries where Cannabis is heavily cultivated, although marijuana plants (types I, II, IV) usually originate from lower latitudes nearer the equator. This may be simply explained in terms of cultural practices. Marijuana traditionally has been cultivated in southerly cultures such as India, Southeast and Central Asia, Africa; and in the West in Mexico, Colombia, Jamaica, and Central American countries. On the other hand, useful characteristics must exist before cultures can put them to use after selection. And the characteristic (drug or fibre) must maintain itself within the local environment (see 18.4).

Non-drug types (type III) usually originate at higher latitudes with shorter growing seasons. A definite gradation exists for non-drug to drug types, starting in temperate zones and moving toward the equator. The same gradation may be found for the appearance of propyl cannabinoids toward the equator. This doesn't mean that the quality of the grass you grow depends on whether you live in the north or south, but that over a period of years and decades, a group of plants may drift toward either the drug or the non-drug type (either rich in THC or rich in CBD).

The majority of the marijuana sold in the United States has less than one percent THC; and the bulk of this comes from Mexican and domestic sources. The highest percentages of THC in marijuana that we've seen are: Colombian (9.7), Mexican (13.2), Hawaiian (7.8), and Thai sticks (20.2; however, this is believed to be adulterated with hash oil). The percentages of THC reported vary greatly, because they depend on the particular method of sampling and estimation used.

Five samples of Colombian Golds, bought in New York City and San Francisco for from \$30 to \$50 (1976) an ounce, averaged 2.59 percent THC and 1.27 percent CBN. The CBN represents an average of about one-third of the THC originally present in the fresh plant by the time it reaches American streets. This is one advantage that homegrowers have, since their marijuana is fresh. In fresh plant material, less than 10 percent of the THC will have been converted to CBN, as long as the material is properly harvested, cured, and stored.

By the time hashish reaches the American market, THC content is usually at the low end of the ranges given here, usually between 1.5 and 4 percent THC. The darker outer layer of hashish is caused by deterioration. The inner part will contain the highest concentration of THC.

The average range for hash oil and red oil is 12 to 25 percent when it is fresh. It is not uncommon for illicit hash oil to have more than 60 percent THC. However, light, as well as air, very rapidly decomposes THC in the oil form (see the section on "Storage" in section 21). You can't tell whether the oil will be wondrous or worthless unless you smoke it.

The preparations listed in Tables 9 and 10 are relatively fresh compared to hashish on the American market. Total cannabinoids make up roughly 25 to 35 percent by weight of hashish and resin preparations. Note that the data in

these tables are relative concentrations.

Table 10 -Relative Percentages of Major Cannabinoids in Hashish from Nepal
Percentage(a) of THC HASHISH THC CBD CBN THCV CBDV CBV LOST(b) Sample 1 11.5
35.9 22.1 5.7 12.5 12.3 66 Sample 2 3.4 41.1 24.8 3 11.9 15.8 88 Sample 3
5.5 41.2 30.3 2.3 9.1 11.6 85 a Each row in these columns sums to 100% b
Percentage of original THC lost as CBN

The very high figures for CBN in hashish indicate that much of the THC is converted to CBN because of processing and aging. During hashmaking many of the gland heads are broken and the THC is exposed to light and air. The figures in these tables are typical of what to expect for relative concentrations of THC in hashish on the American market. Actual concentrations are roughly one-fourth to one-third of these figures.

Obviously, THC percentages for hashish and tinctures are not that high compared to fine marijuana. Hashish in the United States seldom lives up to its reputation. The best buy in terms of the amount of THC for the money is hash oil when it is high quality and fresh. More often a fine homegrown sinsemilla or sometimes a lightly seeded Colombian is the best investment. (Of course, the best value is always what you grow yourself.)

Chapter Three BEFORE CULTIVATION BEGINS

3.2 Choosing Seeds

Popular Market names of different grades of grass, such as Colombian commercial and Mexican regular, are familiar to growers, but each grade actually may encompass many different varieties. For example, there are Colombian Golds that are similar in most respects, but some varieties grow no taller than six feet. The more common types grow 12 to 15 feet under the same conditions. Some Oaxacan Cannabis forms several strong upright branches by maturity, and at a glance may seem to have several stems, yet more often, Oaxacan is conical-shaped and grows about 12 feet.

Most of the fine marijuana sold in this country comes from type I plants with THC as the predominant cannabinoid. Type II plants are less common. You might recognise type II plants by the high. The grass takes longer before its effects are felt, but the high lasts much longer than with other marijuana. Type IV plants are the least common; this marijuana seldom reaches the general American market. This type will get you high after only a few tokes. Type III plants are considered non-drug varieties because they are predominantly CBD with little THC. The effects of CBD are not felt unless it is accompanied by a sizeable concentration of THC, such as in type II plants. However, a lot of marijuana from these plants is sold in the United States. Some Mexican and Jamaican regular and much of the low-grade domestic is harvested from type III plants.

You may not be able to tell what type plant you're smoking, but you can tell what you like. Seeds from high-quality marijuana will grow into high-quality marijuana plants. If you like the grass you're smoking, you'll like the

grass you grow.

The name of your grass has little to do with potency and may have originated in the mind of some enterprising dealer. Always choose your seeds from what you consider to be the best grass. Don't be swayed by exotic names. If you are not familiar with grass of connoisseur quality, ask someone whose experience you respect for seeds. Smokers tend to save seeds from exceptional grass even if they never plan to plant them.

The origin of your grass even if you knew it for certain, has little to do with whether it will be dynamite or worthless smoke. In both India(45) and Brazil, hemp is grown which is worthless for marijuana. Likewise, extremely potent marijuana plants grow which are useless for hemp fibre. These plants are sometimes found growing in adjacent fields. Most of the fine-quality marijuana varieties develop in those countries nearer to the equator. How much this had to do with environmental conditions or cultural practices is unknown. In either case, marijuana traffic has been so heavy that fine varieties now grow all over the world. For example, in the United States thousands of people now grow varieties from Mexico. These fine varieties originated in Asia and Africa, and many were brought to Mexican farmers by American dealers during the 1960s. As more farmers grew these new varieties, the quality of Mexican grass imported to the United States improved. Already people are speaking of varieties such as Maui Wowie and Kona Gold.

The colour of the grass does not determine its potency. Marijuana plants are almost always green, the upper surface of the leaves a dark, luxuriant green, and the undersurface a lighter, paler green. Some varieties develop reds and purples along stems and leaf petioles. Occasionally, even the leaves turn red/purple during the last stages of growth (plate 6). Grasses termed "Red" more often get their colour from the stigmas of the female flowers, which can turn from white to a rust or red colour, giving the marijuana buds a distinct reddish tinge. The golds and browns of commercial grasses are determined by the condition of the plant when it was harvested - whether it was healthy (green) or dying (autumn colours). How the plants are harvested, cured, and stored also has a serious effect on colour. Commercial grasses from Colombia, Mexico, and Jamaica are often poorly cured and packed. Too much moisture is left in the grass, encouraging microbial decomposition; with warm temperatures, whatever green was left disappears, leaving the more familiar browns and golds. By the time they reach the United States, commercial grasses lose about five to 20 percent of their weight in water loss and often smell mouldy or musty.

Colour also depends on origin - varieties adapted to tropical or high-altitude areas have less chlorophyll and more accessory pigments, giving the plant their autumn colours (accessory pigments protect the plant from excessive sunlight). Varieties adapted to northern climates, where sunlight is less intense, have more chlorophyll and less accessory pigments. The dying leaves often turn light yellow, grey, or rust. Variations in pigment concentrations are also influenced by local light particularly the soil conditions under which the plants are grown.

The taste of the smoke - its flavour, aroma, and harshness - also depends more on when the marijuana was harvested and how it was handled after it was grown than on the variety or environmental influences.

You can detect subtle differences in the overall bouquet between freshly picked varieties. The environment probably influences bouquet too, but with most commercial grass the harvesting/storing procedures outweigh these other, more subtle factors. A musty, harsh-smoking Colombian marijuana can give the mildest, sweetest, homegrown smoke when properly prepared. Don't be influenced by the marijuana's superficial characteristics. Choose seeds from the most potent grass.

Grasses of comparable potency can yield plants of different potencies. This is because fine sinsemilla (homegrown, Hawaiians, Thai weeds, and some Mexicans) are carefully tended and harvested at about peak potency. They are also cured and packed well; so they are fresh when they are distributed in the American market. When you smoke them you are experiencing the at about its peak potency. The seeds you plant from this grass will produce plants, at best, of about equal potency. Sometimes they are slightly less simply because of differences in growing conditions. Colombian grasses are not usually harvested at their peak potency. A significant amount (20 percent and up) of the active cannabinoids (THC, CBD) are converted to much less active cannabinoids (CBN, CBS) or inactive ingredients (polymers-tars, resins, oils, etc.). This is also true of many Mexican and Jamaican grasses that are heavily seeded and poorly handled. Homegrown from this grass can produce plants of higher potency than the original, simply because the homegrown is fresh, and is harvested and cured well so that the THC content is at its peak.

When choosing seeds you might consider the following Broad Generalisations. Mexican, Jamaican (if you can find goof Jamaican anymore), and homegrowns, including Hawaiians, often develop quickly and have a better chance of fully maturing in the shorter growing seasons over most of the north and central states. Colombian, African, and Southeast Asian varieties, such as Vietnam and Thai sticks (from Thailand and Japan), more often need a longer season to fully develop/ Under natural conditions they seldom flower in the short growing season that covers the northern United States.

For indoor growers, the growing season is all year; so it doesn't matter if plants need longer to develop. Mexican and Jamaican plants usually reach full potency in about six months. Colombian and Southeast Asian varieties may need eight or nine months until they reach their maximum THC or general resin content under indoor conditions.

The grass you choose should have a good stock of mature seeds. Thai weed and fine homegrowns (sinsemillas, which are by definition female flowers buds without seeds) may have no seeds at all but more often have a few viable seeds. Most Colombian and Mexican grasses contain between one and two thousand seeds per ounce bag or lid of grass. This may sound like an exaggerated figure, but it's not. Look at the photos in Figure 21 showing the yield from some Michoacan buds. The yield is 40 percent grass (1.22 grams, about three joints), 50 percent seeds (1.56 grams or 120 seeds), and 10 percent stems (0.3 grams).

Relative to smoking material, seeds are heavy. Colombian grasses average about 50 percent seeds by weight. A film canister holds about 1,200 Colombian seeds. {Figure 21, Seeded buds often contain more weight in seeds

than grass}

Depending on the variety, healthy mature seeds (which are botanically achene nuts) vary in size between 1/12 and 1/4 inches in length. From any variety, choose seeds that are plump and well-formed with well-developed colour. Seed colours range from a buff through a dark brown, and from light grey to almost black colours. Often seeds are mottled with brown or black spots, bars, or lines on a lighter field {plate 11}. Green or whitish seeds are usually immature and will germinate feebly if at all. Fresh seeds have a waxy glimmer and a hard, intact shell. Shiny, very dark brown or black seeds often mean the contents are fermented and the embryo is dead. Fermented seeds crush easily with finger pressure and are hollow or dust inside. Seeds that are bruised or crushed are also not viable. This happens to some seeds when grass is compressed or bricked.

Fresh, fully matured Cannabis seeds have a high rate of germination; 90 percent or better is typical. It is sometimes helpful to have an idea of how many seeds to expect to germinate. You can tell simply by placing a sample number between wet paper towels which are kept moist. Most of the seeds that germinate do so within a few days of each other. After a week or two, count how many of the original seeds germinated. This gives you a rough idea of what to expect from the seeds when planted.

The viability of seeds gradually declines with time; left in the ground, only 40 percent may germinate next season. Seeds are an ideal prey for many fungi, which are responsible for most of their deterioration. In a warm (70F or over) and humid atmosphere, fungi rapidly destroy seeds. If kept cool and dry in an airtight container, seeds stored in this way and left in the buds also maintain high viability for over two years.

3.3 CANNABIS LIFE CYCLE

Marijuana plants may belong to any one of a number of varieties which follow somewhat different growth patterns. The following outline describes the more common form of growth. Differences between varieties can be thought of as variations on this standard theme.

Cannabis is an annual plant. A single season completes a generation, leaving all hope for the future to the seeds. The normal life cycle follows the general pattern described below.

Germination

With winter past, the moisture and warmth of spring stir activity in the embryo. Water is absorbed and the embryo's tissues swell and grow, splitting the seed along its suture. The radical or embryonic root appears first. Once clear of the seed, the root directs growth downward in response to gravity. Meanwhile, the seed is being lifted upward by growing cells which form the seedling's stem. Now anchored by the roots, and receiving water and nutrients, the embryonic leaves (cotyledons) unfold. They are a pair of small, somewhat oval, simple leaves, now green with chlorophyll to absorb the life-giving light. Germination is complete. The embryo has been reborn and is now a seedling living on the food it produces through photosynthesis. The process of germination is usually completed in three to 10 days.

Seedling

The second pair of leaves begins the seedling stage. They are set opposite each other and usually have a single blade. They differ from the embryonic leaves by their larger size, spearhead shape, and serrated margins. With the next pair of leaves that appears, usually each leaf has three blades and is larger still. A basic pattern has been set. Each new set of leaves will be larger, with a higher number of blades per leaf until, depending on variety, they reach their maximum number, often nine or 11. The seedling stage is completed within four to six weeks.

Vegetative Growth

This is the period of maximum growth. The plant can grow no faster than the rate that its leaves can produce energy for new growth. Each day more leaf tissue is created, increasing the overall capacity for growth. With excellent growing conditions, Cannabis has been known to grow six inches a day, although the rate is more commonly one to two inches. The number of blades on each leaf begins to decline during the middle of the vegetative stage. Then the arrangement of the leaves on the stem (phyllotaxy) changes from the usual opposite to alternate. The internodes (stem space from one pair of leaves to the next, which had been increasing in length) begin to decrease, and the growth appears to be thicker. Branches which appeared in the axils of each set of leaves grow and shape the plant to its characteristic form. The vegetative stage is usually completed in the third to fifth months of growth.

Preflowering

This is a quiescent period of one to two weeks during which growth slows considerably. The plant is beginning a new program of growth as encoded in its genes. The old system is turned off and the new program begins with the appearance of the first flowers.

Flowering

Cannabis is dioecious: each plant produces either male or female flowers, and is considered either a male or female plant. Male plants usually start to flower about one month before the female; however, there is sufficient overlap to ensure pollination. First the upper internodes elongate; in a few days the male flowers appear. The male flowers are quite small, about 1/4 inch, and are pale green, yellow, or red/purple. They develop in dense, drooping clusters (cymes) capable of releasing clouds of pollen dust. Once pollen falls, males lose vigour and soon die.

The female flowers consists of two small (1/4 to 1/2 inch long), fuzzy white stigmas raised in a V sign and attached at the base to an ovule which is contained in a tiny green pod. The pod is formed from modified leaves (bracts and bracteoles) which envelop the developing seed. The female flowers develop tightly together to form dense clusters (racemes) or buds, cones, or colas (in this book, buds). The bloom continues until pollen reaches the flowers, fertilising them and beginning the formation of seeds. Flowering usually lasts about one or two months, but may continue longer

when the plants are not pollinated and there is no killing frost.

Seed Set

A fertilised female flower develops a single seed wrapped in the bracts. In thick clusters, they form the seed-filled buds that make up most fine imported marijuana. After pollination, mature, viable seeds take from 10 days to five weeks to develop. When seeds are desired, the plant is harvested when enough seeds have reached full colour. For a fully-seeded plant this often takes place when the plant has stopped growth and is, in fact, dying. During flowering and seed set, various colours may appear. All the plant's energy goes to reproduction and the continuance of its kind. Minerals and nutrients flow from the leaves to the seeds, and the chlorophylls that give the plant its green colour disintegrate. The golds, browns, and reds which appear are from accessory pigments that formerly had been masked by chlorophyll.

Figure 30 THC potency through various growth stages in the male and female plant

About Plants Generally

Plants use a fundamentally different "life strategy" from animals. Animals are more or less self-contained units that grow and develop to predetermined forms. They use movement and choice of behaviour to deal with the changing environments. Plants are organised more as open systems - the simple physical characteristics of the environment, such as sunlight, water, and temperature, directly control their growth, form, and life cycles. Once the seed sprouts, the plant is rooted in place and time. Since growth is regulated by the environment, development is on accordance with the plant's immediate surroundings. When a balance is struck, the strategy is a success and life flourishes.

Behaviour of a plant is not a matter of choice; it is a fixed response. On a visible level the response more often than not is growth, either a new form of growth, or specialised growth. By directly responding, plant in effect know, for example, when to sprout, flower, or drop leaves to prepare for winter.

Everyone has seen how a plant turns toward light or can bend upward if its stem is bent down. The plant turns by growing cells of different length on opposite sides of the stem. This effect turns or right the plant. The stimulus in the first case is light, in the second gravity, but essentially the plant responds by specialised growth. It is the same with almost all facets of a plant's life - growth is modified and controlled by the immediate environment. The influence of light, wind, rainfall, etc., interacts with the plant (its genetic make-up or genotype) to produce the individual plant (phenotype).

The life cycle of Cannabis is usually complete in four to nine months. The actual time depends on variety, but it is regulated by local growing conditions, specifically the photoperiod (length of day vs night). Cannabis is a long-night (or short-day) plant. When exposed to a period of two weeks of long nights - that is, 13 or more hours of continuous darkness each night

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allows the grower to control the life cycle of the plant and adapt it to local growing conditions or unique situations. Since you can control flowering, you control maturation and, hence, the age of the plants at harvest.

3.4 PHOTOPERIOD AND FLOWERING

For the marijuana grower the most important plant/environment interaction to understand is the influence of the photoperiod. The photoperiod is the daily number of hours of day (light) vs. night (dark). In nature, long nights signal the plant that winter is coming and that it is time to flowers and produce seeds. As long as the day-length is long, the plants continue vegetative growth. If female flowers do appear, there will only be a few. These flowers will not form the characteristic large clusters or buds. If the days are too short, the plants flowers too soon, and remain small and underdeveloped.

The plant "senses" the longer nights by a direct interaction with light. A flowering hormone is present during all stages of growth. This hormone is sensitive to light and is rendered inactive by even low levels of light. When the dark periods are long enough, the hormones increase to a critical level that triggers the reproductive cycle. Vegetative growth ends and flowering begins.

The natural photoperiod changes with the passing of seasons. In the Northern Hemisphere, the length of daylight is longest on June 21. Day-length gradually decreases until it reaches its shortest duration on December 22. The duration of daylight then begins to increase until the cycle is completed the following June 21. Because the Earth is tilted on its axis to the sun, day-length also depends on position (or latitude) on Earth. As one moves closer to the equator, changes in the photoperiod are less drastic over the course of a year. At the equator (0 degrees altitude) day length lasts about 12.5 hours on June 21 and 11.5 hours on December 22. In Maine (about 45 degrees north), day-length varies between about 16 and nine hours. Near the Arctic Circle on June 21 there is no night. On December 22 the whole day is dark. The longer day-length toward the north prevents marijuana from flowering until later in the season. Over most of the northern half of the country, flowering is often so late that development cannot be completed before the onset of cold weather and heavy frosts.

The actual length of day largely depends on local conditions, such as cloud cover, altitude, and terrain. On a flat Midwest plain, the effective length of day is about 30 minutes longer than sunrise to sunset. In practical terms, it is little help to calculate the photoperiod, but it is important to realise how it affects the plants and how you can use it to you advantage.

Cannabis generally needs about two weeks of successive long nights before the first flowers appear. The photoperiod necessary for flowering will vary slight with (1) the variety, (2) the age of the plant, (3) its sex, and (4) growing conditions.

1. Cannabis varieties originating from more northerly climates

(short growing seasons) react to as little as nine hours of night. Most of these are hemp and seed varieties that are acclimated to short growing seasons, such as the weedy hems of Minnesota or southern Canada. Varieties from more southerly latitudes need longer nights with 11 to 13 hours of darkness. Since most marijuana plants are acclimated to southerly latitudes, they need the longer nights to flower. To be on the safe side, if you give Cannabis plant dark periods of 13 or more hours, each night for two weeks, this should be enough to trigger flowering. 2. The older a plant (the more physiologically developed), the quicker it responds to long nights. Plants five or six months old sometimes form visible flowers after only four long nights. Young marijuana plants (a month or so of age) can take up to four weeks to respond to long nights of 16 hours. 3. Both male and female Cannabis are long-night plants. Both will flower when given about two weeks of long nights. The male plant, however, will often flower fully under very long days (18 hours) and short nights (six hours). Males often flowers at about the same time they would if they were growing in their original environment. For most marijuana plants this occurs during the third to fifth month. 4. Growing conditions affect flowering in many ways (see Chapter 12). Cool temperatures (about 50F) slow down the flowering response. Cool temperatures or generally poor growing conditions affect flowering indirectly. Flower development is slower, and more time is needed to reach full bloom. Under adverse conditions, female buds will not develop to full size.

Applications of Photoperiod

The photoperiod is used to manipulate the plants in two basic ways:

1. By giving long dark periods, you can force plants to flower.
2. By preventing long nights, using artificial light to interrupt the dark period, you can force the plants to continue vegetative growth.

Outdoors

Most marijuana plants cultivated in the United States begin to flower by late August to early October and the plants are harvested from October to November. For farmers in the South, parts of the Midwest, and West Coast, this presents no problem and no special techniques are needed for normal flowering.

In much of the North and high-altitude areas, many varieties will not have time to complete flowering before fall frosts. To force the plants to flower earlier, give them longer night periods. If the plants are in containers, you can simply move them into a darkened area each evening. Plants growing in the ground can be covered with an opaque tarpaulin, black sheet plastic, or double or triple-layers black plastic trash bags. Take advantage of any natural shading because direct sunlight is difficult to screen completely. For instance, if the plants are naturally shaded in the morning hours, cover the plants each evening or night. The next morning you uncover the plants at about eight to nine o'clock. Continue the treatment each day until all the

plants are showing flowers. This usually takes two weeks at most, is the plants are well developed (about four months old). For this reason, where the season starts late, it is best to start the plants indoors or in cold frames and transplant outdoors when the weather is mild. This in effect lengthens the local growing season and gives the plants another month or two to develop. By the end of August the plants are physiologically ready to flower; they sometimes do with no manipulation of the photoperiod. More often female plants show a few flowers, but the day-length prevents rapid development to large clusters. The plants seem in limbo - caught between vegetative growth and flowering. The natural day-length at this time of year will not be long enough to reverse the process, so you can discontinue the treatment when you see that the new growth is predominantly flowers.

In areas where frosts are likely to occur by early October, long-night treatments may be the only way you can harvest good-sized flower clusters. These clusters, or buds, are the most potent plant parts and make up the desired harvest. Forcing the plants to flowers early also means development while the weather is warm and the sun is shining strongly. The flower buds will form much faster, larger and reach their peak potency. A good time to start the treatments is early to middle August. This allows the plants at least four weeks of flowering while the weather is mild.

Another reason you may want to do this is to synchronise the life cycle of the plants with the indigenous vegetation. In the northeast and central states, the growing season ends quite early and much of the local vegetation dies back and changes colour. Any marijuana plants stick out like green thumbs, and the crop may get ripped off or busted. Plants treated with long nights during late July will be ready to harvest in September.

Outdoors, growers should always plant several varieties, because some may naturally flower early, even in the northern-most parts of the country. These early-maturing varieties usually come from Mexican, Central Asian, and homegrown sources. By planting several varieties, many of you will be able to find or develop an early-maturing variety after a season or two. This, of course, is an important point, because it eliminates the need for long-night treatments.

Preventing Flowers

Manipulation of the photoperiod can also prevent the plants from flowering until a desired time. For example, in Hawaii the weather is mild enough to grow winter crops. The normal summer crop is harvested anytime from September to mid-November. The winter crop is generally planted from October to December. Because the winter days are so short, the plants flower almost immediately, usually within two month. The plants are harvested in their third or fourth month and yield about 1/4 the yield of summer plants. A large Hawaiian female can yield a pound of buds. Most of the plant's overall size is reached while it is vegetatively growing. By interrupting the night period with light, you can keep these plants vegetatively growing for another month, yielding plants of about twice the size.

The amount of light needed to prevent flowering is quite small (about .03 foot candles⁹⁵ - on a clear night the full moon is about .01 foot candles). However, each plant must be illuminated fully, with the light shining over

the whole plant. This might be accomplished with either electric light or a strong flashlight. The easiest way is to string incandescent bulbs, keeping them on a timer. The lights need be turned on for only a flash at any time during the night period, from about 9:00 pm to about 3:00 am. The interrupts the long night period to less than nine hours. Start these night treatments each night or two, until you want the plants to flower.

Indoors

Natural Light

Indoors, the growing season lasts all year. The night period is much easier to control. Sometimes people grow plants in their windows for more than a year without any female flowers ever forming. This is because household lamps are turned on sometime at night, illuminating the plants. Under natural light exclusively, indoor plants flower at about the same time they would outdoors (sometime a bit sooner because it is warmer indoors or the plants may be shaded). When plants are well developed and you want them to flower, make sure that no household lamps or nearby street lamps are shining on them. During late fall and winter, the natural day-length is short enough for the plants to flower naturally, if you simply keep off any lights at night that are in the same room as the plants. If you must use light, use the lowest wattage possible, such as a six-watt bulb. (The hormone is also least sensitive to blue light.) Shield the light away from the plants. Or shield the plants from any household light with aluminium foil curtains. Once the flowers are forming clusters, you can discontinue the dark treatments, especially if it is more convenient. However, if it is too soon (when you see only a few random flowers), household lights can reverse the process.

By using natural light, you can grow indoor crops all year. The winter light is weak and the days are short, so it is best to use artificial lights to supplement daylight, as well as to extend the photoperiod. The extra light will increase the growth rate of the plants and hence size and yield. You should allow winter crops to flower during late January or February, using the natural photoperiod to trigger flowering. If you wait until spring, the natural light period will be too long and may prevent flowering.

Artificial Lights

Under artificial light the photoperiod is, of course, any length you wish. The most popular way to grow with artificial lights is the harvest system. Start the plants under long light periods of from 16 to 18 hours daily. After the plants have reached a good size, usually between three and six months, shorten the light cycle to about 12 hours to force flowering.

To decide exactly when to force the plants to flower, let their growth be the determinant. If male plants are showing their flowers, then the females are physiologically ready to flower. Most of the plant's overall height is achieved during vegetative growth. Some varieties, of course, are smaller and grow more slowly than others. Wait until the plants are nearing the limits of the height of the garden or are at least five feet tall. This is large enough to support good flower development and return a good yield. If you turn down the light cycle when the plants are young and small, you'll

harvest much less grass because the plants simply can't sustain a large number of flowers.

Some leaf growers prefer a continuous growth system, emphasising leaf growth and a continuous supply of grass. The light cycle is set for 18 to 24 hours a day. This prevents flowering and the plants continue their rapid vegetative growth. Growing shoots and leaves are harvested as used, and plants are removed whenever they lose their vigour and growth has noticeably slowed. New plants are started in their place. In this way, there will be plants at different growth stages, some of which will be in their rapid vegetative growth stage and will be quite potent. Male plants and some females eventually will form flowers, but the females will not form large clusters. People often use this system when the lights are permanently fixed. Small plants are raised up to the lights on tables or boxes. This garden never shuts down and yields a continuous supply of grass.

3.5 INHERENT VARIATIONS IN POTENCY

The potency of a particular marijuana sample will vary because of many factors other than the variety. Many of these have to do with the natural development of the plants and their resin glands. Environmental factors do affect potency but there are large differences in any variety. These inherent factors must be explained before we can talk of factors outside the plant that affect relative potency. Strictly environmental effects are discussed in Chapter 19.

Variations in Potency Within Varieties

There are noticeable differences in THC concentrations between plants of the same variety. Differences are large enough so that you can tell (by smoking) that certain plants are better. This is no news to homegrowers, who often find a particular plant to be outstanding. Five-fold differences in THC concentration have also shown up in research. However, when you consider a whole group of plants of the same variety, they're relatively similar in cannabinoid concentrations. Type II plants are the most variable, with individual plants much higher than other in certain cannabinoids.

Variations by Plant Part

The concentration of cannabinoids depends on the plant part, or more specifically, the concentration and development of resin glands to plant part. The female flower bracts have the highest concentration of resin glands and are usually the most potent plant parts. Seeds and roots have no resin glands. These show no more than traces of cannabinoids. Smoke seeds will give you a headache before you can get high. If you got high on seeds, then there were probably enough bracts adhering to the seeds to get you high. {Figure 29 The highest concentration of stalked resin glands forms a cover on the female flower bracts Resin glands beneath cystolith hairs on a leaf petiole}

Here are the potencies, in descending order, of the various plant parts:

1. Female flowering clusters. In practice you don't separate hundreds of tiny bracts to make a joint. The whole flowering mass (seeds removed),

along with small accompanying leaves, forms the material.

2. Male flower clusters. These vary more in relative potency depending on the strain (see "Potency by Sex," below).

3. Growing shoots. Before the plants flower, the vegetative shoots (tips) of the main stem and branches are the most potent plant parts.

4. Leaves (a) that accompany flowers (small);

(b) along branches (medium);

(c) along main stem (large).

Generally, the smaller the leaf is, the more potent it can be.

5. Petioles (leaf stalks). Same order as leaves.

6. Stems. Same order as leaves. The smaller the stem (twig), the higher the possible concentration of cannabinoids. Stems over 1/16" in diameter contain only traces of cannabinoids and are not worth smoking. The small stems that bear the flowers can be quite potent.

7. Seeds and Roots. Contain only traces (less than .01 percent) and are not worth smoking or extracting.

This order is fairly consistent. The exceptions can be the small leaves that accompany male flowers, which are sometimes more potent than the flowers themselves. The growing shoots are sometimes more potent than the mature female flowers.

Samples of pollen show varying amounts of cannabinoids. Resin glands are found inside the anthers, alongside the developing pollen grains, and form two rows on opposite sides of each anther. Pollen grains are smaller than the heads of large resin glands ({see Plate 7}), and range from 21 to 69 micrometres in diameter²¹. A small amount of resin contaminates the pollen when glands rupture, but most of the THC in pollen samples comes from gland heads that fall with pollen when the flowers are shaken to collect it. One study, using pollen for the sample, found concentrations of up to 0.96 percent THC, more than enough to get you high⁷⁹.

Potency by Position on Plant

The potency of marijuana on any plant increases toward the top of the plant, the topmost bud being the most potent. The bottommost leaves on the main stem are the least potent of the useable material. Along branches there is a less steep THC gradient increasing to the growing tip.

The ratios in Table 11 are representative of high-quality marijuana varieties. Plant no. 2 is an exception, with four percent THC in its lower leaves, a figure comparable to high-quality Colombian and Mexican buds in commercial grass.

Table 11 - Relationship of THC Content to Leaf Position (68)

Percentage of THC by weight of Leaf from Position on plant			
Plant	No. 1 (SP-5)	NO.2 (SP-5)	NO.3 (UNC-335)
Top	6.1	6.9	4.8
Middle	3	5.5	3.1
Bottom	0.8	4	1.5
Ratio (gradient)	8:4:1	1.7:1.4:1	3:2:1

Notice the large difference in the gradients of Plants no. 1 and 2, which are from the same variety (SP-5). Like almost all characteristics of these plants, considerable variation occurs even among sibling. Our experience is that generally the better the quality of the variety, the steeper the gradient: in other words, the bigger the difference between top and bottom leaves. For example, the plants given here are high-quality type I varieties. Plant no. 1 is more typical, with its steep gradient, than no.2, where the gradient is much less pronounced. Lower-quality varieties generally do not have as steep a gradient and the ratios would look more like that of Plant no. 2.

Potency by Sex

Although marijuana lore claimed the female to be the more potent, scientists disclaimed this. But there is some truth to both sides. In fine marijuana varieties, male and female leaves average about the same in cannabinoid concentrations. Either a male or a female individual may have the highest concentration in any particular case. The largest variation is in comparing the flowers. Male flowers may be comparable to the females, or they may not even get you high. It seems that the higher the quality of the grass, the better the male flowers will be. In fine type I plants, male flowering clusters usually approach the potency of the female. In low-quality type III varieties females are usually more potent (20 to 30 percent) than the males.

Type II plants are the most variable, with large differences among individual plants. But the trend is for the females to average about 20 percent high in potency of leaves and flowers.

Table 12 - Relative Potencies of Male and Female Plants (66)

COUNTRY OF ORIGIN	SEX (a)	Percentage by Weight (b) of			TYPE PLANT
		THC	CBD (C)		
Mexico	M	3.7	0.86	I	
	F	3.7	0.35		
India	M	4.3	0.12	I	
	F	1.78	0.19		
Thailand	M	3.2	0.08	I	
	F	3.2	0.42		
India	M	0.81	2.1	II	
	F	1.3	0.89		
Pakistan	M	1.37	1.24	II	
	F	0.71	1.5		
Turkey	M	0.84	2.11	II	
	F	0.92	1.33		
India	M	0.15	2.2	III	
	F	0.12	1.2		
Poland	M	0.04	0.97	III	
	F	0.06	1.1		

a) M, male (staminate); F, female (pistillate). (b) Of flowering mass with accompanying leaves. (c) Includes CBC. _

Potency by Age

In general, the longer the life cycle of the plant, the more the concentration of cannabinoids increases, as long as the plant stays health and vigorous. Actually, it is the development of the plant, rather than chronological age, that determines this difference in potency. A plant that is more developed or more mature is generally more potent.

Because you decide when to plant and/or can control the photoperiod, you also control when the plants flowers and, hence, the overall age at maturity. A six-month-old plant will generally be better than a four-month-old plant, both of which are flowering. Plants eight months old will usually be more potent than six-month-old plants. Most indoor growers plan their gardens to be about five to eight months old at harvest. Healthy plants can be extended to about 10 months. Plants older than 10 months often develop abnormally. There is usually a decline in vigour and a loss in potency. But some growers have decorative plants several years old.

Outdoor growers more often simply allow the plants to develop according to the local growing conditions which will govern their development and flowering time. Where the growing season is short, some growers start the plants indoors and transplant when the local growing season begins. This gives the plants a longer growing season.

One reason female plants are considered more potent is because of age. Males often flower in four to five months and die, while the females may continue to a ripe old age of eight or nine months, especially when they are not pollinated.

Potency by Growth Stage

Although then general trend is for the cannabinoid concentration to increase with age, this is not a matter of the simple addition or accumulation of cannabinoids. The concentration of cannabinoids changes with the general metabolic rate of the plant, and can be related to the plant's growth pattern or life cycle. Figure 30 shows a hypothetical curve following the concentration of THC from the upper leaves and growing tips of a male and female plant.

Notice that THC increases immediately with germination and establishment of the seedling, and continues to rise until the plant enters its vegetative stage. At this point, the plant is well-formed, with a sturdy stem, and no longer looks fragile. As the plant's rate of growth increases, there is a corresponding rise in THC that continues throughout the vegetative stage until a plateau is reached. Before the plateau is reached the arrangement of leaves on the stem (phyllotaxy) changes from opposite to alternate. The plateau is maintained until the plant's rapid growth all but stops and the plant has entered preflowering. By this time, the branches have formed the plant to its characteristic shape. Preflowering lasts about one to two weeks, during which THC concentration falls until the appearance of the first flowers.

For the male plant, preflowering ends with renewed growth. This lengthens the uppermost internodes and the first male flower buds appear. THC immediately increases with the development of the male flower clusters, and reaches its peak when most of the flowers are fully formed and a few are

beginning to release pollen. After pollen release, the male normally loses vigour and THC content slowly declining until the plant is cured and stored.

Female plants reach their maximum THC when the plants are in full bloom. Full bloom is when the plant has filled out with well-formed flower clusters, but flowers are still slowly forming. Most of the stigmas will still be white and healthy.

Flowering lasts anywhere from two to 10 weeks, depending on whether the plants are pollinated or not, as well as on variety and the environment. (See Chapter 20 for details.) THC content declines as the formation of new flowers slows and the majority of the stigmas begin to brown. The only changes you may see in the plants are the maturation of the seeds and the loss of green colour in the leaves and flowers. In some cases the plant's apparent resin (its look and feel) increases during the last few weeks of life while the THC concentration is still declining.

You may feel that you should only pick marijuana when the plants are in full bloom, but this is not the case. Think of the garden as a continuous supply of grass. You can never be sure of the fate of your plants. The biggest problem with outdoor growing is that there is a good chance that the plants will be ripped off before you plan to harvest. It is much better to harvest grass during the course of a season, assuring yourself a return for your efforts. For example, during the third month of growth, you could cut back the growing tips, which should be quite potent, often more potent than Figure 30 suggests. This doesn't mean there will be less to harvest at season's end. In fact, the plant will be forced to develop its branches, possibly yielding a larger plant.

Common sense tells you that it is always best to test one sample before you harvest. By taking one tip, curing and smoking, you'll know whether it's worthwhile to harvest more at that time or to wait longer. When a tip is about equal to its parents' potency, then definitely harvest more growing tips. This peak high often occurs during the middle to late rapid, vegetative-growth stage.

The reader should keep in mind that Figure 30 serves only as an example. Chronological age is not as important as the physiological age of the plant. In this graph, the life of the plants is about six months. But the life cycle depends on the particular variety and the growing conditions, which strongly influence the rate of development. (For details on how to use the graph, see Chapter 20.) The important facts that the reader should get from the graph are that the potency of the grass can decrease as well as increase during the plant's life cycle. Actual studies of the cyclic variations in potency over the course of a season have shown much more complicated rhythms, with many more peaks and valleys than here 71,74,80,86,92. Most varieties will more or less follow a growth pattern as described. Changes in the plant's development, such as phyllotaxy and growth rate, are cues to changes in THC concentration. Secondly, the growing tips of the main stem and branches can be very potent. Growers do not have to wait until flowers form to harvest top-quality smoke.

3.6 Cultivation: Indoors or Outdoors?

The basic elements of the environment (light, water, air, and soil) provide plants with their fundamental needs. These environmental factors affect the growth rates of plants, as well as their life cycles. If one factor is deficient, growth rate and vigour will wane regardless of the other three. For instance, with low light, the growth will be limited no matter how fertile and moist the soil is. In the same sense, if soil minerals are scarce, the growth rate will be limited no matter how you increase the light.

Photosynthesis

Cannabis, like all green plants, manufactures its food through the process photosynthesis. Unlike animals, which depend on pre-formed food for survival, plants can use energy from light to form food (carbohydrates) from simple inorganic molecules absorbed from the air and soil.

Plants absorb light energy through pigments that are concentrated in the leaf cells. These pigments are also found in most of the aboveground parts of the plant. The most abundant pigment is chlorophyll, which gives the plants their green colour. The energy absorbed is stored in chemical compounds such as ATP and NADPH₂. ((ATP, adenosine-triphosphate; NADPH₂, nicotinamide-adenine-dinucleotide-phosphate.)) These are storage/transfer compounds that function to transfer energy and matter in the living system. ATP transfers energy that fuels the reactions for the making of carbohydrates as well as most other metabolic functions. NADPH₂ transfers electrons, usually as hydrogen, for the synthesis of carbohydrates as well as other compounds.

The raw material for the synthesis of carbohydrates (CH₂O)_n comes from carbon dioxide (CO₂) and water (H₂O). Carbon dioxide is absorbed primarily from the air, but can also be absorbed from the soil and secondarily from the air.

Photosynthesis is summarised as follow:

light energy ----- ATP + NADPH₂

CO₂ + H₂O ----- (CH₂O)_n + O₂

For more complex bio-molecules such as amino acids and proteins, the plant absorbs minerals (including nitrogen, phosphorus, and sulfur) from the soil. Carbohydrates provide food energy for the plant using processes similar to those that occur in humans. They also form the basic building blocks for plant tissues. For example, the sugar glucose (CH₂O)₆ is strung and bonded to form long chains of cellulose, the most abundant organic compound on earth. About 80 percent of the structure of the plant's cells is made from cellulose.

The plant is a living thing existing in a holistic world; a myriad of factors affect its life. However, good cultivation techniques require attention to only four basic growth factors. With this accomplished, the plants will do the rest.

As grower, your strategy is to bring out the plant's natural qualities. The cannabinoids are natural to the plants. Seeds from potent marijuana grow into potent marijuana plants when they are nurtured to a full and healthy

maturity.

Since most marijuana plants are adapted to tropical or semitropical climates, it is up to the grower to make the transition to local growing conditions harmonious. This requires sensible gardening techniques and, in some cases, manipulation of the photoperiod. There is no magic button to push or secret fertiliser to sue. The secret of potency lies within the embryo. The environment can and does affect potency, as it does most aspects of the plant's life. However, environmental factors are secondary to the plant's heritage (genetic potential).

Indoors vs. Outdoors

At this point the book divides into separate indoor and outdoor cultivation sections, and you may wonder whether it is better to grow the plant indoors or outdoors. Each alternative has advantages and disadvantages. It is usually better to grow the plants outdoors if possible, because the plants can grow much larger and faster than indoors. Indoors presents space and light limitations. It is possible to grow a 15-foot bush indoors, but this is unrealistic in most homes. There simply isn't enough room or light for such a large plant. Outdoor gardens return a much higher yield for the effort and expense. Most indoor gardeners buy soil and may have to buy electric lights. So there is an initial investment of anywhere from \$10 on up.

On the other hand, outdoor plants are more likely to be seen. Many gardens get ripped off, and busts are a constant threat. Indoor gardens are much less likely to be discovered. Gardening indoors allows the grower closer contact with the plants. The plants can be grown all year long; it is an easy matter to control their growth cycles and flowering. Probably the biggest attraction of indoor gardens is that they are beautiful to watch and easy to set up anywhere.

One popular compromise is to construct a simple greenhouse. Use plastic to either enclose part of a porch or to cover a frame built against the house.

The potency of the plants doesn't depend on whether they are grown indoors or outdoors. As long as you grow healthy plants that reach maturity and complete their life cycle, the grass can be as good as any you've ever smoked.

PART 2: INDOOR GARDENING

Chapter Four

INTRODUCTION

Marijuana adapts well to indoor conditions. You can grow it in sunny rooms or with artificial light. The factor limiting the rate of growth indoors is often the amount of light, since it is less a problem to supply the plants with plenty of water, nutrients, and air.

Natural light is free. If feasible to use, natural light eliminates the most expensive components for indoor gardeners: artificial lights and the electricity they use. Window light is the easiest way to grow plants for

decorative purposes or for a small crop. On the other hand, a greenhouse, sunporch, or particularly sunny room can support larger plants than most artificial light systems. A sunny porch or roof area enclosed in sheet plastic to form a greenhouse is a simple, inexpensive way to grow pounds of grass.

Cannabis grows into a fully formed bush when it receives a minimum of five hours of sunlight a day. But you can grow good-sized plants of excellent quality with as little as two hours of daily sunlight provided windows are unobstructed by buildings or trees and allow full daylight. Windows facing south usually get the most light, followed by windows facing east and west (north-facing windows seldom get any sun). Use the location with the longest period of sunlight. The corner of a room or alcoves with windows facing in two or three directions are often very bright. Skylights are another good source of bright, unobstructed light.

Some growers supplement natural light with artificial light from incandescent or fluorescent fixtures. This is essential during the winter, when sunlight is weaker than the summer, and in spaces where the plants get little direct sunlight. Artificial lights can also be used to lengthen the natural photoperiod in order to grow plants all year.

The best time to plant using natural light is in late March or April, when the sun's intensity and the number of hours of daylight are increasing. Cleaning windows dramatically increases the amount of light, especially in cities where grime collects quickly. Paint walls adjacent to windows a flat white or cover them and the floor with aluminium foil to reflect light to the plants. Place young plants on shelves, blocks, or tables to bring them up to the light. Position the plants as close to the windows as possible. Insulate germinating plants from freezing winter drafts by stapling clear sheets of polyethylene film to the window frame.

The main problem with marijuana in windows is that it may be seen by unfriendly people. This won't be a problem at first, but when the plants grow larger, they are easily recognised. You could cover the windows with mesh curtains, rice paper, polyethylene plastic or other translucent materials to obscure the plants. A strip covering the lower part of the window may be enough to conceal the plants from outsiders.

Most of you will want the garden completely hidden. Some gardeners opt for closets, basements, attics - even under loft beds. They cover the windows if the garden is visible and grow the plants entirely with artificial light.

The amount of light you provide is what determine the garden's size - the amount of soil, number and eventual size of the plants, and the overall yield. Since light is the factor on which you base the planning of your garden, let's begin with artificial light.

{A picture of a self-contained mini-horizontal (150 or 175 watt HID) is perfect for a personal small garden.}

ARTIFICIAL LIGHT[

5.2 Fixtures

Florescent light is the most effective and efficient source of artificial light readily available to the home grower. Florescent lamps are the long tubes typical of institutional lighting. They require a fixture which contains the lamp sockets and a ballast (transformer) which works on ordinary house current.

Tubes and their fixtures come in length from four inches to 12 feet. The most common and suitable are four- and eight-foot lengths. Smaller tubes emit too little light for vigorous growth; longer tubes are unwieldy and hard to find. The growing area must be large enough to accommodate one or more of these fixtures through a height of at least six feet as the plants grow. Fixtures may hold from one to six tubes and may include a reflector, used for directing more light to the plants. Some fixtures are built with holes in the reflectors in order for heat to escape. They are helpful in areas where heat builds up quickly. You can make reflectors with household materials for fixtures not equipped with reflectors. Try to get fixtures that have tubes spaced apart rather than close together. See 5.5 for further suggestions.

The tubes and their appropriate fixtures are available at several different wattage or outputs. Standard or regular output tubes use about 10 watts for each foot of their length - a four-foot tube has about 40 watts and an eight-foot tube about 80 watts.

High Output (HO) tubes use about 50 percent more watts per length than regular output tubes and emit about 40 percent more light. An eight-foot (HO) runs on 112 to 118 watts. Very High Output (VHO) or Super High Output (SHO) tubes emit about two-and-a-half times the light and use nearly three times the electricity (212 to 218 watts per eight-foot tube).

The amount of light you supply and the length of the tube determine the size of the garden. Marijuana will grow with as little as 10 watts per square foot of growing area, but the more light you give the plants, the faster and larger they will grow. We recommend at least 20 watts per square foot. The minimum-size garden contains a four-foot fixture with two 40-watt tubes, which use a total of 80 watts. Dividing total watts by 20 (watts per square foot) gives $80w \div 20w/sq. ft = four sq. ft.$ (an area one by four feet). A four-tube (80 watts each) eight-foot fixture would give: $320w \div 20w/sq. ft. = 16 sq. ft.$ or an area the length of the tube and about two feet wide.

VHO and HO tubes in practice don't illuminate as wide an area when the plants are young, because the light source is one or two tubes rather than a bank. Once the plants are growing well and the light system is raised higher, they will illuminate a wider area. Figure about 25 w/(ft*ft) for HO and 35 w/(ft*ft (or foot squared)) for VHO to determine garden size. A two-tube, eight-foot VHO fixture will light an area the length of the tube and one-and-a-half feet wide.

The more light you give the plants, the faster they will grow. Near 50w/sq.

ft. a point of diminishing returns is reached, and the yield of the garden is then limited by the space the plants have to grow. For maximum use of electricity and space, about 40w/sq. ft. is the highest advisable. Under this much light the growth rate is incredible. More than one grower has said they can hear the plants growing - the leaves rustle as growth changes their position. In our experience, standard-output tubes can work as well as or better than VHO's if four or more eight-foot tubes are used in the garden.

The yield of the garden is difficult to compute because of all the variables that determine growth rate. A conservative estimate for a well-run garden is one ounce of grass (pure smoking material) per square foot of garden every six months.

In commercial grass, the seeds and stems actually make up more of the bulk weight than the useable marijuana.

The grass will be of several grades depending on when and what plant part you harvest. The rough breakdown might be 1/3 equal to Mexican regular, 1/3 considered real good smoke, and the rest prime quality. With good technique, the overall yield and the yield of prime quality can be increased several fold.

5.3 Sources

When sunlight is refracted by raindrops, the light is separated according to wavelengths with the characteristic colours forming a rainbow. Similarly, the white light of electric lights consists of all the colours of the visible spectrum. Electric lights differ in the amount of light they generate in each of the colour bands. This gives them their characteristic colour tone or degree of whiteness.

Plants appear green because they absorb more light near the ends of the visible spectrum (red and blue) and reflect and transmit more light in the middle of the spectrum (green and yellow). The light energy absorbed is used to fuel photosynthesis. Almost any electric light will produce some growth, but for normal development the plants require a combination of red and blue light.

Sunlight has such a high intensity that it can saturate the plants in the blue and red bands, though most of the sun's energy is in the middle of the spectrum. Artificial lights operate at lower intensities; so the best lights for plant growth emit much of their light in the blue and red bands.

Fluorescent Tubes

Several lighting manufacturers make tubes (gro-tubes) that produce much of their light in the critical red and blue bands. (Plant-gro (GE), Gro-Lux (Sylvania), Agro-Lite (Westinghouse), and gro-lum (Norelco) are examples, and they look purple or pink. Vita-lite and Optima (Duro-test) produce a white light with a natural spectrum very similar to daylight. Duro-test tubes are more expensive than other tubes but they last twice as long. {See spectrum for "The action spectra of chlorosynthesis and photosynthesis compared to that of human vision. Adapted from IES Lighting Handbook237"}

Theoretically, these tubes should work better for growing plants than standard lighting tubes. However, some standard or regular fluorescent tubes used for lighting actually work better for growing plants than more expensive natural-spectrum tubes and gro-tubes specifically manufactured for plant growth. The reason is that regular fluorescent produce more light (lumens), and overall lumen output is more important for growth rate than a specific light spectrum. To compensate for their spectrums, use them in combinations of one "blue" fluorescent to each one or two "red" fluorescent (Box B).

Manufacturers use standardised names such as Daylight and Sofwhite to designate a tube that has a certain degree of whiteness. Each name corresponds to a tube that emits light in a particular combination of colour bands. For example, Cool White emits more blue light than other colours and appears blue-white. By combining tubes that emit more blue light with tubes that emit more red light, the tubes complement each other and produce a more natural spectrum for healthy plant growth. More "red light" than "blue light" sources are needed to foster healthy growth, so use two red tubes to each blue tube.

The best combinations are either Warm White or Soft White (red) tubes used with either Cool White or Daylight (blue) tubes. These four tube types are common, much cheaper, and when used in combination, will give you a better return than any of the more expensive gro-tubes or natural-spectrum tubes. Any hardware store carries these common lighting tubes, and the cost may be less than a dollar each.

Do not use tubes with "deluxe" in their designation. They have a more natural spectrum but emit considerably less light. Preferably, buy "Cool White" since it emits 50 percent more light than "Cool White Deluxe."

Incandescents and Flood Lights

The common screw-in incandescent bulb produces light mainly in the longer wavelengths: far-red, red, orange, and yellow. Higher-wattage bulbs produce a broader spectrum of light than lower-wattage bulbs. Incandescents can be used alone to grow marijuana, but the plants will grow slowly and look scraggly and yellow. Incandescents combined with fluorescent work well, but fluorescent are a better source of red light. Fluorescent tubes generate slightly less heat per watt. With incandescents, heat is concentrated in the small bulb area, rather than the length of the tube, and can burn the plants. In addition, incandescents have less than one-third the efficiency of fluorescent in terms of electricity used. If you decide to use incandescents in combination with fluorescent, use two times the wattage of incandescents to blue source fluorescent, that is, two 40-watt Daylight tubes to about three 60-watt incandescents, evenly spacing the red and blue sources.

The common floodlight has a spectrum similar to but somewhat broader than incandescents. Because they cast their light in one direction and operate at higher intensities, these lights work better than incandescents, both as a single source and to supplement natural or fluorescent light. {Figure 33. Supplement natural light with floodlights. Use foil curtains for reflectors.}

The best application for floodlights and incandescents is to supplement natural and fluorescent light, especially when the plants get larger and during flowering. Incandescents and floodlights require no special fixtures, although reflectors increase the amount of light the plants receive. These lights are easy to hang or place around the sides of any light system, and their strong red band promotes more growth and good flower development. Some of their energy is in the far-red band. Most purple gro-tubes and white fluorescent are deficient in this band, and addition of a few incandescents make them more effective. Agro-lite and W/S Gro-Lux emit adequate far-red light and need no addition of incandescents.

Several companies make screw-in spotlights specifically for plant growth. Two brand names are Duro-Test and Gro n'Sho. Although they are an improvement over incandescents as a single source, these lights don't perform nearly as well as fluorescent. A 150-watt bulb would grow one plant perhaps four feet tall. Two eight-foot fluorescent tubes (160 watts) will easily grow eight six-foot plants. For supplemental lighting, the incandescents and floodlight work as well and are cheaper.

HID Lamps. Metal Halide (MH) and Sodium-Vapour Lamps (HPS)

HID's (High-Intensity-Discharge) are the lamps of choice for serious indoor gardeners. HID lamps commonly illuminate streets, parking lots, and sports stadiums, and they emit very intense light and produce more light, more efficiently than fluorescent. All HID's require specific ballasts and fixtures to operate, so purchase complete systems (fixture, ballast, reflector) along with the lamp. High Times and Sinsemilla Tips magazines (p. 332) feature numerous ads by retailers of horticultural HID systems. Contact the advertisers, and they'll send you brochures with enough information to make an informed choice.

Ordinary metal-halides (MH's and HP's) may emit dangerous UV and particle radiation if the bulb envelope breaks, cracks, or develops a small hole. Broken MH bulbs may continue to operate apparently normally, and exposure may cause serious eye or skin injury. Make sure to purchase MH bulbs designed with a safety feature (such as GE Sat-T-Gard or Sylvania Safeline) that causes the bulb to burn out immediately if the outer envelope ruptures. OR purchase fixtures that shield the bulb in protective tempered glass.

HID's come in many sizes, but generally, use only 400 and 1,000 watt sized lamps. The largest size (1,500 watts) is not recommended because of its relatively short bulb life. Sizes less than 400 watts do not return as much marijuana considering set-up costs and ease of operation. The only exceptions are certain "self-contained" mini-units of 150 and 175 watts (see 4.1). These mini-self-contained units have a horizontal fixture and built-in ballast, which is easy to set up. The horizontal fixture directs up to 45 percent more light to the plants than conventional, vertically positioned lamps with reflectors. The intense light encourages excellent growth and bud formation with modest electrical consumption. They are the best overall light system for small, personal gardens such as closet set-ups.

Position 400 watt HID lamps 18 to 30 inches above plant tops, and 1,000 watt lamps 30 to 42 inches above the tops. During flowering, flowers may "run"

rather than form in compact buds if lamps are positioned too close to the plant tops, particularly when using HPS's.

Heat is the main problem with HID's, and the room must be well-ventilated. Use exhaust fans to draw heat out of the room. The fan doesn't need to be large, just active enough to create a strong, ventilating draft.

Light Balancers

Sophisticated gardeners use light balancers which employ a small motor to move reflectors and HID lamps held on tracks or mechanical arms slowly across a garden in either a linear or circular pattern {(see p. 88 Figure 38b)}. Light balancers save considerable power and bulb costs because they dramatically increase the effectively illuminated garden size, while using less the 24 watts per balancer. With the lights moving on a balancer, all of the garden becomes equally illuminated for modest running costs. Instead of adding another 1,000 watt HID, a light balancer increases the garden size without measurably increasing power consumption, an important consideration when electricity consumption or costs are of concern.

With multi-bulb HID gardens, use one MH to each HPS lamp on a light balancer, and hang the lamps about one foot closer to the plant tops than usual. MH's favour blue light, and HPS's produce more orange-red light. By combining the two, the spectrum is more balanced, and you'll get a better return of well-formed buds.

Low Cost HID Systems

By far, the most efficient and effective set-up for a modest artificial light garden is to use fluorescent lamps set on a long photoperiod for germination, growing seedlings or to raise clones; use another room,, or part of the room separated by a light-tight curtain or barrier, for flowering with (HPS) lamps in horizontal reflectors kept on a short photoperiod to induce and promote flowering.

For example, separate and average sized room into two growing areas by hanging an opaque curtain to block light between the two sections. In the smaller area, grow seedling or clones (see 18.5) for two to six weeks under fluorescent set on a constant light. In the larger section, keep HPS lamp(s) on a 12-hour light cycle for flowering. Move larger seedlings under the HPS lamp(s) for about 9 to 15 weeks to initiate and complete flowering. Meanwhile, start more seedling under fluorescent. It's easy to maintain both sections of the room be constantly replenishing either area with new plants. This setup is very productive for a modest investment in both costs and labour - no time or costly light and electricity is wasted on empty space, and you'll find yourself continuously harvesting mature buds.

{A no frills setup with an HID. Notice that the ballast is insulated from the floor with pieces of wood; the fixture is supported by rope and not the electric cord; plastic protects the floor; there is a timer, a reflector, and fan.}

{Figure 34 and 35 for light-output from two and four 40 watt white fluorescent and comparing effectiveness in footcandles.}

Using this setup, the initial long photoperiod and small area necessary for seedlings or clones is illuminated cheaply by fluorescent. Seedlings grow, and cuttings root, better under fluorescent than HPS's. The larger, more costly flowering section is kept under a short photoperiod of 12 hours of daily light and the strong red light is necessary for good flowering.

For example, the whole operation could draw less than 650 watts: 160 watts by four, four-foot fluorescent set on constant light to start the seedlings; one 400 watt HPS set on 12 hours daily light for flowering; two timers and a venting fan for automating the lights and controlling heat. It's possible to harvest four to six, fully mature crops each year, or continuously harvest. (See Mel Frank's new Marijuana Grower's Insider Guide by RED EYE PRESS for much more information on efficient, low cost, indoor systems and greenhouse gardening.)

5.4 Setting up the Garden

Under artificial light, marijuana grows from three to six feet in three months, so the height of the light must be easy to adjust. Fixtures can be hung from the ceiling, shelves, walls, or from a simple frame constructed for the purpose. If you are hanging the lights from the walls or ceiling, screw hooks directly into a stud. Studs are located in every room corner and are spaced 16, 18 or 24 inches apart. Light can be supported from lathing using wingbolts, but plaster is too weak to hold a fixture unless a wooden strip held by several wingbolts is attached to the walls or ceiling first to distribute the pressure. Then hang the fixture from a hook in the strip. Closets have hooks and shelves or clothes rungs that are usually sturdy enough to support the fixture. People have gardens under loft beds.

Chains are the easiest means of raising and lowering fixtures. Two chains can be suspended from a solid support from above, and attached to an "S" hook at each end of the fixture. Raise the fixture by inching the hooks to higher links on the chain. Or tie rope to the fixture, pass through an eye hook or pulley in the ceiling or frame, and tie-off at a hook or boat cleat anchored in the wall or frame.

You can also hang the lights permanently and lower plants on a shelf or plywood. The shelf could be suspended or lowered by supporting the shelf with progressively smaller block. This arrangement is often used in "growing factories" where plants are rotated to larger gardens and grow for only a few weeks in each space. One garden may have fluorescent for starting plants and another garden for maturing plants under HID's. With HID's and skylights, lowering the plants may be your best option. Use lightweight soil components or hydroponics rather than heavier soil, and the operation is easier.

If you plan to use six or more fluorescent, remove end sockets and ballasts from fixtures. Mount end sockets and tubes on a frame of one-by-twos or plywood. Space sockets so tubes cover the garden evenly (see Figure 37 and 38). This arrangement illuminates the garden more evenly and drastically reduces the suspended weight since ballasts make up most of a fixture's weight. Keep ballasts off floors and away from water. Mount the ballasts on a nearby wall or on a wooden box. Wet ballasts could actually explode, and at best, are electrically dangerous when wet.

Always buy fixtures with reflectors. For HID's, companies make their own reflectors, but the best reflectors are for horizontally positioned lights no matter which company. Horizontal reflectors focus much more useable light than either parabolic or cone reflectors. HPS's can work in any position, but MH lamps are made to work in either a horizontal or vertical position, and you must buy bulbs that correspond with the fixtures.

For fluorescents, you can make an overhead reflector from the cardboard cartons in which tubes and fixtures are packaged. Cut off the end flaps and form the cardboard into a "U". Face inner side with aluminium foil or paint them white. Leave enough space so the foil or cardboard does not contact end sockets. Staple or tape the reflector behind the tubes to the fixture or from to reflect light toward the plants.

Surround all garden with reflective surfaces, but not so tightly that air can't freely circulate. Even in window gardens, reflective sheets set adjacent to the plants make a marked difference in growth. When artificial lights are high, reflectors from the floor on up keep lower branches actively growing. Mylar, with its mirror-finish, is popular for facing walls. A flat white paint (super or decorator white) reflects better than glossy white or aluminium foil. Flat white has about three percent more reflecting capacity than aluminium foil, and reflects light more uniformly. The difference is slight, so use whatever means is most convenient. Paint walls that border the garden a flat white or cover them with aluminium, mylar, or white plasterboard. {Figure 36. Reflectors can be made from sturdy paper faced with aluminium foil. Make them with staples, tape, or tacks. Figure 37.}

Natural-light gardens also benefit from reflectors. Make them out of cardboard painted white or faced with aluminium foil. Once the plants are past the seedling stage, surround them with reflectors; otherwise only one side of the plants will be fully illuminated.

Covering the floor with a plastic dropcloth (about \$1 at any hardware store) will protect your floor and your neighbour's ceiling from possible water damage.

Marijuana grows well in a dry atmosphere, but heated or air-conditioned homes are sometimes too dry during germination and early growth. Enclosing the garden in reflectors will contain some of the moisture and insure a healthy humidity. White sheet plastic is available to enclose open gardens. Do not completely enclose the garden. Leave some open spaces at the bottom, top and ends of the garden to allow air to circulate. Air circulation will become more important as the plants grow larger.

Don't rely on training your pets to stay out of the garden. The garden will attract them, and they can easily destroy young plants by chewing on leaves and stems. Soil is more natural to their instincts than the sidewalk or kitty litter. Protect the garden from pets and toddlers; surround it with white plastic or chicken wire. Large plants are more sturdy and animals can do them little harm. The jungle ambience and an occasional leaf are irresistible to most cats, and they'll spend hours in the garden.

5.5 Electricity

For most growers, the amount of electricity used is of little concern. A four-tube, regular-output, eight-foot fixture draws about 320 watts per hour or about the same as a colour TV. The cost increase to your electric bill will be about two to six dollars a month, depending on local rates.

Farmers who devote entire basements or attics to their gardens are sometime restricted by the amount of current they can draw. Older homes or apartments may have only one 15-ampere circuit but more often have two, for 30 amperes total. Newer homes have either 60 or 100 amperes available through four to six circuits. One 15-ampere circuit can safely accommodate three, two-tube VHO fixtures or six tubes for 1,290 watts, or 16 regular-output, eight-foot tubes for about 1,280 watts total. This allows for a 20 percent safety margin of circuit capacity, which is necessary considering heat loss, starting voltages, etc.

In kitchen and basements the circuits may be rated higher, at either 20 or 30 amperes. You can find out the amperage of the circuit by looking at the fuse rating on the face of the fuse. Determine what room or rooms each circuit is feeding by removing the fuse and seeing which outlets are not working. The wattage capacity of any circuit is found by multiplying volts time amps. Standard United States voltage is 110 to 120 volts.

Fluorescent light fixtures are sometimes sold unwired or without a line cord, and the job is left to you. Follow the diagram on the ballast which shows the wires marked by their colour. Simply attach the wires to the sockets as diagrammed. New sockets have small holes which automatically make contact when the bare end of the wire is pushed into them. Older fixtures have sockets with conventional screw terminals.

Indoor gardens may have aluminium foil, chains, reflectors, and wet floors, all of which are good electrical conductors. Coupled with hanging lights, these conditions could lead to dangerous electrical shocks. Never touch a reflector, fixture, or ballast while watering or standing on a damp floor. Eliminate the chance of serious shocks altogether by turning off the lights whenever you work in the garden. An HID ballast on a damp floor is very dangerous. Raise HID ballasts on wood blocks off the floor.

Reduce the risk of dangerous shocks by using fixtures grounded to the power source. A fixture with a three-pronged plug connected to a three-wire outlet is grounded in a properly wired house. You can also ground a fixture by connecting a #12 or #14 gauge wire to any bare metal screw (not an electric terminal) on the fixture housing to the screw that holds the cover plate on the electrical outlet your using.

{With two prong outlets, connect an adaptor plug with a terminal (top left) or third wire (top right) from the plug to the screw that holds the cover plate. This converts two-wire outlets to three wire grounded systems when a three-wire electric cord is used, an important electrical safeguard which grounds the light system.}

Chapter Six

SOIL AND CONTAINERS FOR IT

6.2 Pots and Other Containers

In its natural state, marijuana may grow an extensive root system - a fibrous network of fine, lateral roots that branch off a main, carrot-shaped tap root. In dry areas, the tap root can grow more than six feet deep in its search for water. In moist areas with fertile soil (such as in potting mixtures), the lateral roots are able to supply water and nutritive needs and the tap root remains small, often only three or four inches long on a seven-foot-tall mature plant.

The purpose of the growing medium is to provide adequate water and nutrients in addition to anchoring the roots, which hold the plant upright. By watering and fertilising as needed, you could grow a six-foot plant in a four-inch ((Pots are measured by diameter across the top.)) pot or in a three-foot layer of soil over your whole garden; but neither of these extreme procedures is very practical.

Most growers use containers that will hold between two and five gallons of soil. These are a good compromise in terms of weight, space, cost, and labour. They can be moved easily and hold an adequate reservoir of water and nutrients to support a large mature plant.

Some growers use a single large box or several long troughs that hold a six- to 12-inch layer of soil. These have the advantage of minimal restriction of roots and less frequent waterings, but they require more soil and make rotating or moving the plants impractical.

Determine the right size pot to use in your garden by the amount of light per square foot. For a moderately lighted garden (15 to 25 watts per square foot and most window gardens), use one- to three-gallon containers. For gardens with more light energy - over 25 watts per square foot or one-half day or more of sunlight - use three- to eight-gallon containers. The smallest pot we recommend for a full-grown plant is eight inches or one gallon. This is also a good size for starting plants to be transplanted after two months.

Practically any container that can withstand repeated waterings and has a top at least as wide as its base will do. Each pot must have several holes in the bottom to assure drainage. Growers use flower pots, institutional-sized cans and plastic buckets, baskets and small trash cans, milk crates and wooden boxes.

Plastic trash bags are sometimes used when other large containers can't be found. They must be handled carefully, since shifting the soil damages the fragile lateral roots. They are also more difficult to work with when transplanting. However, a roll of trash bags is an available and inexpensive substitute for other large containers. Plastic bags should be double or triple bagged. Small holes should be punched in the bottom to drain excess water. Use masking tape to patch any unwanted tears. The capacity of the bag should be no more than twice as many gallons as the amount of soil used. For example, with four gallons of soil, the bag should be of a five-gallon, but not more than eight-gallon size. Otherwise, it will not form a cylinder, and the bag will remain a shapeless mass.

Use as many pots as can fit in the lighted area to make the most efficient use of space. Many growers prefer to start the plants in smaller pots, transplanting into larger pots when the plants are larger. There are definite advantages to this method in terms of the yield in the garden, given its space and light energy. Seedlings and small plants take up much less space than they will at maturity, so they can be placed closer together. As the plants grow and begin to crowd each other, remove the less vigorous (to smoke, of course) and transplant the rest into larger pots. Start plants which will be transplanted later in four- to eight-inch flower pots, or one-quart to one-gallon tin cans or milk containers. Peat pots or planting pots are made of compressed plant fibre for the purpose of starting young plants. They are available at garden shops and come in several sizes. Use at least a four-inch pot so that the roots are not restricted in early growth. Peat pots are supposed to break down in the soil, but marijuana's delicate lateral roots may not be able to penetrate unless you score or break away the sides while transplanting. Wax paper cup (six to eight ounces), filled with a soil mixture, work as well as peat pots and are cheaper.

BOX C

Finding Large Containers

Use your ingenuity in finding large containers. Large clay flower pots do not work any better than the large metal and plastic containers discarded by restaurants and food stores. Various milk containers are good starting pots. Many garden shops sell used pots for a few cents each. Wholesalers sell plastic pots by the carton at a discount. Large plastic pots and pails can sometimes be picked up inexpensively at flea markets or variety stores. Any vessel that holds an adequate amount of soil and does not disintegrate from repeated waterings is a satisfactory container.

6.3 Properties of Soil

The soil or growing medium serves as a source and reservoir for water, air, and nutrients, and to anchor the roots. Since marijuana grows extremely fast, it has higher water and nutritive needs than most plants grown indoors. The success of your garden depends on supplying the plant with a medium that meets its needs without creating toxic conditions in the process.

There is no such thing as the perfect soil for Cannabis. Each variety can grow within a range of soil conditions. For healthy, full, growth, marijuana prefers a medium with good drainage, high in available nutrients, and near a neutral pH (7.0). These conditions result from a complex set of physical, chemical and biological factors. We will refer to them simply as: (1) texture; (2) nutrients; (3) pH.

Most indoor growers prepare the growing medium using commercial potting mixes. These mixes are usually sterilised or pasteurised and have good general soil properties. Since they seldom list the contents, nutrients, or pH, do some simple test of your basic soil whether you buy or dig for it. Then you can adjust the soil to meet the basic requirements of the plant.

Texture

The texture of the medium determines its water-holding and draining properties. Marijuana must have a well-drained medium for healthy growth. Soils that hold too much water or hold it unevenly can drown the roots, leading to poor growth or death of the plant. In a well-drained soil the roots are in contact with air as well as water. Soils that have too much clay, or are overly rich in compost or other organic matter, tend to hold too much water and not enough air. This condition worsens in time. This is especially true of the soil in pots.

You can determine the texture of your soil from its appearance and feel. Dry soil should never cake or form crusts. Dry or slightly moist soil that feels light-weight, airy, or spongy when squeezed, and has a lot of fibrous material, will hold a lot of water. Mix it with materials which decrease its water-holding capacity, such as sand, perlite, or even kitty litter.

Wet soil should remain spongy or loose and never sticky. A wetted ball of soil should crumble or separate easily when poked.

Soil that feels heavy and looks dense with fine particulate matter, or is sandy or gritty, will benefit by being loosened and lightened with fibrous materials such as vermiculite, Jiffy Mix, or sometimes sphagnum moss.

Soil Conditioners to Improve Texture

Perlite (expanded sand or volcanic glass) is a practically weightless horticultural substitute for sand. Sand and perlite contribute no nutrients of their own and are near neutral in pH. They hold water, air, and nutrients from the medium on their irregular surfaces and are particularly good at aerating the soil.

Vermiculture (a micaceous material) and sphagnum moss contribute small amounts of their own nutrients and are near neutral in pH. They hold water, air, and nutrients in their fibre and improve the texture of sandy or fast-draining soils. Jiffy Mix, Ortho Mix, or similar mixes are made of ground vermiculite and sphagnum moss, and are fortified with a small amount of all the necessary nutrients. They are available at neutral pH, are good soil conditioners, and are also useful for germinating seeds.

Sphagnum and Peat Moss (certain fibrous plant matter) are sometimes used by growers to improve water holding and texture. Both work well in small amounts (10 to 15 percent of soil mixture). In excess, they tend to make the medium too acidic after a few months of watering. Use vermiculite or Jiffy Mix in preference to sphagnum or peat moss.

Nutrients

Nutrients are essential minerals necessary for plant growth. The major nutrients are nitrogen (N), phosphorus (P), and potassium (K), which correspond to the three numbers, in that order, the appear on fertiliser and manure packages, and that give the percentage of each nutrient in the mix (see section 9).

Marijuana prefers a medium that is high in nitrogen, and mid-range in phosphorus and potassium. Generally, the darker the soil, the more available nutrients it contains. Commercial soils usually contain a good balance of all nutrients and will support healthy growth for a month or two, even in smaller (one gallon) containers. Many growers prefer to enrich their soil by adding sterilised manures, composts, or humus. All of these provide a good balance of the three major nutrients. They also retain water in their fibre. In excess they cause drainage problems, make the medium too acidic, and attract insects and other pests. A good mixture is one part compost or manure to five to eight parts of soil medium. In large pots (four or five gallons), these mixtures might provide all the nutrients the plant will ever need. {Table 13.}

The many prepared organic and chemical fertilisers that can be mixed with the soil vary considerably in available nutrients and concentrations. Used in small amounts, they do not appreciably effect the soil texture. Many prepared fertilisers are deficient in one or more of the major nutrients (see Table 14). Mix them together so there is some of each nutrient, or use them with manures, which are complete (contain some of all three major nutrients). When adding fertilisers, remember that organic materials break down at different rates. It is better to use combinations which complement each other, such as poultry manure and cow manure, than to use either fertiliser alone. (See Table 22 in section 13 for a complete list of organic fertilisers.

Table 14 - Prepared Organic Fertilisers

Type of fertiliser	Percentage by weight of			Availability to Plant
	N	P2O5	K2O	
Blood meal	13	0	0	Rapid/medium
Bone meal	0.5	15	0	Medium/slow
Blood/bone meal	6	7	0	Medium/slow
Cottonseed meal	6	2	1	Slow/medium
Fish meal	8	2	0	Slow/medium
Hoof and bone meal	10	2	0	Slow
Rock phosphate	6	24	0	Slow
Wood ash	0	1.5	3-7	Rapid
Greensand	0	0	2-8	Medium/slow

Chemical fertilisers are made in about every conceivable combination and concentration. Pick one that is complete and where the first number (N) is at least equal if not higher than both P and K. For example, rose foods may be 12-12-12 or 20-20-20, and work very well for marijuana. Others are: Vigoro 18-4-5 and Ortho 12-6-6. The higher the number, the more concentrated the mix is, and consequently, the more nutrients are available.

Don't use fertilisers which come in pellets or capsules, or that are labelled "timed" or "slow release." They do not work as well indoors as do standard organic and chemical fertilisers. Chemical fertilisers seldom list the amount to mix per pot. You can get some idea by the instructions for application per square foot. Use that amount of each one-half cubic foot of soil mixture.

Many growers add no nutrients at this time but rely on watering with soluble fertilisers when they water. These fertilisers and their application are discussed in section 9.

pH

The pH is a convenient measure of the acidity or alkalinity of the soil medium. It is another way of expressing whether the soil is bitter (alkaline) or sour (acid). The pH is measured on a scale of 0 to 14, with 7.0 assigned neutral; below 7.0 is acid and above is alkaline.

You can think of the pH as a measure of the overall chemical charge of the medium. It affects whether nutrients dissolve to forms available to the plant or to forms the plant can't absorb, remaining locked in the soil medium.

Marijuana responds best to a neutral (7.0 pH) medium, although in a fertile, well-drained soil, it will grow well in a range of 6.0 to 8.5. The simplest way to check the pH is with a soil-test kit from a garden shop or nursery. Test kits are chemicals or treated papers - for example, litmus papers or Nitrazine tape - that change colour when mixed with a wet soil sample. The colour is then matched to a colour chart listing the corresponding pH. Nitrazine tape is available, inexpensively, in drug stores. Some meters measure pH, but these are expensive. Agricultural agents, agricultural schools, and local offices of Cooperative Extension will test a soil sample for pH and nutrient content. Occasionally, a garden-shop person will check pH for you or will know the pH of the soils they sell.

Highly alkaline soils are characteristically poor soils that form cakes, crusts, and hardpan. Soil manufacturers don't use them, nor should they be dug for indoor gardens. Alkaline soils are treated with sulphur compounds (e.g., iron sulphate) to lower the pH.

We have never seen commercial soils that were too alkaline for healthy growth, but they are sometimes too acidic. The pH of acid soil is raised by adding lime (calcium-containing) compounds. Liming compounds come in many forms and grades. Some are hydrated lime, limestone, marl, or oyster shells, graded by their particle size or fineness. Use the finest grade available, since it will have more of a neutralising potential than a coarse grade. You need to use less and are more interested in immediate results than long-term soil improvement. For indoor gardens, use hydrated lime (available in any hardware store) or wood ashes to raise the pH. Hydrated lime is rated over 90 percent for its neutralising potential. Wood ashes will neutralise soil acids roughly one-half as well as hydrated lime. However, they also contain some nutrients (potassium, phosphorus, magnesium, and micronutrients) and are handy and free.

There is no exact formula we can give you for raising the pH. The pH does not have to be exact; it's an approximation. At low pH it takes less lime to raise the pH one point than it does when the pH is near neutral. Sandy soils need less lime to raise the pH one point than soils high in clay or organic matter. In general, add three cups of hydrated lime or six cups of fine wood ash to every bag (50 pounds or a cubic foot) of soil to raise the

pH one point. For soils that test slightly acid (about 6.5), add two cups of lime or four cups of wood ash.

Soil that tested below 6.0 should be retested in about two weeks, after thoroughly mixing and wetting the soil. Repeat the application until the pH is in an acceptable range. Check the pH of plain water to see if it is influencing the tests. Distilled water is neutral, but tap water sometimes has minerals that can change the pH. Hard water is alkaline. Sulphurous water and highly chlorinated water are acidic.

If you have already added lime to a soil that now tests from 6.5 to 7.0, don't add more lime trying to reach exactly 7.0. Too much lime will interfere with nutrient uptake, notably of potassium, phosphorus, and magnesium.

General Soil Characteristics

The texture, pH, and available nutrients of the soil are all related. The most important single factor is texture (good drainage). When soil drains poorly, it creates anaerobic (without air) pockets in the soil. Bacteria or microbes that live without air will begin to multiply and displace beneficial microbes that need air to survive. The anaerobic microbes break down organic matter to a finer consistency, and release CO₂ and organic acids to the medium. Drainage worsens, the acids lower the pH, and nutrients, even though present, become unavailable to the plant.

The result can be a four-month-old marijuana plant that is only three inches tall, especially if you use high concentrations of manures and composts, peat and sphagnum moss. If your soil lists manures or composts as additives, add no more than 10 percent of these on your own.

Drainage problems sometimes develop after several months of healthy growth. It is a good idea to add about 20 percent sand or perlite to even a well-drained soil. You can never add too much of these; they can only improve drainage. They dilute the nutritive value of the soil, but you can always water with soluble fertilisers.

Mixtures using many components in combination seem to work particularly well. This may be because, at a micro-level each component presents a slightly different set of physical, chemical and biological factors. What the plant can't take up at one point may be readily available at another.

6.4 Preparing Commercial Soils and Mixes

Garden soils (or loams) and potting mixes are actually two different groups of products, although they are frequently mislabelled. Some companies sell soil in large bags and a potting mixture in smaller bags, while labelling them the same. Soils and potting mixtures are usually manufactured locally, since transportation costs are prohibitive; so they differ in each area.

Texture and Nutrients

Soils and loams are usually topsoil blended with humus or compost for use as a top dressing in gardens, for planting large outdoor containers, or for the

soil part of a potting mixture. They may have a tendency to compact under indoor conditions and will benefit from the addition of perlite or vermiculite. Soils and loams usually contain a good supply of nutrients and may support a full-grown plant in a large container. Commercial soils that are heavy generally work better than lightweight soils. Heavy soils usually contain topsoil, in which marijuana grows very well. Lightness indicates more fibrous content.

For example of possible soil mixtures, see Box D. pre?

BOX D Examples of Soil Mixtures* 1. 5 parts soil 2. 8 parts soil 2 parts perlite 3 parts sand 1 part cow manure 1/4 part 10-10-10 chemical fertiliser 3. 5 parts soil 4. 4 parts soil 2 parts perlite 1 part sand 2 parts humus 1 part vermiculite 1/2 part cottonseed meal 2 parts humus 1/2 part poultry manure 5. 3 parts soil 6. 6 parts soil 1 part perlite 2 parts perlite 1 part sand 2 parts vermiculite 2 parts Jiffy Mix 1/2 part poultry manure 1/2 part blood/bone meal 1/2 part cow manure 1/2 part wood ash 1 part wood ash
*Almost all fertilisers are acidic, and need to be neutralised by lime. For the above mixtures, or any similar ones, mix in one cup of lime for each five pounds of manure, cottonseed meal, or chemical fertiliser in order to adjust the pH.

Potting mixes are intended to support an average-size house plant in a relatively small pot. They are sometimes manufactured entirely from wood and bark fibre, composts, and soil conditioners. These mixes are made to hold a lot of water and slowly release nutrients over a period of time, which is what most house plants require. For marijuana, these mixes seldom contain enough nutrients to support healthy growth for more than a couple of months. (Their N is usually low, P adequate, and K usually very high.) They work best when sand or perlite is added to improve drainage, and fertilisers are added to offset their low nutrient content.

The pH

Most commercial mixes and soils are between 6.0 and 7.0 in pH, a healthy range for marijuana. If you buy your soil, it will not be too alkaline for healthy growth, but it might be too acidic. You can minimise the chances of getting an acid soil by avoiding soils with "peat" or "sphagnum" in their names. Avoid soils that are prescribed for acid-loving plants such as African violets or azaleas, or for use in terrariums. With common sense, you can buy a soil, add two cups of lime to each large bag, and not have to worry about the pH. However, the surest procedure is to test the pH yourself.

Probably the best way to find the right soil for your garden is to ask long-term growers. They can relate their past experiences with various mixes and blends. Most long-term growers with whom we have talked have tried many of the mixes available in their areas. A reliable, enlightened nursery person or plant-shop operator may also be able to give you some advice.

6.5 Buying Soil Components

All the materials discussed here are available at farm and garden stores or nurseries. Many suburban supermarkets sell large bags of soil and humus.

Always buy your materials in the largest units possible to reduce the cost.

Large bags of soil and humus come in either 50-pound bags or one- to four-cubic-foot bags. A 50-pound bag fills about six gallons. There are eight gallons to a cubic foot. Perlite is sold in four-cubic-foot bags (thirty-two gallons). Jiffy Mix and vermiculite are sold in four-cubic-foot bags and in 16 pound bags (about 18 gallons). Sand, perlite and vermiculite come in coarse, medium, and fine grades. All grades work well, but if you have a choice, choose coarse. Sand (not beach sand) is an excellent soil conditioner. The only disadvantage is its heavy weight. Buy sand from lumber yards or hardware stores where it is sold for cement work. It will cost from 1/50 to one-half the cost of garden or horticultural sand. Sand from piles at construction sites works very well.

Calculating the Amount of Soil

The maximum amount of soil mixture for any garden can be found by multiplying the capacity of the largest pot you plan to use by the number of pots that you can fit in the garden. In many cases, the actual amount of the mixture used will be somewhat less. Two illustrations follow.

1. A small garden with a two-tube, eight-foot fixture (160W). Using 20 watts per square foot for fast growth gives 160W divided by 20W/sq.ft. = eight sq.ft. The largest pot needed for this system is three gallons, but two gallons would work. You can fit about 10 three gallon pots in eight square feet; so $3 * 10 = 30$ gallons of soil mixture are needed (see Box E).

BOX E

Examples Showing How Much Soil Material to Buy to Fill
a Known Number of Unit-Volume Containers

Example 1. For a garden eight square feet in size,
Buy Component Which amounts to

3	50-lb (6 gal. ea.) bags of soil	18 gallons
1	cubic foot of perlite	8 gallons
30	lbs of humus	3 gallons
10	lbs of chicken manure	2 gallons
	TOTAL	31 gallons

Example 2. For a garden 24 square feet in size,
Buy Component Which amounts to

4	1-cu. ft. bags of soil	32 gallons
2	1-cu. ft. bags of perlite	16 gallons
1	1-cu. ft. bag of vermiculite	8 gallons
20	pounds of cow manure	3 gallons
	cottonseed meal	2 gallons
	wood ash	2 gallons
	TOTAL	63 gallons

2. A large garden with two two-tube, eight-foot VHO fixtures (four times 215 watts or 860 total watts) illuminating a garden three by eight feet, or 24 square feet.

860 watts divided by 24 sq. ft. = about 36W/sq. ft.

The largest pot size for this system is about five gallons. About 16 five-gallon containers can fit in 24 square feet; so 16 * 5 = 80 gal. of mixture are needed. But you could start many more plants in smaller containers and transplant when they are root-bound. You do not use more soil by starting in smaller pots, since all soil is reused. In many cases, you actually use much less soil.

In this system you could start and fit about 40 plants in one-gallon pots in 24 square feet. When the plants begin to crowd each other, some are harvested, making room for the others, which are transplanted to larger pots. In practice, a high-energy system such as this one (36W/sq. ft.) will grow large plants whose size is limited mainly by the space available. Twelve large female plants are about the most you would want in the system during flowering and for final harvest. Sixty gallons of mixture is all that is needed for the seedlings and the mature crop. This is one-fourth less than the original estimate of 80 gallons, and you actually will harvest a lot more grass (see Box E).

Mixing and Potting

Mix your soil in a large basin, barrel, or bathtub. Individual pots are filled with mixtures by using a smaller container to measure out by part or volume.

Perlite, sand, and dry soil can give off clouds of dust. When mixing large amounts of these, wear a breathing mask or handkerchief over your nose and mouth.

To pot any of the mixtures, first cover any large drainage holes with a square of window screen or newspaper to prevent the mixture from running out. Place a layer of sand, perlite, or gravel about one inch deep to insure drainage. Fill the pots with soil mixture to within three-fourths of an inch from the top of the pot. If your mixture contains manures or composts, cover the last inch or two in each pot with the mixture minus the manure and compost. This will prevent flies, gnats, moulds, and other pests from being attracted to the garden. Press spongy soils firmly (not tightly) to allow for more soil in each pot; otherwise, after a period of watering, the soil will settle and the pot will no longer be full.

Some growers add a few brads or nails to each pot to supply the plant with iron, one of the necessary nutrients. Water the pots and allow them to stand for a day or two before planting. As the soil becomes evenly moist, beneficial bacteria begin to grow and nutrients start to dissolve. {Figure 40.}

6.6 Digging Soil

Most growers prefer to buy their soil, while some prefer to dig it. Marijuana cannot tolerate heavy clays, mucks, or soils that dry to crusts. Choose a soil from a healthy garden or field, or from an area that supports a lush growth of annual weeds.

Fields that support a good crop of alfalfa, corn or other grains will support a good crop of marijuana. Fields with beets, carrots, and sugar cane indicate a well-drained soil, with near neutral pH. Red clover, sweet clover, and bluegrass have soil requirements similar to those of marijuana. Garden soils are usually fertile and well-drained, but often need lime to counteract soil acidity.

Take the topsoil layer that starts about two inches below the surface debris. Good soil will look dark, feel moist, and smell clean and earthy. Use all of the topsoil layer that maintains its dark colour and is interlaced with roots. Your hands should be able to easily penetrate the underlying topsoil if the soil is in good condition. When the soil changes colour, or roots no longer appear, then you are past the fertile topsoil layer. Abundant worms, millipedes, and other small lifeforms are a good indication that the soil is healthy. A rich layer of topsoil collects by walls, fences, and hedges where leaves and debris collect and decay to a rich humus. Sift the soil to remove stones and root clods. Also, shake out the root clods, which are rich in nutrients.

Soil that is dug should be tested the same way as already prescribed. It should be adjusted with at least 30 percent sand or perlite (vermiculite for very sandy soils), since potting will affect the drainage of even well-drained soils. Never use manures or composts that are not completely degraded to a clean-smelling humus.

Soil that is dug must be sterilised to kill weed seeds, insect eggs, and harmful moulds and fungi. Some chemical treatments (e.g. formaldehyde) are mixed with water and poured over the soil to sterilise it. Soil can be sterilised in a pressure cooker at 15 pounds pressure for 15 minutes, or by baking wet soil in a large pot at 200 degrees for 30 to 40 minutes. Be advised that baking soil will release some formidable odours.

6.7 Growing Methods

As we said before, there are probably as many growing methods as there are marijuana growers. These methods are personal preferences or adaptations to fit particular situations; one method is not necessarily better than any other. However, the value of a garden is often based on the amount of high-quality grass it yields. Since indoor gardens are limited in size, you want the plants to quickly fill the garden with lush growth in order to use the garden efficiently. Otherwise, for the first couple of months, the lights are shining on empty space.

Secondly, the possession of small quantities of marijuana will probably be decriminalised nationally within the next few years. Decriminalisation for personal possession will open the way for decriminalisation for cultivation for personal possession. But small quantities are more difficult to define for cultivation than for simple possession, which is done by weight. Several possible ways to limit the amount for cultivation have been raised: by the number of plants, by the area cultivated, or by the number of plants at a particular stage of development. The outcome may determine whether you try to grow the largest plants possible or the most plants possible in a given area.

There are several ways to increase your garden's yield.

1. Pinch or cut back the growing shoots when the plants are young. This forces each plant to develop several strong growing shoots and generally yield large robust plants.
2. Plant a number of plant in each pot.
3. Start many plants in small pots and transplant the best plants to larger pots when the plants crowd each other.
4. Use different light systems to grow plants at different growth stages.

Here are some examples of how to carry out each of these four methods.

1. Fill the growing area with large containers (about five gallons each). Start several plants in each pot but thin the seedlings over a period of six weeks to two months, until one plant is left in each pot. During the fourth or fifth week of growth, pinch back the plants to about equal heights. Cut the growing shoot at about the fourth internode. Each plant will develop a sturdy stem which will support four to eight growing stems and will quickly fill any empty space in the garden. The whole garden is the treated like a hedge. After another month or two, you cut back the growing shoots again to have plants of equal heights. Remove the male plants as soon as they begin to release pollen (or before any male flowers open for sinsemilla). This will leave more space and light for the females to develop. By the time females flower, they've been cut back two or three times or more, and form a dense growth of growing shoots that fill the garden with a cubic layer of flowers. Some growers maintain the plants for up to a year before the final harvest.

{Figure 41. Plant clipped at fourth internode.}

2. This method also requires large pots. Instead of thinning the seedlings to leave one per pot, leave at least three. After a few months of growth, remove any plants that lag far behind or any plants that show male flowers. The value of this method is that the odds are at least seven to one that any pot will have at least one female plant.

Most of the plants you'll grow will fill out with branches by four months at the latest. Often the branches develop young seedlings. The plants may begin to look like small Christmas trees by the second to third months of growth.

Generally, you don't want to have more than three or four plants in a five-gallon container, because growth will be limited by competition for light and space.

{Figure 42. Basement growing factory in Atlanta.}

Some varieties never do fill out. The branches remain small, only two to three inches long, and yield very little grass. We've seen

plants like this grown from grass from Vietnam, Thailand, Afghanistan, and Africa. These plants are also quite short, being four to six feet tall fully grown. With varieties like this, it is better not to pinch tops, and to start about six plants per square foot of garden space. At harvest, the garden will be crowded with top stems that are laden with flower clusters.

Of course, you don't know what varieties will look like until you've seen them grow. For most varieties, each plant will need at least one square foot or space at maturity. It is much less common to find varieties that naturally grow small or especially thin, and, therefore, are those of which you would want to plant more than a few per large pot.

3. Another popular way to grow is to start plants in a large number of small pots. As the plants crowd each other, some are removed and the rest transplanted to larger pots.

4. To get the most for your investment requires conservation of light and soil. When the plants are young, a large number fit into a small place. Some growers take advantage of this fact by having several light systems, each with plants at different growth stages. The plants are rotated into larger gardens and pots. This method conserves space, materials, and electricity, and yields a harvest every two months. Using this method, "growing factories" turn out a steady supply of potent grass. {Table 15.}

Chapter Seven MAINTAINING THE CORRECT ENVIRONMENT

7.2 Requirements for Germination

Before the seed fell, almost all of its water was sapped to prepare the seed for winter. With only the tiny drop that it holds, the embryo lives a life so slow as to be outside of time as we know it. Cannabis seeds need only water to germinate or sprout. The seeds germinate without light and at temperatures low enough to form ice. Higher temperatures hasten germination. Fresh, homegrown Oaxacan seeds germinated in three days at 70F and in eight days at 33F. Temperatures 70 to 90F are best for germination.

Fresh, mature seeds have a high rate of germination (about 90 to 100 percent) and sprout quickly. Usually sprouts appear three to seven days after planting. Older seeds (over a year, depending on storage) have a lower rate of germination and respond slower. They may take up to three weeks to sprout. To get an idea of what to expect from the seeds follow the procedure in 3.1.

Seeds that do sprout will grow normally, no matter how old they are or how long they take to sprout. From any batch of seeds, most of the ones that sprout will do so within two or three days of each other. A few will continue to come up as many as six months later, but the garden should consist of plants that are basically the same age and size. This makes the

garden easier to care for.

Choosing Seeds

Different varieties grow at different rates and attain different sizes and shapes. Under artificial lights, gardens plants from one batch of grass require the least attention, because the plants sprout and grow uniformly and can all be tended at the same time. When several varieties are grown together, some plants are taller than others; you must adjust the height of the plants to keep the marijuana equally illuminated. You may also have to water and fertilise the plants on an individual basis. Some growers start at different varieties under separate light systems. On the other hand, planting several varieties offers you a comparison in potency and yield, and a source for hybrids if you want to develop seed. The next time you plant you'll know which seeds gave the best results and what growing methods will work best for you. {Figure 43. Within each seed lies an embryo.}

There is no strict correlation between the form and height of the plants and seed size, colour, or pattern. However, some large-seeded varieties grow too tall, with long spaces between leaves. Under artificial lights they yield more stems than leaves. If you have a choice between two equally potent grasses, and one has particularly large seeds (3/16 to 1/4 inch), choose the smaller-seeded variety.

Sowing

The easiest way to start the plants is to sow the seeds directly into the soil. First, wet the soil with a moderate amount of water, enough to wet the soil with a moderate amount of water, enough to get the soil evenly moist without water running out the bottom. This takes about one-half quart of water for one-gallon containers, and about one quart for three-gallon containers. Plant the seeds a quarter- to half-inch deep. The germination rate is lower when they are planted deeper; and if seeds are planted less than one-quarter inch deep, the sprouts may have difficulty anchoring their roots. Plant about six seeds per pot to assure some sprouts in each pot. Gently press each seed into the soil. Cover the seeds with soil and sprinkle lightly with water. Each day, sprinkle or spray the surface with enough water to thoroughly wet the top half-inch of soil, since the seed must be kept moist for germination.

For most people, germinating the seed is easy. Problems with germination come from either too much or too little water. If you saturate the pots with water, and especially if you continue to saturate the pots after the seeds have sprouted, the seedlings may develop stem rot or root problems. When stem rot develops, the base turns brown, and the seedlings fall over, ending the garden. This can also happen if you keep seedlings in germination boxes or terrariums where the humidity is very high. When the humidity is low, the soil surface dries out quickly and the seeds won't germinate. Sprouts that may come up shrivel and dry at the base of the stem and die.

The key to germination is to keep the soil surface moist after first having moistened the whole pot; then, after the first sprouts have been up for a few days, let the surface of the soil dry between waterings. Don't spray the surface any more. Water with medium amounts of water when the soil in the

top couple of inches feels dry. For small pots, water seedlings about twice a week. For larger pots, once each week or two may be enough.

Some growers prefer to plant only seeds they know will sprout, especially when planting seeds which have a low viability. Start the seeds in wet towels or a glass of water. Add one teaspoon of liquid bleach (a three-percent solution) to each cup of water. This will prevent fungus from attacking the seeds, which happens when they are soaked for more than three days. Check the seeds each day. Plant when the radical or roots begins to come out from the pointed end of the seed. Cannabis seed is quite small and has only enough stored food for the embryo to anchor its root and raise its cotyledons. The more developed the root is when planted, the less energy it has to anchor itself in the soil. The sprout may die or growth be delayed until the root is established (transplant shock). In Figure 44, the seeds in a circle are all ready to plant. The centre seed will not survive transplanting. {Figure 44. Seeds in a circle are ready to plant. Centre sprout will not survive planting

{**Centre sprout too large**}

Some growers prefer to start the plants in a germination box. This extra hassle is not necessary. Transplanting seedlings from one medium to another often causes transplant shock. It is best to plant the seeds directly into the soil.

If you use Soilless mixtures, your seedlings should be started in paper cups, peat pots, or other small pots filled with a soil mixture (see Transplanting in Chapter 8 {8.3}). This procedure is also helpful if you have the difficulty starting the plants in large containers. Expandable peat pellets also work very well.

The position of the seed in the soil has a slight effect on germination. The root directs its growth in response to gravity, as shown in Figure 45. However, germination is a little faster when the seeds are planted with the pointed end up. The difference is small, and it's not really necessary to position the seeds in the soil.

If a dry atmosphere presents problems, you can create the moist atmosphere of a germination box and still plant directly in the pot. Cover the seeds with transparent plastic cups or glasses, or cover the pot with plastic kitchen wrap. This creates a greenhouse effect and keeps the soil surface moist without watering. Remove all the covers as soon as you see the first sprouts begin to appear; the sprouts will die if the cover is left on. {Figure 45. The root directs its growth toward gravity. Seeds are germinated between glass and cotton, and held vertically. Four seeds to left have pointed and up. Two middle seeds are horizontal. Six seeds on right have pointed end down.} {Figure 46. During germination soil can be kept moist by using plastic covers to create a greenhouse effect.}

7.3 Light Cycle and Distance of Lights from Plants

The seed doesn't need light to germinate. The sprout does need light as soon as it breaks through the soil. Most growers turn the light on when they sow the seeds, though, to warm the soil and encourage germination. Lights may

also dray the surface of the soil, especially in large pots or with VHO fixtures. If this is a problem during germination, leave the lights off until you see the first sprout breaking through the soil; or hang the lights about 18 inches above the soil, and lower them to six inches as soon as the sprouts appear.

It is important for normal development that the plants receive a regulated day/night cycle. We emphatically recommend that you use an automatic electric timer (about \$8). A timer makes gardening much easier, since you don't have to turn the lights on or off each day. The plants won't suffer from irregular hours or your weekend vacations. Set the timer so that the plants get about 16 to 18 hours of light a day, and leave it on this setting until the plants are well grown (three to six months) and you decide to trigger flowering.

During the seedling and vegetative stages of growth, the plants may be subjected to light during their night period. During flowering, however, the night period must be completely dark.

The plants grow more slowly with less than 16 hours of artificial light a day, and they may flowers prematurely. Some growers leave the lights on up to 24 hours. A cycle longer than 18 hours, may increase the growth rate, especially if the plants are not saturated with light. A longer cycle is helpful in small gardens, such as under standard four-foot fixtures.

No matter what the light source, place the lights as close to the tops as possible without burning the plants. Pay no attention to the manufacturer's instructions for the distance of the plants from the lights; these instructions don't apply to a high-energy plant such as Cannabis. With standard-wattage tubes, keep the lights from two to six inches above the plant tops. With VHO tubes, allow four to eight inches. Maintain the lights at these distances throughout the life of the garden. In most cases you will have to raise the lights once or twice a week as the plants grow.

Standard fluorescents don't get hot enough to burn the plants unless they are in direct contact with leaves for several hours. VHO tubes will burn leaves before they touch them. But you do want to keep the lights as close to the plants as possible. This encourages stocky, robust growth. Incandescents and floodlights get very hot; place them at a greater distance from the plants. Test the distance by feeling for heat with your hands. Place the bulb at the distance where you begin to feel its heat. For a 75-watt incandescent lamp, this is about eight inches.

7.4 Water

Water, the fluid of life, makes up more than 80 percent of the weight of the living plant. Within the cells, life processes take place in a water solution. Water also dissolves nutrients in the soil, and this solution is absorbed by the roots. About 99 percent of the water absorbed passes from the roots into the conduits (xylem) of the stem, where it is distributed to the leaves via the xylem of the leaf veins. Transpiration is the evaporation of water from the leaves. The flow of water from the soil, through the plant to the air, is called the transpiration stream. Les then one percent of the water absorbed is broken down to provide electrons (usually in the form of

hydrogen) which, along with carbon dioxide, are used to form carbohydrates during photosynthesis. The rest of the water is transpired to the air.

Watering

Water provides hydrogen for plant growth, and also carries nutrients throughout the plant in the transpiration stream. However, it is not true that the more water given a plant, the faster it will grow. Certainly, if a plant is consistently under-watered, its growth rate slows. However, lack of water does not limit photosynthesis until the soil in the pot is dry and the plant is wilting.

The amount of water, and how often to water, varies with the size of the plants and pots, soil composition, and the temperature, humidity, and circulation of the air, to name a few variables. But watering is pretty much a matter of common sense.

During germination, keep the soil surface moist. But once the seedling are established, let the top layer of soil dry out before watering again. This will eliminate any chance of stem rot. Water around the stems rather than on them. Seedlings are likely to fall over if watered roughly; use a hand sprinkler.

In general, when the soil about two inches deep feels dry, water so that the soil is evenly moist but not so much that water runs out the drainage holes and carries away the soil's nutrients. After a few trials, you will know approximately how much water the pots can hold. Marijuana cannot tolerate a soggy or saturated soil. Plants grown in constantly wet soil are slower-growing, usually less potent, and prone to attack from stem rot.

Over-watering is a common problem; it develops from consistently watering too often. When the plants are small, they transpire much less water. Seedlings in large pots need to be watered much less often than when the plants are large or are in small pots. A large pot that was saturated during germination may hold enough water for the first three weeks of growth. On the other hand, a six-foot plant in a six-inch pot may have to be watered every day. Always water enough to moisten all the soil. Don't just wet the surface layer.

Under-watering is less of a problem, since it is easily recognized. When the soil becomes too dry, the plant wilts. Plant cells are kept rigid by the pressure of their cell contents, which are mostly water. With the water gone, they collapse. First the bottom leaves droop, and the condition quickly works its way up the plant until the top lops over. If this happens, water immediately. Recovery is so fast, you can follow the movement of water up the stem as it fills and brings turgor to the leaves. A plant may survive a wilted condition of several days, but at the very least some leaves will drop.

Don't keep the pots constantly wet, and don't wait until the plant wilts. Let the soil go through a wet and dry cycle, which will aerate the soil and aid nutrient uptake. Most growers find that they need to water about once or twice a week.

When some soils get particularly dry, the water is not absorbed and runs down the sides and out the bottom of the pot. This may be a problem the first time you water the soil, or if you allow the soil to get very dry. To remedy, add a couple of drops of liquid detergent to a gallon of water. Detergent acts as a wetting agent and the water is absorbed more readily. First water each pot with about one cup of the solution. Allow the pots to stand for 15 minutes, then finish watering with the usual amount of pure water.

Use tepid water; it soaks into the soil more easily and will not shock the roots. Try to water during the plant's morning hours. Water from the top of the pot. If you do want to water from the bottom with trays (not recommended), place a layer of pebbles or gravel in the trays to insure drainage. Don't leave the pots sitting in water until the pot is heavily saturated. The water displaces the soil's oxygen, and the plants grow poorly.

Tap water in some areas highly chlorinated, which does not seem to harm Cannabis; and many fine crops are raised with water straight from the tap. But chlorine could possibly affect the plants indirectly, by killing some beneficial micro-organisms in the soil. Chlorine also makes the water slightly acidic. However, neither effect is likely to be serious. Some growers have asked whether they should use pet-shop preparations that are sold to remove chlorine from water in fish tanks. These preparations generally add sodium, which removes the chlorine by forming sodium chloride (table salt). This solution does not harm the plants, although repeated use may make the soil too saline. Probably the best procedure is to simply allow the water to sit in an open container for a few days. The chlorine is introduced to water as the gas Cl_2 , which dissipates to the air. The water temperature also reaches a comfortable level for the plants.

Hard (alkaline) water contains a number of minerals (e.g., Ca^{++} , Mg^{++} , K^+) which are essentially nutrients to the plants. Water softeners remove these minerals by replacing them with sodium, which forms slightly salty water. It is much better to water with hard water, because artificially softened water may prove harmful after some time. Occasionally, water may be acidic (sulphurous). Counteract this by mixing one teaspoon of hydrated lime per quart water and watering with the solution once a month.

Water and Potency

We've seen no studies that have evaluated potency in relation to water. A few studies have mentioned the fact that plants that received less water were slightly more potent. Water stress has been practiced by several marijuana-growing cultures. In parts of India, watering is kept to a minimum during flowering.

To limit watering, water with the usual amounts but as infrequently as possible. To encourage good growth, yet keep watering to a minimum, wait until the plants are a few months old before you curtail watering. Give the plants their normal water and note the number of days before they begin to wilt. As the plants get larger, the water needs increase, but this generally stabilises by the time of flowering.

7.5 Air

The properties of the air seldom present any problems for indoor gardeners. The plants grow well under the ordinary conditions that are found in most homes and can withstand extremes that are rarely found indoors. The plants can survive, in fact thrive, in an atmosphere many house plants can't tolerate. For plant growth, the most important properties of the air are temperature, humidity, and composition.

Temperature and Growth Rate

Temperature control should be no problem. The plants can withstand temperatures from freezing to over 100F. Plant growth is closely related to temperature. Marijuana varieties are, in general adapted to warm if not hot climates. Different varieties will reach their maximum rate of photosynthesis at different temperatures. For almost all marijuana varieties, the rate of photosynthesis will increase sharply with increases in temperatures up to about 70F. Some strains reach their peak rate of growth at about 75F. Others, especially from areas near the equator, such as Colombia, may not reach their peak rate until the temperature is about 90F. However, for all varieties, increases in the growth rate will be slight with increased temperatures over 75F. The average temperature for maximum is about 75 to 80F. In other words, normal household temperatures are fine for growing marijuana and no special temperature control is necessary for most gardens.

Don't set up the garden right next to, or in contact with, a heat source such as a radiator or furnace. If the garden is nearby, the plants should do quite well. The plants are most susceptible to cool temperatures during germination and the first few weeks of growth. In basement gardens, the floor temperature is often lower than the air. It is a good idea to raise the pots off the floor with pallets or boxes. The seeds will germinate quicker, and the plants will get off to a faster start.

If heating is necessary, propane catalytic heaters work well, are safe and clean, and increase the carbon-dioxide content of the air. Electric and natural gas heaters also work well. Do not use kerosene or gasoline heaters. They do not burn cleanly, and the pollutants they produce may harm the plants. Any heater that burns a fuel must be clean and in good working order. Otherwise, it may release carbon monoxide, which is more dangerous to you than to the plants.

Temperature and Potency

Since marijuana varieties are most often grown in semi-tropical and tropical areas, the idea that high temperatures are necessary for potent marijuana is firmly entrenched in marijuana lore. This myth, like many others, is slowly disappearing as marijuana farmers and researchers accumulate more experience and knowledge. There are only a few published papers on the effects of temperature on potency. The best study we've seen grew four different varieties in a controlled environment under artificial lights on a 15-hour day-length. Two temperature regimes were used: a "warm" regime, with temperatures of about 73F during the day and 61F at night (about average for most homes); and a "hot" regime, set at 90F daytime and 73F at night. In all

four varieties, the concentration of THC and of total cannabinoids was higher under the "warm" regime. For instance, a Nepalese strain was 3.4 times higher in concentration of total cannabinoids, and 4.4 times higher in THC, when grown under the "warm" regime than the same strain grown under the hot regime. Although we agree with the findings in principle, these figures are higher than our experience tells us.

Interpretation of the data does show one point clearly. In all four varieties, the amount of THC lost as CBN was higher under the "hot" regime (see Table 16 - currently excluded from this guide), even though the concentration of THC was higher under the "warm" regime.

Another research group in France has looked at the relationship of potency to temperature. The most recent paper 79 compared four temperature regimes, given in descending order of potencies found: 75F day, 75F night (highest potency); 72F day, 54F night; 81F day, 81F night; and 90F day, 54F night (lowest concentration of THC). In each, the day period was 16 hours and the night period eight hours.

Interestingly, this same research group in an earlier paper 20 reported that the concentration of THC was higher for male plants grown at 90-72F than for those grown at 72-54F. For the female plants, the differences in THC concentration were small. The variety used was a propyl variety (type IV) containing about half as much THCV as THC. For both the male and female plants, the concentration of THCV were high under the 90-72F regime.

The simplest interpretation of all these results is that mild temperatures seem to be optimum for potency. Temperatures over 90F or below 60F seem to decrease the concentration of THC and total cannabinoids. Also, at higher temperatures, much more THC will be lost as CBN. And last, propyl varieties may produce less THCV under a cool regime. Bear in mind that none of these papers accounted for all of the many variables that could have affected the findings. For instance, the concentration of THC was 18 times higher at 75-75F than at 90-54F. We've never seen differences of this magnitude, and sampling error undoubtedly influenced the findings.

In terms of growth rate and potency, daily temperatures of about 75F, give or take a few degrees, are roughly optimum. Normal household temperatures are in the low 70's during daytime and the low 60's at night. The heat from a light system will raise the garden's temperature a few degrees. In most gardens temperatures will be near 75F during the day. Night-time temperatures drop about 10 to 15 degrees. When night-time temperatures drop into the 50's or below, set the light cycle to turn on during the early morning, when the temperature will be lowest. In a small room, the light system will generate enough heat to warm the garden without any need for a heater. Whenever you wish to raise the temperature by, say, five or 10 degrees, it is better to add more lights than a heater. The plants will benefit from the additional light, as well as from the heat they generate. And an electric heater, watt for watt, doesn't generate much more heat than a lamp and its fixture.

Composition of the Air

Air provides two essential ingredients for the living plant: oxygen and

carbon dioxide. The plant uses oxygen for respiration in the same way we do. The oxygen is used to burn carbohydrates (CH₂O) and other food, yielding energy (ATP; see section 4) for the organism, and releasing carbon dioxide and water into the environment.

During photosynthesis, CO₂ is used to form carbohydrates. As part of photosynthesis, light energy is used to split water molecules, releasing oxygen into the environment. In plants, the net result from respiration and photosynthesis is that much more oxygen is released than consumed, and more carbon dioxide is consumed than released. The oxygen in the Earth's atmosphere is formed by photosynthetic organisms.

The similarity between plant and animal respiration ends at a cellular level. Plants don't have lungs to move the air. The passage of gases, whether oxygen or carbon dioxide, is primarily a passive process. The gases diffuse through microscopic pores called stomata, found in Cannabis on the undersides of the leaves. The plants can open and close their stomata, allowing moderate control of the flow of air. However, for good exchange of gases, the plants require adequate ventilation for air circulation. {Cannabis is a C3 plant}

Cannabis is not particularly susceptible to a stuffy or stagnant atmosphere. A garden in the corner of a room that is open to the house will be adequately ventilated. Ventilation is not a problem unless the garden is large and fills a quarter or more of the space in a room. Gardens in small, confined spaces such as closets, must be opened daily, preferably for the duration of the light period. Plants growing in a closed closet may do quite well for the first month, but they'll need the door opened as the plants begin to fill the space. The larger the plants get, the greater the need for freely circulating air.

When the weather is mild, an open, but screened, window is the best solution for ventilation. In large indoor gardens where there isn't much air circulation, a small fan is helpful. After germination, make spaces in the surrounding reflectors to allow air to circulate freely. Leave the spaces at the bottom, ends, and the tops of the garden. The higher the temperature or the humidity, the more the plants need good ventilation.

CO₂

CO₂ is a natural, non-poisonous gas present in the atmosphere, which plants absorb and use during photosynthesis to synthesise sugars and organic compounds for energy and growth. Plants can effectively use CO₂ up to about .15 percent concentration, about five times the concentration (.03) naturally present in the atmosphere. Increasing the CO₂ dramatically increases the growth rate, often up to twice the rate of growth in plants in a natural atmosphere. Supplemental CO₂ systems are an inexpensive way serious gardeners dramatically increase a garden's yield. {And decrease fire risk.} {Picture Common emitter systems are safe, inexpensive, easy to setup, and may double the rate of growth in a garden.}

There are two good ways to increase the concentration of CO₂. Greenhouse growers use CO₂ generators which produce CO₂ by burning a clean-burning fuel such as propane or butane. The problems with CO₂ generators are that they

require a fuel, operate with an open flame, and produce a lot of heat. These are not necessarily problems if the grow room needs to be heated, and if the room is constantly monitored.

For home-growers, the emitter system is more efficient, relatively cheap, safe, and easy to use. Many suppliers who advertise in High Times and Sinsemilla Tips offer complete emitter systems that come with a regulator, solenoid valve, flow-meter, timer, (sometimes distribution tubing), and detailed, yet simple instructions. You must rent compressed CO₂ gas tanks from a local compressed gas supplier or beverage company. The setup is not complicated or expensive, and a walk through the Yellow Pages should show several suppliers.

Since the CO₂ in the atmosphere is about .03 percent, and the maximum CO₂ concentration that your plants use is about .15 to .2 percent, set your emitter system to regulate a concentration of .12 to .17 percent CO₂ in the room. Don't worry if you don't understand. All systems are easy to install and come with easily understood instructions.

7.6 Humidity

Marijuana flourishes through a wide range of relative humidity. It can grow in an atmosphere as dry as a desert or as moist as a jungle. Under ordinary household conditions, the humidity will rarely be too extreme for healthy growth. The effects of the humidity on plant growth are closely tied to temperature, wind speed, and the moisture of the soil.

The relative humidity affects the rate of the plant's transpiration. With high humidity, water evaporates from the leaves more slowly; transpiration slows, and growth slows also. With low humidity, water evaporates rapidly; the plant may not be able to absorb water fast enough to maintain an equilibrium and will protect itself from dehydration by closing its stomata. This slows the transpiration rate and growth also slows. There is a noticeable slowing of growth because of humidity only when the humidity stays at an extreme (less than 20 percent or over 90 percent).

Cannabis seems to respond best through a range of 40 to 80 percent relative humidity. You should protect the plants from the direct outflow of a heater or air conditioner, both of which give off very dry air. During the first few weeks of growth, the plants are especially susceptible to a dry atmosphere. If this is a problem, loosely enclose the garden with aluminum foil, white sheet plastic, or other materials. This will trap some of the transpired moisture and raise the humidity in the garden. Once the seedlings are growing well, the drier household atmosphere is preferred.

Where the humidity is consistently over 80 percent, the plants may develop stem rot or grow more slowly. Good air circulation from open windows or a small fan is the best solution.

As long as the air is freely circulating, the plants will grow well at higher humidities. Dehumidifiers are expensive (over \$100) and an extravagance.

Humidity and Potency

As far as we know, there has been little work done correlating the relative humidity with potency. In the two related cases we've seen, 85, 117 neither study was intended to examine the effects of relative humidity and potency. However, a lower humidity (50 to 70 percent) produced slightly more potent plants than a higher relative humidity (80 percent and over).

A dry atmosphere seems to produce more potent plants. When the humidity is about 50 percent or less, plant development is more compact, and the leaves have thinner blades. When the atmosphere is humid, growth is taller and the leaves luxuriant with wider blades. The advantage to the plant is that wider blades have more surface and hence can transpire more water. The converse is that thinner blades help conserve water. Higher potency may simply be due to less leaf tissue for a given amount of cannabinoids and resin glands.

The temperature also influences the form and size of the leaves. At higher temperatures, the leaves grow closer together; under a cool regime, the leaves are larger, have wider blades, and are spaced farther apart 77. Possibly, cool temperatures yield slightly lower potency for much the same reason that a moist atmosphere does.

However, differences in potency caused by any of the growth factors (light nutrients, water, temperature, humidity, etc.) are small compared to differences caused by the variety (heredity) and full maturation (expression of heredity). For example, the humidity in Jamaica, Colombia, Thailand, and many other countries associated with fine marijuana is relatively high and averages about 80 percent.

However, try to keep the atmosphere dry. The atmosphere in heated or air-conditioned homes is already dry (usually 15 to 40 percent). For this reason, many growers sow so that the plants mature during the winter if the home is heated or in mid-summer if it is air-conditioned. As we mentioned, there should be no need to use dehumidifiers. Good air circulation and raising the temperature to 75 to 80F are the simplest means of dealing with high humidity.

Chapter Eight GARDENING TECHNIQUES

8.2 Thinning

Depending on the viability of the seeds, there should be several plants growing in each pot. Most growers thin to one plant per pot, but the plants don't have to be thinned until they crowd each other and have filled the garden with foliage. The longer you let them grow, the more potent they'll be.

It is virtually impossible to tell the gender of the plants when they are young. The normal ratio of males to females in Cannabis is one to one. Some farmers end up with more male plants because of their thinning practices. When the plants are less than a month old, the male plants often appear taller and better developed than the females. The male seedling uses more of

its energy to develop its aboveground parts than the female. The female devotes more energy to establishing a strong root system. During the first few weeks, don't thin the plants by leaving only the tallest, or you'll wind up with a higher ratio of males. Try to leave seedlings that are healthy and vigorous and that are roughly at the same point of development.

To thin your garden, remove any plants with yellow, white, or distorted leaves. Remove the less vigorous and those that lag far behind in development. Cut the unwanted plants near the base; the root system can remain in the pot.

These harvested seedlings will be your first taste of homegrown grass. Usually they produce a mild buzz, but if you separate the growing tips from the large leaves, they may be more potent.

8.3 Transplanting

However you transplant, try to disturb and expose the roots as little as possible. If you transplant carefully, the plants will not exhibit delayed or slowed growth due to transplant shock.

Transplanting Seedlings

When the plants are a week to two weeks old, transplant to any pot that has no plants. First, moisten the soil in the pot from which you will remove the transplant and let it sit for a few minutes. Take a spade or a large spoon, and insert it between the transplant and the plant that will be left to grow. Try to leave at least one inch of space from spoon to stem. Lever the spoon toward the side of the pot, in order to take up a good-size wedge of soil. Place the transplant in a prepared hole at the same depth that it was growing before. Replace the soil in both pots and moisten lightly again to bond the new soil with the original. If you are careful, a wedge of soil can be removed intact. The root system will not be disturbed and the plant will survive with little or no transplant shock. Do not fertilise a transplant for two weeks.

To prevent possible drop-off and wilting from shock, you may want to use Rootone or Transplantone. These safe powders, available at nurseries, contain root-growth hormones and fungicides. They won't be necessary if you transplant carefully.

Transplanting to Large Pots

Transplanting from smaller to larger pots is a simple procedure. The marijuana root system quickly fills small pots. To transplant, moisten the soil and let it sit to become evenly moist. Pick the potted plant up, and, while holding the base of the stem, rap the pot sharply against something solid. You might cover the soil surface with a piece of newspaper or aluminium foil, which makes the job cleaner. When it is done at the right time, the root system, with all the soil adhering, will pop out of the pot intact.

An approximate time guide for transplanting is shown in Table 17 (currently excluded from this guide). At these times, give or take a week, the plants

should be root-bound and all the soil will adhere to the roots, making the transplanting clean and easy.

If the root system has not filled the pots by this time, wait a few weeks and the process will be easier. If the root system comes out in a small ball and much of the soil is empty of roots, then soil conditions are poor (usually poor drainage and over-watering) or you are transplanting much too soon.

If the root system doesn't easily pop out, run a knife around the sides of the pot. Sometimes the roots stick to the sides, particularly in paper and clay containers. Check to see if the drainage holes are plugged. Plugged holes stop air from displacing the soil, and the vacuum pressure prevents the soil from sliding out of the pot.

Table 17
Guide for Transplanting

Transplant	During
Six-ounce cups	Second to third week
Four-inch pots	Third to fourth week
Six-inch pots (half gallon)	Fourth to fifth week
Eight-inch pots (one gallon)	Seventh to eighth week
Two-gallon containers	About the tenth week

Transplant into a soil mixture that is the same as (or is very like) the one in the original pots. Otherwise, the soils may have different osmotic properties, and the water may not disperse evenly. (This doesn't apply to small pots that are used for germination and are filled with vermiculture, Jiffy Mix, or other mediums.) Don't bury the stem. Keep the stem base at the same depth that it was growing. {Figure 47. Transplant when the plant is root-bound.}

Transplanting in Plastic Bags

To transplant plants that are in plastic bags, place the old bag into the larger-size bag. Put some soil mixture underneath, to bring the base of the stem to where the new soil surface will be. Cut the old plastic bag away and fill the side spaces with soil mixture. Two people make the job easier.

8.4 Supports for Plants

Under natural conditions, stems undergo stress from wind, rain, and animals. These stresses, which indoor plants do not ordinarily face, strengthen the stem. Indoor stems grow sturdy enough to support their own weight and not much more. Plant energy is used to produce more light-gathering leaf tissue, rather than wind-resistant stem tissue. Stems remain slender, usually about one-half to three-quarter inches at maturity. Since you are growing the plants for their leaves and flowers, this does not present a problem.

Healthy plants do not ordinarily need support. If many of your plants have weak or spindly stems, there is a deficiency in either light or nutrients (notably potassium). Simply not having enough light will cause the plants to elongate, with sparse foliage and weak growth. Too much red light will cause

elongation, too, so make sure you include a strong blue light, if you are using incandescents or floodlights.

Hanging the lights higher than the recommended distances will cause the plants to elongate by rapidly growing up to the lights. Unlike sunlight, the intensity of artificial light diminishes dramatically with the distance from the lights. The plants respond by growing toward the light, seeking the higher intensity.

Under artificial light, some plants may need support during the seedling stage or because of accident. Depending on plant size, use straws, pencils, dowels, or standard plant stakes such as cane sticks. Set them in the soil and affix the stem with string, masking tape, or wire twists such as those that come with plastic trash bags. Do not tie string or wire tightly around the stem; make a loose loop. The stem will grow in girth and can be injured by a tight loop.

Probably the simplest method of support is to take a rigid piece of wire, form a "C" at one end and bend it to a right angle to the stem. Set the straight end in the soil and place the stem inside the "C." Pipe cleaners are ideal for seedlings. With larger plants, straighten a coat hanger and use the same method.

A common practice in greenhouses where tree seedlings are raised is to shake each plant once or twice daily. This practice simulates natural vibrations from the wind, and the plant reacts by increasing the growth around the stem. The stem grows thicker and stronger, and the tree can better fend once it is transplanted. It works the same way with marijuana. A fan blowing on the plants will also work. These practices are useful if you plan to move your plants outdoors. Otherwise, healthy indoor plants that will remain indoors need no special stem strengthening.

8.5 Uniform Growth

The light intensity from artificial lights drops dramatically as the distance from the light source increases. When the plants are not of equal height, the shorter ones receive less light and consequently grow slower than the taller ones. This compounds the situation and, left to themselves, the shorter plants will stop growing and eventually die from lack of light.

It is important to keep all of the plants close to the lights. {Figure 48. Hang the fixture at an angle corresponding to that of the tops of the plants.} This encourages stocky, full growth and can make the difference between harvesting stems and harvesting smoking material.

One way to deal with uneven height is to line the plants up to the line of the plant tops. As the plants grow, move them to different spots in the garden to accommodate their different sizes. Or raise the shorter plants up to the lights by placing them on milk crates, tin cans, bricks, etc.

The quality and quantity of light emitted by a fluorescent is strongest in the middle and weaker toward the ends of the tube. Female plants require more light than males. Once the genders of the plants become clear, move the males to the ends of the system, thus leaving the stronger middle light for

the females.

8.6 Pruning

Probably the easiest way to deal with uneven growth is to cut back the taller plants to the average height. You may find this emotionally difficult, but pruning will not harm the plant. Cutting off the growing shoot forces the plant to develop its branches. Some growers cut back all of their plants when they are three to four weeks old. Any horizontal space is quickly filled with growing branches and the plants grow full and robust.

The growing shoots are the most potent plant parts until the flowers appear. Generally, the potency increases with growth. By three months' age, most shoots will be high-quality smoke. You can cut shoots at any time; just don't overdo it. Give the plant a chance to grow and fill out to a good size. Severe pruning will slow growth. New growth may be distorted and abnormal, with a drop in potency.

Each time you cut a growing shoot, whether it is the stem tip or a branch tip, two shoots begin to grow from the nearest leaf axils. However, don't think that cutting all the growing shoots of a plant twenty times over the course of a season will yield a plant bearing over a million new shoots, or even that the plants will double their size if pruned. Pruning simply allows the plant to develop its branches earlier. The branches present more area to gather light and, hence, can grow to fill a larger space. However, the plant's size is basically determined by the seed's potential within the limitations of the environment.

Cutting the growing shoots or removing some leaves does not harm the plants. Plants are well adapted to the loss of parts to predators, wind, etc., in the natural world. When leaves are damaged or lost, the plant plugs the wound. The leaf isn't replaced or repaired, but new leaves are continually being formed from the growing shoots. The stem, since it connects all parts of the plant, is more important to the plant as a whole. When the stem breaks or creases, it is capable of repair. You can help the plant repair its stem by splinting the wound or somehow propping the stem up straight. Stems take about four or five days to heal.

When you cut the stem or leaves, you may see the plant's sap momentarily spurt before the wound is plugged. The sap contains primarily the products of photosynthesis, in the form of sucrose (table sugar). Smaller amounts of materials associated with the living organism such as minerals, amino acids, and enzymes are also present. In marijuana, the sap is usually colourless, although a bright red colour - it looks like blood - is not uncommon in later life. The red colour is due to haematin compounds and anthocyanin pigments that naturally build up in some varieties. The red colour may also indicate a nutrient deficiency, notably of nitrogen, phosphorus, potassium, or magnesium.

8.7 Training

Plants grow from the tips of their stems and branches. The growing tip (apical meristem) of the plant contains a hormone that acts as a growth inhibitor. This prevents the branches (lateral buds) from growing. The

further a branch is from the growing tip, the less effect of the inhibitor. This is why some species of plants form a cone or Christmas-tree shape with the longest branches toward the bottom of the stem. This is also why the branches grow from the top of the plant when the tip is removed. Once the growing tip is removed, the next highest growing shoot(s) becomes the source of the inhibitor. Under artificial light, the bottom branches may not receive enough light to grow even though they are far away from the inhibitor. Usually the longest branches are toward the middle of the plant.

Some growers hate to cut the growing shoots on the main stem, since it forms the largest and most potent buds by harvest. But you can neutralise the effects of the inhibitor, without cutting the growing shoot, by bending the tip. This allows you to control the height of the plants, and forces them to branch. The top two to six inches of the stem are flexible. Bend it in an arc and secure it to the stem with a wire twist or string. Remove the wire twist in a few days so that the growing tip does not break itself as it twists up to the light. Don't bend the stem too far down. Keep it in the strong light or else it will stop growing. If you accidentally break the tip, you can splint it with matchsticks or ice-cream sticks secured with wire twists or tape until it heals. {Figure 49. The flexible tip is held in place with a wire twist.}

To develop large, full plants with well-developed branches, secure the growing tip once or twice for a few days while the plants are young (one to three months).

It is possible to train the tip so that the stem will form a series of "S" shapes or even circles. During flowering, train the tips so that they grow horizontally. This method encourages thick, dense growth. The branch tips can also be trained. Keep bending any tips that grow above the others. This creates a garden filled with a cubic layer of vigorous flower clusters rather than a lot of stems.

We want to emphasise that when you get the knack of training the tips, you can more than double the yield of the most potent plant parts. {Figure 50. Stem trained in an "S" shape.} {Figure 51. Tops trained horizontally during flowering.}

Chapter Nine NUTRIENTS AND FERTILISING

9.2 Nutrients

There are about 15 elements known to be essential to plant life. Carbon, hydrogen, and oxygen are absorbed from air and water. The remaining 12 elements are absorbed primarily from the soil, in mineral (inorganic) forms such as NO_3^- and K^+ . They constitute a natural part of soil that becomes available to the plant as organic matter decays and soil particles such as sand and clay dissolve.

Soil elements that are necessary for normal growth are called nutrients. The elements nitrogen (N), phosphorous (P), and potassium (K) are considered

major nutrients. The three numbers that appear on all fertiliser packages give the available percentage of these three nutrients that the fertiliser contains; and always in the order N-P-K. For example, 10-2-0 means 10 percent N, 2 percent P (actually, 2 percent P₂O₅), and no K (actually, no K₂O). Fertility is often measured by the amounts of major nutrients a soil contains. Relatively large amount of N-P=K are needed for lush growth.

Three other elements - calcium (Ca), sulphur (S), and magnesium (Mg) - are called secondary nutrients. Plants require less of these nutrients, and most cultivable soils contain adequate amounts for good growth.

Six remaining elements are called trace elements or micronutrients. As their name implies, they are needed in very small amounts. Commercial soils contain enough trace elements to sustain normal growth. The trace elements are also present in manures, humus, ash, and limestone.

Nitrogen

The amount of nitrogen a soil can supply is the best indication of its fertility. Nitrogen, more than any other soil nutrient, is inextricably linked with the living ecosystem. Nitrogen is continually cycled through living systems: from soil to plants and back to the soil, primarily by the activity of soil microorganisms. Nitrogen is essential to all life. Nitrogen is a key element in the structure of amino acids, the molecules which make up proteins. These, and all other biomolecules, are synthesised by the plant. Chlorophyll, genetic material (for example, DNA), and numerous enzymes and plant hormones contain nitrogen. Hence, N is necessary for many of the plant's life processes.

Cannabis is a nitrophile, a lover of nitrogen. Given ample N, Cannabis will outgrow practically and plant. Ample nitrogen is associated with fast, lush growth, and the plant requires a steady supply of nitrogen throughout its life. Marijuana's requirements for N are highest during the vegetative growth stages.

Phosphorous

P is a constituent of energy-transfer compounds such as NADP and ATP, and molecular complexes such as the genes. The energy compounds are necessary for photosynthesis, respiration, and synthesis of biomolecules. Cannabis takes up large amounts of P during germination and seedling stages. During flowering and seed set, Cannabis' need for phosphorous is also high.

Potassium

K influences many plant processes, including photosynthesis and respiration, protein synthesis, and the uptake of nutrients. Just as with P, K uptake is highest during the earliest growth stages. K is associated with sturdy stems and resistance to disease in plants.

Calcium

Ca functions as a coenzyme in the synthesis of fatty compounds and cell membranes, and is necessary for normal mitosis (replication of cells).

Plants take up much more Ca than the small amount necessary for normal growth. Ca is not added to soil as a nutrient; is added to adjust the soil's chemistry or pH.

Sulfur

S is a constituent of certain amino acids and proteins. It is an important part of plant vitamins, such as biotin and thiamine, which are necessary for normal respiration and metabolism. (Plants synthesise all vitamins they need.) Most soils suitable for growing marijuana contain plenty of S.

Magnesium

Mg is involved in protein synthesis and metabolism of carbohydrates. Mg is the central element in the structure of chlorophyll molecules and hence has an important role in photosynthesis. Most mineral soils and commercial soils have a good supply of Mg.

Trace Elements

The trace elements (Fe, Mn, Mb, B, Cu, Zn) are particularly important in the coenzymes and catalysts of the plant's biochemistry. Many life processes, particularly the synthesis and degradation of molecules, energy transfer, and transport of compounds within the plant, depend on trace elements. Trace elements are not used in large quantities to spur growth, but are necessary in minute amounts for normal growth. Indoor soils rarely require an addition of trace elements.

All the nutrients are needed for normal growth. However, most of them are supplied by the potting soil. Ca, S, and the trace elements rarely present any problems. For most growers, fertilising will simply require periodic watering with a complete fertiliser, one that contains N, P, and K.

9.3 Application: Fertilising

To grow to a large size, marijuana requires a steady supply of nutrients. These can be added to the soil before planting or anytime during growth. Bulk fertilisers are added while the soil is mixed, as described in section 6. These include manures, composts, humus, and concentrated fertilisers, such as rose food. Once the plants are growing, never condition or mulch indoor soils with bulk fertilisers. they promote moulds and fungi and attract other pests to the garden. Concentrated fertilisers can damage the plants if they come in direct contact with the stem or roots.

While the plants are growing, nutrients are given in solution; they are dissolved in water, and the plants are watered as usual. Soluble fertilisers can be either organic or inorganic (chemical), and come in a wide range of concentrations and proportions of nutrients. Two organic fertilisers are liquid manure (about 1.5-1.0-1.5) and fish emulsion ((Some fish emulsion may contain whale by-products.)) (about 5-1-1). Chemical fertilisers commonly may have 20-20-20 or 5-10-5, or may contain only one nutrient, such as 16-0-0.

A 10-5-5 fertiliser is 20 percent soluble nutrients and 80 percent inert

ingredients. a 30-10-10 has 50 percent available nutrients and 50 percent inert ingredients. There is approximately the same amount of N in one tsp. of 30-10-10 as in three tsps. of 10-5-5.

Actually, you can almost use any fertiliser, but the nitrogen content should be proportionately high, and there should be some P and L also present. For example, a 20-20-20 would work fine, as would a 12-6-6 or a 3-4-3, but not a 2-10-10 or a 5-10-0.

How much fertiliser to use and how often to fertilise depend primarily on the fertility of the soil and the size of the container relative to the size of the plant. Small plants in large pots usually do not need to be fertilised. Even in small pots, most plants do not need to be fertilised for at least the first month.

As the plants grow, they take nutrients from the soil, and these must be replaced to maintain vigorous growth. During the vegetative stage, even plants in large pots generally require some fertilising, particularly with N.

The rate of growth of indoor plants is usually limited by the amount of light and space, once adequate nutrients are supplied. At this point, an increase in nutrients will not increase growth. Your goal is to supply the plants with their nutritional needs without overfertilising and thus toxifying the soil.

Most fertilisers are designed for home use and have instructions for fertilising houseplants. Marijuana is not a houseplant, and it requires more nutrients than houseplants. The extra nutrients that it needs may be supplied by the use of large pots and a fertile soil mixture. In many cases, you will need to fertilise only in the dosages recommended on fertiliser packages for houseplants. For instance, Rapid-Gro (23-19-17) is popular among marijuana growers; use one tablespoon per gallon of water every two weeks.

A typical program for fertilising might be to fertilise during the fifth week of growth and every two weeks thereafter until flowering. Then discontinue fertilising (or give at one-half concentration) unless the plants show a definite need for nutrients. It is better to fertilise with a more diluted solution more often than to give concentrated doses at longer intervals. (For instance, if instructions call for one tablespoon of fertiliser per gallon once a month, use one-quarter tablespoon per gallon once a week.)

Make sure that a fertiliser is completely dissolved in the water before you apply it. Put the recommended amount of fertiliser in a clear glass bottle and mix with about one cup of water. Shake vigorously and then allow it to settle. If any particles of fertiliser are not dissolved, shake again before adding the rest of the water. If you have difficulty getting all the fertiliser to dissolve, first add hot tap water. If the fertiliser still does not completely dissolve, you should use another fertiliser.

Never fertilise a dry soil or dry Soilless medium. If the medium is dry, first water with about one-half quart of plain water per pot. Let the pots

sit for about 15 minutes so that the water is evenly dispersed in the pot. Then fertilise as usual.

It is difficult to give instruction for fertilising that will cover all garden situations. You want to supply the plant with its nutritive needs, but overfertilising can toxify the soil. Fertilising according to instructions for houseplants (both in frequency and concentration) should not toxify the soil. However, the plants may sometimes require more frequent or more concentrated fertilising. A good way to judge the plant's needs is not to fertilise one plant, double the fertiliser of another plant, and give the rest of the plants their normal dose. If the unfertilised plant grows more slowly, or shows symptoms of deficiencies, then probably all the plants are depending on soluble fertilisers and must be fertilised regularly. If the plants receiving the double dose grows faster than the other plants, increase the other plants' supply also. On the other hand, if there is little difference among the plants, then the soil is providing the plants with enough nutrients, and they either should not be fertilised or should be fertilised with a less-concentrated solution.

Because they are grown in a relatively small area, it is easy to overfertilise indoor plants. When plants are vigorous, look healthy, and are growing steadily, don't be anxious to fertilise, particularly if you have already fertilised several times with soluble fertilisers. Slow growth or symptoms of deficiencies clearly indicate the need for fertilising.

Overfertilising

In an effort to do the best for their plants, some people actually do the worst. Overfertilising puts excessive amounts of nutrients in the soil, causing toxic soil conditions. Excessive amounts of one nutrient can interfere with the uptake of another nutrient, or change normal plant-soil relations. Since it takes time for a build-up to occur high concentrations of nutrients generally encourage excellent growth until the toxic level is reached.

It takes less N than other nutrients to toxify the soil; hence there is less margin for error when using N. Too much N changes the osmotic balance between plant and soil. Instead of water being drawn into the plant, water is drawn away and the plant dehydrates. The leaves feel limp even though the plant is well watered. The plant will soon die. This tips of the leaves die first and very rapidly the leaves change colour, usually to gold, but sometimes to a brown or green-grey. This change in the plants is faster, more dramatic, and more serious than for any kind of nutrient deficiency.

You can save the plants by immediately leaching the pots as soon as the condition is recognised. Place the pots outdoors or in a sink or bathtub. Discard the top inch or two of loose dirt. Run lukewarm water through the soil until a gallon of water for each two gallons of soil has passed through each pot. The leaves recover turgor in one or two days if the treatment works.

Foliar Feeding

Foliar feeding ((Nitrogen fertilisers are usually NO₃ (nitrate) or NO₂

(nitrite), substances which are also used to preserve food. They have been shown to undergo reactions to form carcinogenic substances (nitrosamines). As with eating food treated with nitrates and nitrites (hot dogs, sandwich meats, etc.), there is a possibility that such substances might be ingested by eating or smoking foliar-fed plants.) (spraying the leaves with fertiliser) is a good way to give the plants nutrients without building up the amount of soluble substances in the soil. After the first month, foliar feed the plants with, for example, fish emulsion or a chemical fertiliser. Use any fertiliser that states it can be used for foliar feeding even if it says "not recommended for foliar feeding houseplants." Use a fine-mist sprayer, such as a clean Windex or Fantastik bottle. Dilute the fertiliser according to directions (fish emulsion at one tablespoon per gallon) and spray both sides of the leaves. When foliar feeding, you should spray the plants with plain water the next day, to dissolve unabsorbed nutrients and clean the plants.

Foliar spraying is also a good way to treat plants suffering from nutrient deficiencies. Some nutrient deficiencies actually are caused by the soil's chemistry, rather than by the absence of the nutrient in the soil. Addition of the necessary nutrient to the soil may not cure the plants' problem, because the nutrient becomes locked in the soil, or its uptake may be limited by high concentrations of other elements present in the soil. Foliar feeding is direct, and if the plant's deficiency symptoms do not begin to clear up, then the diagnosis is probably incorrect.

9.4 Nutrient Deficiencies

Before Diagnosing

Before you assume the plant has a nutrient deficiency, make sure the problem is not due to other causes. Examine the plant leaves, and along the stem and in the soil.

Even under the best conditions, not all leaves form perfectly or remain perfectly green. Small leaves that grew on the young seedling normally die within a month or two. Under artificial lights, bottom leaves may be shielded from the light, or be too far away from the light to carry on chlorosynthesis. These leaves will gradually turn pale or yellow, and may form brown areas as they die. However, healthy large leaves should remain green at least three to four feet below the plant tops, even on those plants under small light systems. Under low light, the lower-growing shoots as well as the large leaves on the main stem are affected. Some symptoms of nutrient deficiencies begin first at the bottom of the plant, but these symptoms generally affect the lower leaves on the main stem first, and the progress to the leaves on the branches.

Although some deficiency symptoms start on the lower, older leaves, others start at the growing shoots or at the top of the plants. This difference depends on whether or not the nutrient is mobile and can move from the older leaves to the active growing shoot. Deficiency symptoms of mobile nutrients start at the bottom of the plant. Conversely, deficiency symptoms of immobile nutrients first appear on the younger leaves or growing shoots at the top of the plant. N, P, K, Mg, B, and Mb are mobile in the plant. Mn and Zn are less mobile, and Ca, S, Fe, and Cu are generally immobile.

A dry atmosphere or wet soil may cause the blade tips to turn brown. Brown leaf tips also may indicate a nutrient deficiency, but in this case, more tissue will turn brown than just the end tips.

Chlorosis and necrosis are two terms which describe symptoms of disease in plants. Chlorosis means lacking green (chlorophyll). Chlorotic leaves are pale green to yellow or white. Chlorotic leaves often show some recovery after the necessary nutrient is supplied. Necrosis means that the tissue is dead. Dead tissue can be gold, rust, brown, or grey. It is dry and crumbles when squeezed. Necrotic tissue cannot recover.

Symptoms of deficiencies of either N, P, or K have the following in common: all involve some yellowing and necrosis of the lower leaves, and all are accompanied by red/purple colour in stems and petioles. The simplest way to remedy these deficiencies is to fertilise with a complete fertiliser containing nearly equal proportions of three nutrients.

Nitrogen

N is the most common deficiency of Cannabis indoors or out. Nitrogen deficiencies may be quite subtle, particularly outdoors, where the soil may continuously provide a small amount of nitrogen. In this case the top of the plant will appear healthy, and the plant will grow steadily, but at a slow pace. The deficiency becomes more apparent with growth, as more and more of the lower leaves yellow and fall. The first sign is a gradual, uniform yellowing of the large, lower leaves. Once the leaf yellow, necrotic tips and areas form as the leaves dry to a gold or rust colour. In small pots, the whole plant may appear pale (or lime colour) before many bottom leaves are affected to the point that they yellow or die. Symptoms that accompany N deficiency include red stems and petioles, smaller leaves, slow growth, and a smaller, sparse profile. Usually there is a rapid yellowing and loss of the lower leaves that progresses quickly to the top of the plant unless nitrogen is soon added.

Remedy by fertilising with any soluble N fertiliser or with a complete fertiliser that is high in N. If your diagnosis is correct, some recovery should be visible in three or four days. Pale leaves will regain some colour but not increase in size. New growth will be much more vigorous and new stems and petioles will have normal green colour.

Indoors, you should expect plants to need N fertilisation a few times during growth. Once a plant shows N deficiency, you should fertilise regularly to maintain healthy and vigorous growth. Fertilise at about one-half the concentration recommended for Soilless mixtures. Increase the treatment only if the plants show symptoms again. Once the plants are flowering, you may choose not to fertilise if the plants are vigorous. They will have enough N to complete flowering and you don't want to chance toxifying the soil at this late date.

Phosphorous

P deficiency is not common indoors, but may appear outdoors, particularly in dry, alkaline soils or in depleted soils, or during cool weather. Phosphorus

deficiency is characterised by slow and sometimes stunted growth. Leaves overall are smaller and dark green; red colour appears in petioles and stems. The leaves may also develop red or purple colour starting on the veins of the underside of the leaf. Generally the tips of most of the leaf blades on the lower portion of the plant die before the leaves lose colour. Lower leaves slowly turn yellow before they die. Remedy with any soluble P-containing fertiliser. Affected leaves do not show much recovery, but the plant should perk up, and the symptoms do not progress.

Potassium

K deficiencies sometimes show on indoor plants even when there is apparently enough supplied for normal growth. Often, potassium-deficient plants are the tallest ((Potassium is associated with apical dominance in some plant species.)) and appear to be the most vigorous. Starting on the large lower leaves, the tips of the blades brown and die. Necrotic areas or spots form on the blades, particularly along the margins. Sometimes the leaves are spattered with chlorotic tissue before necrosis develops, and the leaves look pale or yellow. Symptoms may appear on indoor plants grown in a soil rich in organic material. This may be due to high salinity (Na) of some manures or composts used in the soil. Red stems and petioles accompany potassium deficiencies. K deficiencies that could seriously affect your crop rarely occur with indoor soils. However, mild symptoms are quite common. Usually the plants grow very well except for some necrotic spotting or areas on the older leaves. (This condition is primarily an aesthetic problem, and you may choose not to fertilise. See 19.3.)

K deficiencies can be treated with any fertiliser that contains potassium. Wood ashes dissolved in water are a handy source of potassium. Recovery is slow. New growth will not have the red colour, and leaves will stop spotting after a couple of weeks. In a K-deficient soil, much of the added potassium is absorbed by the soil until a chemical balance is reached. Then additional potassium becomes readily available to the plant.

Calcium

Ca deficiencies are rare and do not occur if you have added any lime compound or wood ash. But calcium is added primarily to regulate soil chemistry and pH. Make sure that you add lime to soil mixtures when adding manures, cottonseed meal, or other acidic bulk fertilisers. An excess of acidic soil additives may create magnesium or iron deficiencies, or very slow, stunted growth. Remedy by adding one teaspoon of dolomitic lime per quart of water until the plants show marked improvement. Periodically fertilise with a complete fertiliser. Foliar feeding is most beneficial until the soil's chemistry reaches a new balance.

Sulfur

S is plentiful in both organic and mineral soils. Liming and good aeration increases S availability. Hence S deficiencies should not occur in soils that are suitable for growing marijuana. However, sulfur deficiencies sometimes can be confused with N deficiencies and may also occur because of an excess of other nutrients in the soil solution. Sulfur-deficiency symptoms usually start at the top of the plant. There is a general yellowing

of the new leaves. In pots, the whole plant may lose some green colour. Both sulfur and Mg deficiencies can be treated with the same compound, epsom salts (MgSO_4). Epsom salts, or bathing salts are inexpensive and available at drug stores.

Magnesium

Mg deficiencies are fairly common. They frequently occur in Soilless mixtures, since many otherwise all-purpose fertilisers do not contain Mg. Magnesium deficiencies also occur in mixtures that contain very large amounts of Ca or Cl. Symptoms of Mg deficiency occur first on the lower leaves. There is chlorosis of tissue between the veins, which remain green, and starting from the tips the blades die and usually curl upward. Purple colour builds up on stems and petioles.

A plant in a pot may lose much of its colour in a matter of weeks. You may first notice Mg symptoms at the top of the plant. The leaves in the growing shoot are lime-coloured. In extreme cases, all the leaves turn practically white, with green veins. Iron deficiency looks much the same, but a sure indication of Mg deficiency is that a good portion of the leaf blades die and curl. Treat Mg symptoms with one-half teaspoon of epsom salts to each quart of water, and water as usual. The top leaves recover their green colour within four days, and all but the most damaged should recover gradually. Continue to fertilise with epsom salts as needed until the plants are flowering well. If you are using soilless mixtures, include epsom salts regularly with the complete mixture. Because Mg deficiencies may indicate interference from other nutrients, foliar-spray with Mg to check your diagnosis if the plants are not obviously recovering.

Iron

Fe deficiency rarely occurs with indoor mixtures. Iron is naturally plentiful in most soils, and is most likely to be deficient when the soil is very acid or alkaline. Under these conditions, which sometimes occur in moist eastern soil outdoors, the iron becomes insoluble. Remedies include adjusting the Ph before planting; addition of rusty water; or driving a nail into the stem. Commercial Fe preparations are also available. If the soil is acidic, use chelated iron, which is available to the plants under acidic conditions.

Symptoms of iron deficiency are usually distinct. Symptoms appear first on the new growing shoots. The leaves are chlorotic between the veins, which remain dark green and stand out as a green network. To distinguish between Mg and Fe deficiencies, check the lower leaves for symptoms. Iron symptoms are usually most prominent on the growing shoots. Mg deficiencies will also show in the lower leaves. If many of the lower leaves have been spotting or dying, the deficiency is probably Mg. Mg deficiencies are much more common than iron deficiencies in marijuana.

Other Trace Elements

The following deficiencies are quite rare. Trace elements are needed in extremely small amounts, and often enough of them are present as impurities in fertilisers and water to allow normal growth. Many houseplant fertilisers

contain trace elements. Trace-element deficiencies are more often caused by an extreme pH than by inadequate quantities in the soil. If a deficiency is suspected, foliar-spray with the trace element to remedy deficiencies. Our experience has been that trace-element deficiencies rarely occur indoors. We advise you not to add trace elements to indoor soils, which usually contain large amounts of trace elements already because of the addition of organic matter and liming compounds. It is easy to create toxic conditions by adding trace elements. Manufacturers also recommend using amounts of trace elements that may be too high for indoor gardens; so use them at about one-fourth of the manufacturer's recommended dose if an addition is found to be necessary.

Manganese

Mn deficiency appears as chlorotic and the necrotic spots of leaf tissue between the veins. They generally appear on the younger leaves, although spots may appear over the whole plant. Manganese deficiencies are not common. Manganese is present in many all-purpose fertilisers. Mn deficiencies may occur if large amounts of Mg are present.

Boron

B deficiency may occasionally occur in outdoor soils. The symptoms appear first at the growing shoots, which die and turn brown or grey. The shoots may appear "burned," and if the condition occurs indoors, you might think the lights have burned the plant. A sure sign of boron deficiency is that, once the growing tip dies, the lateral buds will start to grow but will also die. B deficiency can be corrected by application of boric acid, which is sold as an eyewash in any drugstore. Use one-fourth teaspoon per quart of water. Recovery occurs in a few days with healthy growth of new shoots.

Molybdenum

Mb deficiency occurs in outdoor soils, but rarely indoors. Mb is readily available at neutral or alkaline pH. Mb is essential for nitrogen metabolism in the plant, and symptoms can be masked for a while when N fertilisers are being used. Usually there is a yellowing of the leaves at the middle of the plant. Fertilising with nitrogen may remedy some of the yellowing. However, Mb symptoms generally progress to the growing shoots and new leaves often are distorted or twisted. Mb is included in many all-purpose fertilisers.

Zinc

Zn-deficiency symptoms include chlorosis of leaf tissue between the veins. Chlorosis or white areas start at the leaf margins and tips. More definite symptoms are very small, new leaves which may also be twisted or curled radially. Zn deficiencies may occur in alkaline western soils. Galvanised nails can be buried or pushed into the stem. Commercial preparations of zinc are also available.

Copper

Cu deficiencies are rare; be careful not to confuse their symptoms with the symptoms of overfertilisation. The symptoms appear first on the younger leaves, which become necrotic at the tips and margins. Leaves will appear

somewhat limp, and in extreme cases the whole plant will wilt. Treat by foliar-spraying with a commercial fungicide such as CuSO_4 .

9.5 Soilless Mixtures

Soilless mixtures are an alternative to using large quantities of soil. Their main advantage is complete control over the nutrients that your plants receive. Soilless mixtures are also inexpensive and easy to prepare. They have a near-neutral pH and require no pH adjustment.

Soilless mixtures are made from soil components such as vermiculite, sand, or perlite. Soilless mixtures should be blended in such a way that they hold adequate water, but also drain well and do not become soggy. A good general formula is two parts vermiculite to one part perlite. About 10 percent coarse sand or gravel can be added to give weight and stability to the pots. Instead of vermiculite, you can use Jiffy-Mix, Metro-Mix, Ortho-Mix, Pro-Mix and other commercial soilless mixtures, which are fortified with a small amount of necessary nutrients, including trace elements. You can also substitute coarse sand for perlite.

Potting

It is best to use solid containers with soilless mixtures rather than plastic bags. Grow the plants in one- to three-gallon containers. There won't be much difference in the size of the plants in one-gallon or in three-gallon sizes, but you will have to water a large plant every day in a one-gallon container. (The plants can always be transplanted to a larger container.) The pots must have drainage holes punched in the bottoms. Pot as usual, and add one tablespoon of dolomitic lime or two tablespoons of wood ash to each gallon of mixture.

Germinating

Plants may have problems germinating in soilless mixtures. The top layer of mixture often dries rapidly, and sprouts may die or not germinate. Young seedlings also seem to have difficulty absorbing certain nutrients (notably potassium), even though adequate amounts of nutrients are being added. Since this difficulty may retard growth, it is best to start the plants in small pots with soil. Use eight-ounce paper cups, tin cans, or quart milk containers cut in half. Mix three parts topsoil or potting soil to one part soilless mixture. Fill the starting pots and germinate as usual. When the plants are two to three weeks old, transplant to the soilless mixture. First moisten the soil, and then remove the soil as intact as possible. You might handle the transplant like making castles, by carefully sliding the moist soil out of the pot. Or you can cut away the sides of the container while you place the transplant in the soilless mixture. When watering, make sure you water around the stem to encourage roots to grow into the soilless mixture.

Peat pellets that expand are also good for starting seedling. Plant several seeds in each pellet, and place it in the soilless mixture after the sprouts appear.

Fertilising

Soilless mixtures can be treated with a trace-element solution. We have grown crops with no special addition of trace elements, and the plants completed their lives without showing symptoms of trace-element deficiency. In these cases there were apparently enough trace elements in the lime and the fertilisers that were used to provide the major nutrients. Many all-purpose fertilisers also contain trace elements. However, it is a good idea to treat soilless mixtures with a mild solution of trace elements before planting. Large plants can be treated a second time during the third or fourth month of growth. Do not use trace elements more often unless plants show definite trace-element deficiencies.

Iron is the only trace element that is needed in more than minute quantities. Iron can be supplied by mixing a few brads or nails into the soilless mixture.

Use any soluble fertiliser that is complete, that is, that contains some of each of the major nutrients. Choose one with a formula that is highest in N but contains a good portion of both P and K. For example, Rapid-Gro is 23-19-17 and works well for soilless mixtures.

Table 18 gives a formula that has worked well for us. The figures in it are a guide for estimating the amounts of fertiliser to use. When choosing a fertiliser by means of this chart, use N for a guide. For example, suppose the only fertiliser you can find that has good proportions of the major nutrients as a 20-15-15. Divide 5 (the figure for N in the table) by 20 (the figure for N in the fertiliser), and get the result 1/4. That is, the fertiliser is four times as concentrated in N as you need; so you would use one-fourth the amount of fertiliser shown in Table 18. For instance, during the vegetative stage, you would give the plants one-half to three-fourths of a level teaspoon of fertiliser per gallon of water each time you water.

Table 18 - Guidelines for Fertilizing Soilless Mixtures

Growth Stage	N	P2O5	K2O	Amount
Seedling	5	3	4	1.5 to 2 tsp/gal
Vegetative	5	2	3	2 to 3 tsp/gal
Flowering	5	5	3	0.5 to 1.5 tsp/gal

It is also not necessary to fertilise in these ratios. You could use a 10-10-10 fertiliser throughout growth; you would use half the amounts listed in Table 18. The most important point is that the plant receive enough of each element, not that they receive specific proportions.

Fertilising according to volume of fertiliser is not very accurate, and also does not take into account other variables (such as variety, light, temperature, etc.) that determine the amounts of nutrients your plants can use. However, it is a simple and useful way of estimating the plant's needs. You can more accurately gauge the plants' needs by giving a sample plant twice the concentration of fertiliser, and another half the concentration. Their performance will give you an idea of whether you are using too much or too little fertiliser. Too much fertiliser is the most damaging condition; so when in doubt give the plants less rather than more. Do not continue to give the plants the recommended amounts of fertiliser if the sample plant

that is receiving less nutrients is growing as well as the other plants.

Another way of monitoring the plant's growth is to grow a few plants in a standard soil mixture. This will show you whether the plants in the soilless mixture are growing as fast as they should, and will give you a reference for diagnosing deficiencies.

Besides providing N, P, K, and the trace elements, you must also give your plants secondary nutrients. Ca is added by mixing a tablespoon of lime or two tablespoons of wood ash when preparing the soilless mixture. (Calcium is usually present in water and in many fertilisers as part of the salts that contain nutrients, for example, $\text{Ca}(\text{NO}_3)_2$.) Magnesium and sulfur are both found in common epsom salts, MgSO_4 . Use one-eighth teaspoon of epsom salts to each teaspoon of 5 percent N. For example, if you are using a 20 percent N fertiliser, you would use half a teaspoon of MgSO_4 to each teaspoon of fertiliser. (Actually, enough sulfur is often present, either as part of the soilless mixture or as part of nutrient salts to allow growth.) Magnesium can also be supplied by using dolomitic limestone.

Soilless mixtures are something between soil mixtures and water cultures (hydroponics). With hydroponics, the plants are grown in a tank of water. The fertilisers are added in solution, and the water solution is periodically circulated by a pump.

Another variation on soilless mixtures is to add a small amount of soil or humus to the soilless mixture. Some examples are:

1. 4 parts soilless mixture to 1 part soil;
2. 8 parts soilless mixture to 1 part humus;
3. 15 parts soilless mixture to 1 part limed manure.

Overfertilising is less a problem with soilless mixtures than with soil, because of higher concentrations of salts are tolerable in soilless mixtures and because excess salts are easily flushed out of the mixture. A good idea is to flush each pot once after two months of growth, again after four months. Any time the plants show symptoms of overfertilisation, leach the pots immediately. Flood each pot with plain water so that it runs out the drainage holes. Continue flooding the pots until a couple of gallons of water have run through the pot. Don't fertilise for at least a week. Then fertilise with a more dilute solution that was used before. {Figure 51a. Over fertilisation. Leaves turn bright gold and die, starting at the top of the plant.}

Chapter Ten DISEASES AND PLANT PESTS

Plants are considered diseased when their health or development is impaired enough that the adverse effects become visible to the eye. Disease may be caused by infectious microbes, such as bacteria or viruses, by pests such as insects, or by nutritional deficiencies or imbalances. However, for diseases that might affect your plants, there should be no need for a plant doctor. You'll be able to diagnose the symptoms after careful observation.

Leaves naturally drop from plants during the course of their lives. Not every leaf will develop perfectly or so. The small leaves that are formed during the first few weeks of growth normally die within three months. Leaves at the bottom of healthy plants often die because they are shielded by the upper instance, in a garden receiving only 80 watts of fluorescent light, the plants may stay green only up to three or four feet away from the lights. Lower leaves may turn pale and yellow and then dry to gold or rust colours.

10.2 Microbial Diseases

Because Cannabis is not native to the Americas, most of the microbial diseases that attack the plant are not found in this country. Homegrown Cannabis is remarkably free of diseases caused by microbes, and there is little chance of your plants suffering from these diseases. Fungal stem and root rots seem to be the only ones of consequence. These occur only because of improper care. Watering too often, coupled with a stagnant, humid atmosphere, encourages stem rot to develop. Stem rot appears as a brown or black discolouration at the base of the stem and is soft or mushy to the touch. Allow the soil to dry between waterings, and be sure to water around the stem, not on it. Wipe as much of the fungus and soft tissue away as possibly. If the rot doesn't disappear in a few weeks, treat it with a fungicide.

10.3 Nutrient Diseases

Diseases due to nutrient deficiencies (see section 9), are common indoors, and their symptoms usually worsen with time, affecting more and more of the plant. Whole leaves may be pale, or turn yellow or white; the condition may first afflict the bottom, or top, or the entire plant at once. Deficiency symptoms often appear as spots, splotches, or areas of chlorotic (lacking green) tissue. Sometimes necrotic (dead) tissue appears that is copper, brown, or gray. However, before you search to section 9, carefully inspect the plants for any signs of plant pests.

10.4 Plant Pests

The indoor garden is an artificial habitat where the plants live in isolation from the natural world. For this reason, few of you will have any problems with plant pests. However, indoor plants are particularly susceptible to pests once contaminated. In nature, the pest populations are kept in check by their natural enemies, as well as by wind, rain, and changing temperatures. Without these natural checks, pests can run rampant through the indoor garden.

The most common and destructive pests are spider mites and whiteflies. Spider mites are barely visible to the naked eye; they are ovoid-shaped. Juvenile mites are transparent and change to green as they suck the plant's tissue. Adults are tan, black, or semitransparent. False spider mites are bright red. Mites are usually well-established before you discover them, because they are so difficult to see.

Whiteflies are white (obviously) but look like tiny moths rather than flies. The adults are about 1/16 inch long, and you may not see one unless if

flutters by the corner of your eye. Then shake the plants. If the result looks like a small snowstorm, the plants are infested with whiteflies. {Figure 52. Left: Spider mite (x16). Right: A match head dwarfs tiny spider mites.}

The symptoms of infection by mites and whiteflies are similar. Symptoms usually appear on the lower leaves and gradually spread to the top of the plant. The first indications are that the plant loses vigour; lower leaves droop and may look pale. Look closely at the upper surfaces of the leaves for a white speckling against the green background. The speckles are due to the pests sucking the plant's chlorophyll-rich tissue. With time, the leaf loses all colour and dies.

Pests are easiest to find on the leaves that are beginning to show some damage. You can usually see mites and whitefly larvae as tiny dots looking up at the lights through the undersides of the leaves.

To find out which pest you have, remove some damaged leaves and inspect the undersides under bright daylight. With spider mites, if you discover them early, a leaf may show only one or two tiny dots (adults) and a sprinkling of white powder (eggs) along the veins. In advanced cases, the undersides look dusty with the spider mites' webbing, or there may be webbing at the leaf nodes or where the leaflets meet the petioles. With whiteflies, you usually see the adults first. On the undersides of the leaves the whitefly larvae look like mites, but there is no webbing, and there are tiny golden droplets of "honeydew" excreted by the adult whiteflies. {Figure 53. Mites appear as black specks when you look up to the lights from the undersides of the leaves. Also see Plate 14.}

Take quick action once you discover plant pests. If the plants are less than a month old, you will probably be better off to clean out the garden, in order to eliminate the source of the pests, and start over. As long as the plants are healthy they can withstand most attacks. The more mature the plants are, the less they are affected by pests. Whiteflies and mites sometimes disappear from flowering plants, particularly the female flowers. Mites are difficult to eliminate completely. Often a holding action will save a good crop.

If only a few plants in your garden are infected, remove them. Or else, remove any leaves that show damage. If the plants are three or more months old, you might consider forcing them to flower while they are still healthy. Plants that are good-sized and still vigorous will usually stand up well to mites once they are flowering.

If you don't want to use insecticides, there are several alternative ways to keep the pests in check until flowering. Mix 1/8 to 1/4 pound of pure soap (such as Ivory flakes) thoroughly in one gallon of lukewarm water. Then cover each pot with foil or newspaper, invert it, and dip and swish the plant around several times in the soapy solution. Let it drip dry and rinse with clear water. Use the dunking procedure every week or two until the plants are larger. This is often enough to get the plants growing well and into flowering before the pest population can become a serious problem.

Two homemade sprays that can be effective are dormant oil sprays ((See

Insects and Pests in the Outdoor Section.)) and hot pepper sprays.

To make hot pepper spray, mix four hot peppers with one medium onion and one clove garlic (213). Grind or chop and mash them along with some water. Cover the mash with water and allow it to stand a day or two. Add enough water to make two quarts. Strain through a coffee filter or paper towels in a funnel. Add one-half teaspoon of detergent and spray as you would an insecticide.

No one wants to use insecticides; yet they seem to be the only way to eliminate mites. There are a number of insecticides on the market that are relatively safe. Insecticides such as pyrethrum, rotenon, and malathion are relatively non-toxic to warm-blooded animals when used as directed. These are effective against many different plant pests besides mites and whiteflies. Additionally, they break down into harmless compounds such as carbon dioxide and water in a matter of days; so they do not persist in the environment.

Safe insecticides are used for vegetables. Follow all the package precautions. Do not use more, or more often, than recommended. Overuse can kill the plant. The label will list the number of days to wait before you can safely ingest the plant, usually from two to 35 days after spraying.

Both mites and whiteflies generally complete their brief life cycles in about one to two weeks. Because sprays are not effective against the eggs, repeat the spraying about once a week for three successive weeks to completely eliminate the pests. Since their generations are short-lived, some pests may become resistant to the spray. This can be a problem with whiteflies. Try a different insecticide if the first one does not seem to be working.

Add a couple of drops of liquid detergent to each quart of insecticide solution. Detergent acts as a wetting agent and helps the insecticide to contact the pests and stick to the plant. Small plants can be dunked directly in the solution, the surest way to kill pests.

To spray the plants, start at the back of the garden so that you are working away from the plants already sprayed. Spray the entire plant and soil surfaces, paying special attention to the undersides of the leaves where pests tend to congregate. Stay out of the garden and keep the room closed that day.

Sulfur dusts can also be effective against mites and many other pests, and are safe to use. The easiest way to apply them is with a plastic "squeeze" bottle which has a tapered top. Make sure you dust the underside of the leaves.

Before using any insecticide, remove all damaged leaves. Do not use any insecticide during flowering. Rinse the plant with a clear water spray about one week after applying any insecticide, and once more before you harvest. Otherwise there may be residues left which will affect the taste of the grass.

There are several other pests that can be a problem, although they rarely seriously affect marijuana. Aphids are about 1/16 inch long and are black,

green, red, or pink. They have roundish bodies with long legs and antennae. Some species have wings. They congregate on the undersides of leaves which may then lose colour and become curled or distorted. Aphids excrete honey-dew droplets on the undersides of the leaves which can attract ants. If ants are also present, set out ant traps, because the ants will spread the aphids to other plants. A few successive washings in soapy water or one or two sprayings of the insecticides mentioned above should eliminate aphids.

Mealy bugs are white, about 3/16 of an inch long, and look like small, flat sowbugs. They don't seem to like marijuana and avoid it if other plants are present. Mealy bugs can be removed individually with cotton swabs and alcohol.

Gnats are attracted to moist soil that is rich in partially decayed organic matter such as manures. To discourage gnats when using manures, cover the top few inches in the pot with the soil mixture and no manure. Drench the soil with malathion solution for gnats or any other soil pest. Flypaper will also help against gnats as well as whiteflies.

Some people don't mind having a few pests on their plants. Whether you want to eliminate the pests completely or simply keep them in check may come down to whether you mind hearing the snap, crackle, and poop as their little bug bodies heat and explode when the harvest is smoked. Commercial marijuana, or any marijuana grown outdoors, will contain innumerable bugs and other small lifeforms.

Prevention

Whiteflies and spider mites are extremely contagious. Mites can be carried to the plant on hands, clothing, or an animal's fur. Many houseplant pests can fly or float to the garden through open windows. Mites crawl through cracks in walls and foundations during autumn, seeking warmth.

Many houseplants are popular because they can withstand abuse and infections by common plant pests. Your houseplants may harbor mites for years without your knowledge. You can find out if your houseplants have mites by placing some marijuana seedlings among the houseplants. Mites seem to enjoy young marijuana plants so much that the plants show symptoms of mites in a matter of weeks if any are nearby.

Hopefully, you'll never have to deal with pests. Prevention is the best policy. Use soil that has been pasteurised or sterilised to avoid bringing pest eggs and larvae into the garden. Keep the garden isolated from other plants. Use separate tools for the marijuana garden and for other plants. Screen windows in the garden with wire screen or mesh fabrics such as nylon.

Chapter 11 MAINTENANCE AND RESTARTING

To start a new crop, it is best to begin with a fresh soil. This is especially true if the plants were in small pots or were root-bound.

If you have fertilised regularly, the soil may contain near-toxic amounts of salts. Most of the salts build up in the top two-inch layer of soil. To salvage large quantities of soil, discard the top three-inch layer of soil from each pot. Add fresh soil and bulk fertilisers. Thoroughly mix and repot in clean containers.

It is generally not advisable to use the same soil for more than two crops. Although the used soil may not support healthy growth for potted plants, it is an excellent addition to any garden soil. Spread the soil as you would a mulch. The salt concentration is quickly diluted and benefits, rather than harms, garden soil.

Periodically clean the tubes and reflectors to remove dust and grime. As with windows, this dirt substantially decreases the amount of light the plants receive. Fluorescents lose approximately 20 to 40 percent of their original output within a year's use. Generally the higher-wattage tubes decline more rapidly than standard-output tubes. Vita-lite tubes last the longest, followed by standard fluorescents. Gro-tubes are the shortest-lived, and most growers replace them after two crops. Older tubes can be used to start seedlings and during the first month of growth. Since the plants are small and the light system is low, the old tubes generate enough light for healthy growth. Replace incandescent bulbs after 500 light hours.

PART 3: OUTDOOR

CULTIVATION

Chapter 12 CHOOSING A SITE

There are several factors to consider when deciding where to plant, including sunlight, microclimate, availability of water, and condition of the soil. But the garden's security should be your first consideration. No matter what size your garden, rip-offs and confiscation are constant threats. But these risks can be minimised by careful planning and common senses.

In some countries, law-enforcement agencies take a tolerant attitude toward small gardens, and people grow Cannabis in their backyards. In other areas, police are not as enlightened and place an emphasis on cultivation busts. In either case, the larger the garden, the greater the potential danger. {Figure 55. A Nassau Country police officer stands in a field of marijuana plants in Lattingtown, Long Island.}

In Hawaii and California, where marijuana growing has become a booming business, helicopters have been a problem for commercial growers. Aircraft outfitted with visual or infrared equipment, dogs, and finks have all been used to seek out illicit plots. Aircraft equipment is least effective on

steep slopes and where the vegetation is lush and varied. Where aircraft are a problem, growers prune marijuana to obscure its distinctive shape. The plants are difficult to detect from a distance when intercropped with bamboo, sunflowers, sugar cane, soybeans, or tall weeds (see Figure 60). Commercial growers often plant several small dispersed stands or many single plants, which are more difficult to detect and serve as insurance against total loss.

But rip-offs rather than the law are more of a problem for marijuana growers. From every section of the United States, reports confirm that marijuana theft has reached epidemic proportions, and even well-hidden plants fall prey to unscrupulous people. These lowlifes often search near hippie communities and popular planting areas. Their best ally is a loose lip; so keep your garden on a "need to know" basis.

12.2 Where to Grow

Given the value of marijuana, many people think they'll grow an acre or two. But it is much harder to find spots suitable for large-scale farming than to find small garden plots. Large gardens require more planning and commitment, and usually a remote area. They may need a lot more time, energy, and investment in materials and labor-saving machinery than smaller gardens.

A small but well-cultivated garden, say, ten by ten feet, can yield over four pounds of grass each crop. By planning realistically, you'll harvest a good stash of potent grass rather than a lot of disappointment.

Most people who grow marijuana plant it in their backyards. They hide the plants from curious neighbors and passers-by with walls, fences, arbor, or similar enclosures. Some people plant Cannabis as part of their vegetable garden, pruning the plants to make them less conspicuous.

Gardeners often use ingenious ideas to keep their gardens secret. A woman on Long Island grows over thirty large plants in containers in her drained swimming pool. Although some of the plants reach a height of 12 feet, they can't be seen over the enclosing fence.

A couple living near Nashville, Tennessee, took the roof off their three-car garage and painted the walls white to create a high-walled garden. Other growers use sheds with translucent roofs.

Guerilla Farming

Many growers feel safer planting away from their property. Should the garden be discovered, they are not in jeopardy. On the negative side, they usually lose the close contact and control that a home gardener has.

Urban gardeners use makeshift greenhouses, rooftops, vacant lots, and city dumps. Vacant lots that are overgrown with lush weeds can support a good crop, if the marijuana plants get a head start on the indigenous weeds.

Fields, forest clearings, railroad rights-of-way, stream banks, runoff and irrigation ditches, clearings beneath high-tension lines, deserted farms and quarries, overgrown fields, and abandoned houses have all been used as

garden spots. In areas where hemp is a problem weed, people plant seeds from high-potency marijuana in the same fields where the weedy hemp grows. Growers harvest the plants in late July before they flower and before the fields are watched or destroyed by law enforcers.

Larger growers often look for rough, unpopulated terrain that is accessible only by plane, helicopter, four-wheel-drive vehicles, or long hikes. They avoid areas which hunters and hikers are likely to use before harvest.

Serious growers often find unusual places to start gardens. A grow in Chico, California, hacks through two hundred yards of dense underbrush and bramble to reach his clearing. In Oregon some growers maintain fields which are a gruelling eight-hour uphill hike from the nearest road. Some Florida farmers commute to their island and peninsula gardens by boats. A master gardener in Colorado lowers himself by rope to a fertile plain 50 feet below a cliff.

A farmer in Hawaii wrote, "The main concern is to grow in an undetectable place where the plants can still get enough sun. This is becoming very difficult to find and some very elaborate subterfuges have been developed. People on Maui are growing plants suspended from trees and on tree platforms! Around here some people carry small plants in buckets far out on the lava fields where there is a light shading from Ohia trees and you don't leave tracks. Also people go into the sugarcane fields, tear out some cane, and put in their plants. I am sure many other things are being done."

12.3 Light

Marijuana is a sun plant. The plants will grow in partially shaded areas, but about five hours of direct sunlight are needed for development into a lush bush. Marijuana does best when it has direct sunlight all day. If it grows at all in a heavily shaded area, it will be dwarfed and sparse - a shadow of its potential.

Try to choose a place that maximises light. Flat areas get the most sunlight, but many growers prefer to use slopes and hillsides which help to hide the plants. Southern slopes usually receive more sun and stronger light than eastern and western slopes, which are shaded in the afternoon and morning, respectively. Northern slopes are rarely used, since they get the least sunlight and are also the coldest. Steeper slopes are shaded sooner than gradual slopes, and lower areas are shaded earlier than high ones.

Sunlight at high altitudes is more intense, because of the thinner atmosphere and the usually lower pollution. The atmosphere and pollutants at lower elevations absorb and scatter some of the solar radiation.

Backyard gardeners usually compromise between the need for maximum light and the need for subterfuge. An area that gets several hours of direct sunlight and bright unobstructed daylight for the rest of the day will do well. A garden exposed to the south usually gets the strongest light and is the warmest. Overhanging vegetation should be pruned so that the plants are shaded as little as possible.

Most marijuana strains are acclimated to tropical and semitropical latitudes, where the daytime is relatively short (10 to 14 hours, depending

on season), but the sunlight is quite strong. At latitudes in the United States, the sun is not as intense (although in the summer the difference is small), but the days are longer, and the plants can grow extremely fast. It is not true that intense sunlight is needed to grow great marijuana. However, a summer characterised by clear sunny weather will usually produce a larger and slightly more potent crop than if the season is cloudy and rainy.

Sunlight can be maximised by adequate spacing and orientation of the garden. This is covered in section 14.

Chapter 13 SOIL

Of all the factors involved in growing plants, soil is the most complex. It has its own ecology, which can be modified, enriched, or destroyed; the treatment it receives can ensure crop success or failure.

There is no such thing as the perfect soil for Cannabis. Each variety can grow within a wide range of soil conditions. Your goal is garden soil within the range for healthy growth: well-drained, high in available nutrients, and with a near neutral (7.0) pH. Cannabis grows poorly, if at all, in soils which are extremely compacted, have poor drainage, and low in fertility, or have an extreme pH.

There are several soil factors that are important to a grower; these include soil type, texture, pH, and nutrient content. We will begin this chapter by discussing each of these topics in succession, and will then turn to discussion of fertilisers, soil-preparation techniques, and guerilla farming methods.

13.2 Types of Soil

Each soil has its own unique properties. These properties determine how the soil and plants will interact. For our purposes, all soils can be classified as sands, silts, clays, mucks, and loams. Actually, soils are usually a combination of these ingredients. If you look carefully at a handful of soil, you may notice sand granules, pieces of organic matter, bits of clay, and fine silty material.

Sandy Soils

Sands are formed from ground or weathered rocks such as limestone, quartz, granite, and shale. Sandy soils may drain too well. Consequently, they may have trouble holding moisture and nutrients, which leach away with heavy rain or watering. Some sandy soils are fertile because they contain significant amounts (up to two percent of organic matter, which also aids their water-holding capacity. Sandy soils are rich in potassium (K), magnesium (Mg), and trace elements, but are often too low in phosphorous (P) and especially nitrogen (N). N, which is the most soluble of the elements, is quickly leached from sandy soil. Vegetation on sands which is pale, yellowed, stunted, or scrawny indicates low nutrients, usually low N.

Sandy soils can be prepared for cultivation without much trouble. They must

be cleared of ground cover and treated with humus, manure, or other N-containing fertilisers. In dry areas, or areas with a low water table, organic matter may be worked into the soil to increase water-holding capacity as well as fertility. Sandy soil does not usually have to be turned or tilled. Roots can penetrate it easily, and only the planting row need be hoed immediately before planting. Growers can fertilise with water-soluble mixes and treat sandy soil almost like a hydroponic medium.

Sandy soils are also good candidates for a system of sheet composting (spreading layers of uncomposted vegetative matter over the garden), which allows nutrients to gradually leach into the soil layers. Sheet composting also prevents evaporation of soil water, since it functions as a mulch.

Silts

Silts are soils composed of minerals (usually quartz) and fine organic particles. To the casual eye, they look like a mucky clay when wet, and resemble dark sand or brittle clods when dry. They are the result of alluvial flooding, that is, are deposits from flooding rivers and lakes. Alluvial soils are usually found in the Midwest, in valleys, and along river plains. The Mississippi Delta is a fertile alluvial plain.

Silts hold moisture but drain well, are easy to work when moist, and are considered among the most fertile soils. They are frequently irrigated to extend the length of the growing season. Unless they have been depleted by faulty farming techniques, silts are rich in most nutrients. They often support healthy, vigorous vegetation. This indicates a good supply of N.

Mucks

Mucks are formed in areas with ample rainfall which supports dense vegetation. They are often very fertile, but may be quite acidic. They usually contain little potassium.

Mucks range from very dense to light sandy soils. The denser ones may need heavy tilling to ensure healthy root development, but the lighter ones may be cleared and planted in mounds. Mucks can support dense vegetation, and are often turned over so that the weeds thus destroyed form a green manure.

Clay Soils

Clays are composed of fine crystalline particles which have been formed by chemical reactions between minerals. Clays are sticky when wet, and can be moulded or shaped. When dry, they form hard clods or a pattern of square cracks along the surface of the ground. Clays are usually hard to work and drain poorly. Marijuana roots have a hard time penetrating clay soils unless these soils are well-tilled to loosen them up. Additions of perlite, sand, compost, gypsum, manure, and fresh clippings help to keep the soil loose. Clay soils in low-lying areas, such as stream banks, may retain too much water, which will make the plants susceptible to root and stem rots. To prevent this, some growers construct mounds about six inches to one foot high, so that the stems and tap roots remain relatively dry.

Clay soils are often very fertile. How well marijuana does in clay soils

usually depends on how well these soils drain. In certain areas "clay" soils regularly support corn cotton. This type of soil will support a good crop of marijuana. Red colour in clay soil (red dirt) indicates good aeration and a loose soil that drains well. Blue or gray clays have poor aeration and must be loosened in order to support healthy growth.

A typical schedule for preparing a heavy clay soil In the late fall, before frost, turn soil, adding fresh soil conditioners, such as leaves, grass clippings, fresh manure, or tankage. Gypsum may also be added to loosen the soil. Spread a ground cover, such as clover, vetch, or rye. In early spring, making sure to break up the large clods, and add composts and sand if needed. At planting time, till with a hoe where the seeds are to be planted.

As the composts and green manure raise the organic level in the soil, it becomes less dense. Each year, the soil is easier to work and easier for the roots to penetrate. After a few years, you may find that you only need to turn under the cover crop. No other tilling will be needed.

Loams

Loams are a combination of about 40 percent each of sand and silt, and about 20 percent clay. Organic loams have at least 20 percent organic matter. In actuality, a soil is almost always a combination of these components, and is described in terms of that combination, e.g., sandy silt, silty clay, sandy clay, or organic silty clay. Loams range from easily worked fertile soils to densely packed sod. Loams with large amounts of organic matter can support a good marijuana crop with little modification.

13.3 Humus and Composts

Humus and composts are composed of decayed organic matter, such as plants, animal droppings, and microbes. Their nutrient contents vary according to their original ingredients, but they most certainly contain fungi and other microorganisms, insects, worms, and other life forms essential for the full conversion of nutrients. As part of their life processes, these organisms take insoluble chemicals and convert them to soluble forms, which plant roots can then absorb. Humus and composts hold water well and are often added to condition the soil. This conditioning results from the aerating properties and water-holding capacity of humus and composts, as well as balanced fertility.

Humus and composts have a rich, earthy smell, look dark brown to black, and may contain partially decayed matter, such as twigs or leaves. They are produced naturally as part of the soil's life process or can be manufactured at the site by gathering native vegetation into piles. Composts cure in one to three months, depending on both ingredients and conditions. Decomposition can be speeded up by turning and adding substances high in N. Composts are frequently acidic and are sweetened with lime when they are piled. This also shortens curing time, since the desirable microbes prefer a neutral medium.

13.4 Texture

Soil texture refers to density, particle size, and stickiness, all of which

affect the soil's drainage and water-holding characteristics. The most important quality of the soil for marijuana is that it drains well - that is, water does not stand in pools after a rain, and the soil is not constantly wet. In a well-drained soil, the roots are in contact with air as well as water.

Cannabis does best on medium-textured soils: soils that drain well, but can hold adequate water. Loams, silts, and sands usually drain well and are loose enough to permit good root development. Some clays and most mucks are too compact to permit the lateral roots to penetrate and grow. In addition, they often drain poorly, and when dry they may form hard crusts or clods, a condition marijuana cannot tolerate.

Several simple tests will indicate the consistency and drainage qualities of your soil. Test when the soil is moist but not wet. First, dig a hole three feet deep to check the soil profile. In a typical non-desert soil, you will find a layer of decaying matter on the surface, which evolves into a layer of topsoil. Most of the nutrients available to the plant are found at this level or are leached down from it. The topsoil layer is usually the darkest. It may only be an inch thick or may extend several feet. When in good condition, the topsoil is filled with life. Healthy topsoil contains abundant worms, bugs, and other little animals, and is interlaced with roots. If you can easily penetrate the underlying topsoil with your hands, its texture is light enough for healthy root growth.

The next layer, or subsoil, may be composed of a combination of sand, clay, and small rocks, or you may hit bedrock. Sandy, rocky, and loamy subsoils present no problems as long as the topsoil is at least six inches thick. Clay or bedrock often indicates drainage problems, especially if the spot has a high water table and stays wet.

Next scrape up a handful of soil from each layer. Press each handful in your fist, release it, and poke the clump with a finger. If it breaks apart easily, it is sandy or loamy. Clods that stick together, dent, or feel sticky indicate clay or muck.

To test for drainage, fill the hole with water. Wait half an hour to let the moisture penetrate the surrounding soil; then fill the hole with water again. If the water drains right through, you are working with sandy soil. If it doesn't drain completely within 24 hours, the soil has poor drainage.

13.5 pH

The pH is a measure of how alkaline (bitter) or acid (sour) the soil is. The pH balance affects the solubility of nutrients, and helps the plant regulate metabolism and nutrient uptake. The scale for measuring pH runs from 0 to 14, with 7 assigned as neutral. A pH below 7 is acid; a pH above 7 is alkaline.

Marijuana grows in soils with a pH range from 5 to 8.5, but it thrives in nearly neutral soils. Relative to other field crops, it has high lime requirements, similar to those for red or white clover or sunflower. But it does well in fields where plants with medium lime requirements, such as corn, wheat, and peanuts, are grown.

The solubility of nutrients is affected by soil type as well as by the pH. In soils with a high content of organic matter, all nutrients are soluble between 5.0 and 6.5. Phosphorous, manganese, and boron are less soluble at pH values above 6.5. Acid soils are usually found in the United States east of the 100th meridian and along parts of the West Coast, and a deep topsoil layer. Marijuana does best in acid soils when the pH is adjusted to a range of 6.3 to 7.0. {Figure 58. Map of pH for US.}

Mineral soils in the dry western states may be slightly acid to highly alkaline. Most nutrients are very soluble in these soils, as long as the pH ranges from 6.0 to 7.5. Some of these soils are too alkaline (over 8.5); so their pH must be adjusted to near neutral to ensure healthy growth.

Adjusting the pH

First test the soil pH in the garden area. Previous gardeners may have adjusted native soils, or your yard soil may have been trucked in to cover poor native soils, so that the pH of your garden soil may be different from that of other soils in the area. Different soils vary in the amount of material needed to adjust the pH. Sandy soils do not require as much as loam, and loam requires less than clays, partly because of the chemistry, and partly because of the density and physical qualities of the soils' particles.

Adjusting Acid Soils

Acidic soils are treated with limestone, which is expressed as an equivalent of calcium carbonate (CaCO_3). Limestone is usually quarried and powdered, contains large amounts of trace elements, and comes in different chemical forms: ground limestone, quicklime, and hydrated lime (which is the fastest acting form). Dolomitic limestone is high in magnesium and is often used to adjust magnesium-deficient soils, such as those found in New England. Marl (ground seashells) is also mostly lime and is used to raise soil pH. Eggshells are another source of lime. They should be powdered as finely as possible, but even so, they take a long time to affect the soil. Wood ashes are alkaline and very soluble; so they have an almost immediate effect.

Every commercial lime has a calcium carbonate equivalent or neutralising power which is listed on the package. To find out how much to use, divide the total amount of limestone required by the pH test (see Figure 59) by the calcium carbonate equivalent. For instance, a field requires fifty pounds of limestone, but the calcic limestone you are using has an equivalent of 1.78. Divide the 50 by 1.78. The resulting figure, about 29 pounds, is the amount required. Commercial limes also list the grade or particle size of the powder. In order of fineness they are: superfine, pulverised, agricultural grade, and fine meal. The finer the grade, the faster the action. {Figure 59. Approximate amount of lime required to adjust pH of a 7" layer of different types of soil.}

For best results, lime should be added at least four or five months before planting. In this way, the lime has a chance to react with the soil. But acid soils can be limed profitably and time before planting, or after, as long as the lime does not come into direct contact with the plants. Most

growers add lime at the same time that they fertilise and turn the soil. That way, tilling and conditioning are handled in one operation. The lime should be worked into the soil to a depth of ten inches. Lime can also be added by spreading it before a rain. Make sure that the soil is moist enough to absorb the rain, so that the lime does not run off. Growers who have not adjusted the pH can dissolve lime in water before they irrigate. However, this is not advised if the water runs through a hose or pump, because mineral buildup may occur in the equipment.

Adjusting Alkaline Soils

Most alkaline soils have a pH no higher than 7.5, which is within the range for optimum growth. Soils that are too alkaline can be adjusted by adding gypsum, which frees insoluble salts, and include iron, magnesium, and aluminium sulphate. Marijuana has a low tolerance for aluminium; so marijuana growers should use iron or magnesium sulphate in preference to aluminium sulphate. Sulphur and gypsum are worked into the soil in the same manner as lime.

{Table 19.}

Some growers correct alkaline soils by adding an organic mulch or by working acidic material into the soil. Cottonseed meal, which is acidic and high in nitrogen, can also be used. As it breaks down, cottonseed meal neutralises the soil. Pine needles, citrus rinds, and coffee grounds are all very acidic, and can be used to correct alkaline conditions. The addition of soluble nitrogen fertilisers aids the breakdown of these low-nitrogen additives. (See Table 22 in the section on "Fertilisers" in this section.)

Adjusting Alkali Soils

Alkali soils (pH usually above 8.5) are hardpacked and crusty, and sometimes have an accumulation of white powdery salts at the surface. They may not absorb water easily and can be extremely difficult to work. To prepare alkali soils with a permeable subsurface for cultivation, farmers leach them of their toxic accumulation of salts. The soil is thoroughly moistened so that it absorbs water. Then it is flooded so that the salts travel downward out of contact with the roots. Gypsum can be added to free some of the salts so that they leach out more easily. Gypsum can be added at the rate of 75 lbs per 100 sq.ft., or 18 tons per acre. Leaching requires enormous quantities of water, an efficient irrigation system, and several months.

{Plate 1. Skylights are a good source of bright, unobstructed light. Thai plant (closest) and Colombian plants reached over 14 feet in six months.

Plate 2. Top: A hidden garden using fluorescent light, foil reflectors, and bag containers. Plants are ten weeks old. Bottom: Simple to construct dome greenhouse in southern California. At two months, some of these plants are six feet tall.

Plate 3. Upper left: Stem of a female plant. Upper right: In full sunlight, a pruned plant can grow incredibly dense. Bottom: A garden in the wilds of Oregon mountains.

Plate 4. Marijuana does well in most gardens. Top: Here a female plant is in early bloom at five months. The main stem was clipped at three months (Berkeley). Middle: Lower branches are spread out to catch the sun. Bottom: A female bud about two weeks before harvest. Leaves show some damage from leafhoppers (insects shown).

Plate 5. A giant sinsemilla cola grown from Mexican seed in northern California.

Plate 6. Top: Purple colours often appear late in life, when vigour is waning. Lower left: Resin glands glistening on a purple, female flowering shoot. Lower right: Yellow male flowers and purple leaves against a normal green leaf.

Plate 7. Top: Male flowers at different stages in development. A line of resin glands can be seen on the anthers of the open flowers. Lower left: Resin glands lining the pollen slit of an anther (x40). Middle right: Male flowers in full bloom. The leaves are covered with fallen pollen. Lower right: Gland heads may fall with the pollen grains. Mature grains are spherical in field of focus (x40).

Plate 8. Top: Resin glands on the lower (adaxial) surface of a small, fresh leaf blade. Integrals are one millimetre (x16). Middle and lower left: Stalked glands are concentrated along the veins of the lower leaf surface (x40). Lower right (x100).

Plate 9. Top: Upper (adaxial) fresh leaf surface. Left of picture, from left to right: Sharp-pointed cystolith hair, stalked gland, and tiny bulbous gland (x40). Lower left: Upper surface of a Thai leaf (x16). Lower right: Upper surface of fresh homegrown Colombian leaf (x40).

Plate 10. A young female flower (homegrown Colombian). Resin glands are not yet fully developed (x16).

Plate 11. Top left: A mature female flower from the same plant is in Plate 10. The flower bract is swollen from the ripe seed it contains. Notice the well-developed resin glands (x25). Top right: A mixture of seeds from common marijuana varieties shows comparative size. Bottom: The tip of a sinsemilla flower at harvest. Notice cream-coloured stigmas to the left and the fresh, clear resin glands (x40).

Plate 12. Upper and lower left: An overly ripe sinsemilla flower bract. Many gland heads are brown or missing (top, x16; bottom, x40). Upper and lower right: Carefully handled Thai weed with intact glands. Notice the high concentration of glands and very long stalks on this bract (top, x16; bottom, x40).

Plate 13. Upper and lower left: A Colombian Gold. Gland contents are brown and stalks have deteriorated on this bract (top, x16; bottom, x40). Top right: Hawaiian; well-handled and showing little deterioration (bract x40). Middle right: Gland heads easily detach from stalks when overripe (leaf vein x40). Lower right: Stalked glands on both upper and lower leaf surfaces beginning to brown (leaf margin x40).

Plate 14. Top: Whitefly larvae and their honeydew excretions on the lower surface of a leaf. Middle left: Leaf showing whitefly damage and a tiny adult. Lower left: White speckles on leaves indicating mite damage. Lower right: An overdose, or overuse of pesticide, can kill the plant.

Plate 15. Upper left: Healthy green plant next to a N-deficient plant. Middle left: Ultraviolet burn. Plant was moved outdoors without conditioning. Lower left: "Bonsai" marijuana grown from a cutting. Upper right: Mg-deficient plant has chlorotic leaves dying from their tips. Lower right: Afghani variety, with characteristically wide leaf blades, show minor symptoms of N deficiency (pale leaves and red petioles).

Plate 16. Upper left: Male flowers lose some green and turn "blond" during slow drying. Upper right: Cigar joints made with undried marijuana, which is wrapped with lone blades of fan leaves before drying. Bottom: Sequence shows change in colour in one day from sun curing. {Unfortunately, all the plates are in black and white.}

Another method of reclaiming alkali soils is by adding a thick mulch and letting it interact with the soil during the winter. The mulch should be about nine inches thick, or 130 lbs or more per 100 sq.ft. This thick layer neutralises the salts and also helps to retain moisture.

Nutrients

Marijuana is a high-energy plant which grows quickly to its full potential in a fertile soil that is rich in available nutrients. Nutrients are found in the soil's parent materials: sand, clay, humus, minerals, rocks, and water. Nutrients dissolve in soil water (soil solution), which is then absorbed by the plant. In complex chemical processes, roots release ions in exchange for nutrients that are dissolved in the soil solution.

The soil acts as a reservoir for the nutrients. Most of them are in non-exchangeable forms: that is, they do not dissolve, or dissolve only slightly in water. Only a small percentage of the total reserve is free at any time as the result of chemical processes or microbial action. Healthy soils maintain a balance between free and unavailable nutrients, so that the plants they support continually receive the right amounts of required nutrients. Alkali soils have large supplies of compounds which are extremely soluble. The solution is so concentrated that alkali soils are often toxic to plants.

There are three primary nutrients, N (nitrogen), P (phosphorus), and K (potassium). These are the nutrients that gardeners are most likely to be concerned with and which most fertilisers supply. Soils are most likely to be deficient in one of these nutrients, especially N.

In addition to the primary nutrients, soil supplies plants with three secondary nutrients, Ca (calcium), Mg (magnesium), and S (sulfur), and seven micronutrients: iron, boron, chlorine, manganese, copper, zinc, and molybdenum. Although deficiencies of all the secondary and micronutrients are reported from various parts of the United States, serious deficiencies do not occur often. ((For a discussion of the symptoms of nutrient deficiencies in marijuana, see section 9.))

Marijuana absorbs nutrients primarily through a fine network of lateral roots which grow from the taproot. Lateral roots may spread over an area with a diameter of five feet, and may go as deep as the roots can penetrate. Plants in deep sandy soils or in soils that have porous mineral subsoils may grow roots as deep as even seven feet. Roots which can absorb nutrients from a larger area are more likely to fulfil the plants' needs than are shallow roots which result in shallow topsoil layers over compacted subsoils. When the roots have a large area from which to absorb nutrients, the soil does not need to be as fertile as when the roots are restricted to a small area by poor soil or by being grown in pots.

You can get a good indication of soil fertility by observing the vegetation that the soil supports. If the vegetation is varied, has a lush look to it, is deep green, and looks vigorous, it is probably well-supplied with nutrients. If the plants look pale, yellowed, spindly, weak, or generally unhealthy, the soil is probably deficient in one or more nutrients.

Testing

Agricultural colleges, County Extension Agents, and private companies perform soil analyses for a small fee from a sample you mail to them. The tests include nutrient, pH, and texture analyses, and are very accurate. There are also simple-to-use test kits available at nurseries and garden shops which give a fair indication of soil fertility and pH. Test results include a suggested fertiliser and lime program catered to the soil's individual requirements for the crop to be planted. Marijuana has nutrient requirements similar to those for corn, wheat, and sugarcane, and prefers just a little more lime (a more alkaline soil) than those crops; so soil can be fertilised as it would be for those crops.

Soil tests are one indication of soil fertility. They test for available nutrients, but not for reserves that are held in the soil. Test results may also vary because of recent rainfall, changes of moisture content, and seasonal changes. Most soil tests do not measure the ability of the soil to make nutrients available. This is a very important factor when considering a fertiliser program and should not be overlooked. As an example, an uncultivated field showed only moderate amounts of N available, and indicated a need for N fertiliser. The vegetation - tall grass, weeds, and bush - had a healthy look and was dark green, and the lower leaves remained healthy. Obviously, the soil was able to supply an adequate amount of N to the plants, which withdrew it from the soil solution as it became available. The soil and plants had reached a balance, and the soil solution slowly became more dilute over the course of the season.

To a great extent, the soil's ability to maintain a constant and adequate supply of nutrients depends on the soil's humus content. Humus can support dense populations of microorganisms. As part of their life processes, microorganisms decompose organic matter in the humus. Nutrients contained in the organic matter are released by microbes as simply inorganic molecules (e.g., NO_3) which can dissolve in soil water. Generally, soils with a high humus content can keep plants supplied with more nutrients than soil tests indicate.

The Primary Nutrients

If you look at any fertiliser package, you will note three numbers on the package. They stand for N-P-K, always in that order. Marijuana does best in a soil which supplies high amounts of N and medium amounts of P and K.

Nitrogen

The availability of N is the factor most likely to limit the growth of marijuana. For fast healthy growth, marijuana requires a soil rich in available N. Nitrogen is constantly being replaced in the soil solution by microbial breakdown of organic matter. Some microorganisms can use N directly from the atmosphere. They release N as waste in the form NO_3 , which is the primary form in which plants absorb N. A small amount of N is also dissolved in falling rainwater. When the soil is moist, it loses N through leaching and to plants. In its available form (NO_3 , NO_2 , NH_4), N is very soluble and may be carried away with runoff or may drain into the subsoil.

Probably the most accurate method of measuring a soil's ability to produce N is by the percentage of organic matter in the soil (see Table 20). Organic matter releases N at a rate that is determined by the type of soil, the temperature, and the moisture. Generally, the more aerated and warmer the soil, the faster organic matter decomposes and releases N. Most professional testing services report the percentage of organic matter, and some sophisticated kits can also test for it.

In its available state, N is tested in two compounds, ammonium (NH_4) and nitrate (NO_3). Test results are converted into PPM (parts per million) of N and then added to arrive at the total amount of N available in the soil. The formulas to convert nitrate and ammonium to N are $(\text{NO}_3) * 0.226 = \text{N}$, $(\text{NH}_4) * 0.78 = \text{N}$. Each PPM indicates 10.7 pounds of N per acre available in the top 7.87 inches. If the soil level is deeper, there is probably more N available. If it is shallower, less is available. But a test for available N gives only a fair approximation of the soil's ability to feed the plant. An individual test may be untypical because of recent leaching or depletion during the growing season.

An intensively cultivated crop of hemp takes about 250 pounds of N per acre or six pounds per 1,000 square feet from the soil during the growing season. When the plants are spaced well apart, the crop does not require as much N.

Fields which have more than 200 lbs of available N per acre (or 4.5 lbs per 1,000 sq.ft.) at the start of the growing season require no additional fertilisation. Soils with less available N will probably yield a larger crop if they are given additional N. Actually, the amount of N that can profitably be used depends on the soil and its potential to produce N as well as on other factors: how fast N is lost, the soil depth, and moisture content.

One way to calculate the amount of N to add to the soil is to build your soil to an "ideal" level. For example, an Iowa silt loam may test about 1.6 pounds of N per 1,000 sq.ft. and an organic content of 3 percent. Together, the available and potential N total about 3.2 lbs per 1,000 sq.ft. To increase the available N to 4.5 per 1,000 sp.ft., you would need to add 1.3

lbs of N.

Phosphorus

P is an important nutrient which is used directly by the soil bacteria as well as by the plant, so that an increase in the amount of P in the soil often results in an increase of N. Because of P's low solubility, it is rarely leached from the soil. It is usually found in the greatest concentration in the soil's top layers, where it accumulates as a result of decomposition of organic matter.

In slightly acid organic soil, up to one percent of the total P is available at any time. The total amounts of P in soils range from 1,000 to 10,000 lbs per acre. For example, a typical Kansas prairie soil has 3,000 lbs per acre. In soils with a lower pH, more of the P is tied up in insoluble compounds of iron or aluminium. In highly alkaline soils, the P forms insoluble compounds with calcium.

Insoluble P reacts with the dilute acids that are released during decomposition of organic matter. These compounds are available to the plants. Both the chemical processes in which P is released and the organic processes of decomposition occur faster in warm soils.

If P is available, young plants absorb it rapidly, and may take in 50 percent of their lifetime intake by the time they are only 25 percent of their adult size. Young plants grown outdoors in cold weather may grow slowly until the soil warms up and more P is available. Older plants grown out of season in cold weather sometimes exhibit purple leaves. This condition may result from a P deficiency, because of the unavailability of P at low temperatures.

Most soil-test kits test available P, but the nutrient value of P is usually expressed as phosphoric acid (P₂O₅), which is converted using the formula $P * 2.3 = (P_2O_5)$, $(P_2O_5) \text{ divided by } 2.3 = P$. Any soil that has available P of 25 lbs per acre (0.58 lbs per 1,000 sq.ft.) or more is well-supplied with P. Stated in terms of phosphoric acid, this is $25 * 2.3 = 57.5$ lbs per acre (1.33 lbs per 1,000 sq.ft.).

Most inexpensive soil kits test available P. Soil that test less than 1 PPM or 10.7 lbs per acre (0.25 lbs per 1,000 sq.ft.) of available P should be tested to make sure there are adequate reserves, or can be fertilised to assure maximum yield. Soil-test kits give only a fair indication of the P available. A low reading may indicate the plants are absorbing P as fast as it breaks down from its unavailable form, especially during early growth! The main factors affecting the rate at which P becomes available are the total amount of reserve P in the soil and the pH.

Most professional soil analyses include a report of reserve P. Generally soils with reserve P of 3,000 lbs per acre (70 lbs per 1,000 sq.ft.) do not need additional P. Intensively cultivated and cropped fields may have had their reserve supply depleted, and will lock up available P that is supplied as fertiliser until a balance is reached.

Potassium

K is found in adequate quantities in most soils which have a pH within the range needed for growing marijuana. K is held in soils in three forms: unavailable, fixed, and readily available. Most K is held in the unavailable form as part of the minerals feldspar and mica. But a small percentage of the total K in any soil is held in fixed, slightly soluble forms. Some of these can be absorbed and used directly by the plant. The exchangeable K is equal to a fraction of the fixed K. Each soil maintains a balance or ratio of unavailable to fixed and to exchangeable forms. Organic soils have a higher percentage of K in the fixed or available form than mineral soils. As K is used by the plants, some of the unavailable K goes into the more available forms. Plants can use K in both the soluble and the fixed forms.

Most clays and soils that are well-limed have adequate reserves of K. Acidic soils generally have low K reserves. Mucks, silts, and peats have low reserves of K, and have little capacity to hold it chemically when it is applied. Sands have K reserves, but little capacity to convert it to a fixed or available form. Most western soils have adequate reserves of K. The exchangeable K in soils becomes fixed if the soil dries out; so the available K of a recently dried soil is usually low.

K is tested in its elementary state, but when described as a nutrient, it is given as potash (K₂O). The formulas for converting are $K * 1.2 = (K_2O)$, $(K_2O) \div 1.2 = K$. Soils with 180 lbs or more of available potash per acre (4 lbs per 1,000 sq.ft.) have an adequate supply. The total reserve K should test no lower than 900 lbs per acre (21 lbs per 1,000 sq. ft.).

The Secondary Nutrients

Magnesium (Mg), calcium (Ca), and sulfur (S) are usually found in adequate quantities in soils suitable for growing marijuana. However, some New England soils do have Mg deficiencies. Soils which have a neutral or near-neutral pH almost always have adequate Ca and sulfur levels.

Magnesium deficiencies are corrected by adding 50 to 100 lbs of Mg per acre (2.25 lbs per 1,000 sq.ft.). The most inexpensive way to add Mg is to use a dolomitic limestone for adjusting soil pH. Dolomitic limestone is about 12 percent Mg (see Table 21); so 800 lbs of it are needed to supply 100 lbs of Mg. Dolomitic limestone releases Mg to the soil gradually. For faster action, epsom salts (magnesium sulfate, MgSO₄) can be used. Five hundred lbs of epsom salts are required to supply soil with 100 lbs of Mg. Mg deficiencies can also be corrected by using foliar sprays. Dissolve one ounce of epsom salts in a gallon of water and spray all foliage.

{Picture The relationship between soil pH and relative plant nutrient availability. The wider the bar, the more the availability. This chart is for soil types recommended in this book..

- {Nitrogen - pH of 6.3 to 8
- Phosphorus - 6.5 to 7.5
- Potassium - 6.5 to 9
- Sulfur - 6 to 9
- Calcium - 6.7 to 8.5
- Magnesium - 6.5 to 8.5
- Iron - <4 to 6

Manganese - 4.7 to 6.5
Boron - 5 to 7 or 9
Copper and Zinc - 5 to 7
Molybdenum - 7}}

Micronutrients

Micronutrients are used by plants in minute quantities, and most soils contain enough of them to meet plant requirements. Home gardeners and guerilla farmers seldom encounter any micronutrient deficiencies. But heavily cropped lands sometimes develop a deficiency of one or more micronutrients because of crop depletion. Micronutrients are made available to the plants only if there is a delicate balance in the soil chemistry, and it is easy to create toxic conditions by adding them to soil when they are not needed. For that reason, soils should be treated with micronutrients only when symptoms occur or when the deficiency is known by analysis or past experience. Only small quantities of additives are required for treatment. Manures, composts, other organic fertilisers, lime, rock powders, and ash contain large quantities of trace elements. Active organic additives quickly release micronutrients in a form that is available to the plants.

Boron

Boron deficiencies in marijuana occur in acid soils as a result of depletion by heaving cropping. The areas most affected by it are vegetable fields in the mid-Atlantic states, alfalfa and clover fields east of the Mississippi, and truck farms and orchards in the Northwest. Boron is found in phosphate fertilisers, gypsum, and lime, and is the main ingredient of boric acid and borax. When borax or boric acid are used, they are applied at the rate 10 to 20 lbs per acre. They are used as a foliar spray at the rate of 1 ounce per gallon of water.

Chlorine

Chlorine deficiency does not normally occur. Some chemical fertilisers contain chlorine, and toxic conditions occur infrequently. Toxic chlorine conditions are eliminated by leaching.

Copper

Copper deficiencies occur infrequently in truck farms in Florida, California, and the Great Lakes region. Wood shavings and tobacco contain large amounts of copper. A foliar spray composed of 1 ounce each of calcium hydroxide and copper sulfate (a fungicide) per gallon of water is used by commercial vegetable growers.

Iron

Iron deficiencies occur in orchards west of the Mississippi and in Florida, and in alkaline soils in which iron is largely insoluble. Lowering soil pH often solves the problem. Chelated iron, which is water-soluble, is available at most nurseries and quickly supplies iron even when pH is extreme. Humus and seaweed are excellent sources of iron.

Manganese

Manganese deficiencies occur in the Atlantic states, the Great Lakes area, Utah, and Arizona. Manganese is found in manure, seaweed, and some forest leaf mould (especially hickory and white oak). Manganese deficiencies can be corrected by using a foliar spray of manganese sulfate at the rate of 0.5 to 1.0 oz. per gal. Soil is sometimes treated with manganese sulfate at the rate of 20 to 100 lbs per acre. In neutral or alkaline soils, most of the manganese sulfate becomes fixed and unavailable to the plants by the end of the growing season.

Molybdenum

Molybdenum deficiencies occur primarily along the Atlantic and Gulf coasts and in the Great Lakes region. Plants need extremely small amounts of molybdenum, less than 1 PPM in leaf and stem tissue. Molybdenum deficiencies occur when the soil is too acidic. By raising the pH level, one can make molybdenum available.

Zinc

Zinc deficiencies occur in soils throughout the U.S., primarily because of heavy cropping. It is most likely to occur in acid-leached sandy soils, and in neutral and alkaline soils where it is insoluble. In soils with high amounts of available P, zinc is also unavailable. Many deciduous tree leaves and twigs, composts, slag, and rock phosphate contain large amounts of zinc. Zinc sulfate is used as foliar spray at the rate of 3 oz. of zinc sulfate per gallon of water, or as a soil treatment at the rate of 100 lbs per acre. Some orchard growers drive galvanised nails into the trees to provide zinc.

13.6 Fertilisers

Most soils can benefit from a realistic soil-conditioning program. Most organic programs build soil, and minimise leaching and runoff. Programs using chemical fertilisers emphasise immediate increase in yield and a minimum of labor. The approach that you use should be tailored to the soil's needs and to your situation and goals. For example, a home gardener interested in building soil quality can easily add manure or compost to his garden. But a guerilla farmer may use concentrated chemical fertilisers, which are easy to transport to a remote area. A farmer cannot use the labor-intensive techniques which a small planter might use as a hobby. Many gardeners use both organic and inorganic fertilisers.

Organic Fertilisers

Organic fertilisers are usually less concentrated than chemical mixes. Their bulk consists of fibrous materials which condition the soil by aiding drainage and increasing the organic content and water-holding capacity. As they are decomposed by microbial action, the nutrients they contain are released in soluble form. Since this is a gradual process, there is little chance of creating toxic conditions.

Manures and composts are basic, all-purpose conditioners. They contain adequate amounts of most of the nutrients that marijuana absorbs from the

soil and can be used generously. Uncomposted manures are "active" and should be used only in the fall. Over the winter they compost in the ground. Composts and composted manures can be added in the spring. Table 22 lists some common organic fertilisers which are usually available. Some of them, such as bone meal and granite dust, break down slowly and are available only after a period of time. Others are low or lacking in one or more of the major nutrients. Organic fertilisers can be combined to provide a complete balance.

Chemical Fertilisers

Most chemical fertilisers act quickly because all the nutrients are in soluble form. They are usually more concentrated than organic fertilisers, and can toxify the soil and kill the plants when they are overused. Fertilisers come in various concentrations and ratios of nutrients. All packaged fertilisers list the percentages of N-P-K (actually n-(P₂O₅)-(K₂O)). Also listed is the potential acidity or alkalinity, that is, the number of pounds of lime or sulfur required to counteract pH changes caused by the fertilisers. Chemical fertilisers are often incompatible with each other; so home gardeners who use them should buy them pre-mixed or as a complete component fertiliser set.

Solubility is a major problem with commercial fertilisers. In irrigated areas as well as areas with rainfall during the growing season, they are likely to be leached away; so they must often be applied several times during the growing season. A typical program might be to fertilise at planting and every six weeks thereafter until the beginning of flowering. When spreading fertilisers during the growing season, do not let them come into direct contact with the roots. An easy way to fertilise during the growing season is to make a small trough between rows with the corner of a hoe. Fertiliser is placed in the depression. Some new chemical formulas release nutrients during the length of the growing season, and therefore need only one application.

Amounts to Use

The amounts of nutrient needed per acre and per 1,000 sq.ft. are shown in Table 23. Soils rich in one nutrient may be average or deficient in another. To calculate the required amount of a specific fertiliser, divide the amount of nutrient required as listed in the chart by the percentage of nutrient in the fertiliser. For instance, to add 5 lbs of N to an area by using bloodmeal, divide 5.00 by 0.15. The total comes to a little more than 33 lbs. Dried cow manure contains about 1.5 percent N. About 333 pounds of it are needed to supply 5 lbs of N. Urea, a chemical fertiliser, contains 46 percent N. Only 11 pounds are required to supply 5 lbs of N.

Planning a Garden Fertiliser Program

Now let's plan some garden fertilisation programs, to help some cultivators in three areas which have different soils and climates: New England, Kansas, and Florida. We'll see how growers with different goals adjust their garden soil.

New England

Most New England soils, and many soils in humid temperate areas, have a thick layer of humus which supplies N. New England soils also contain moderate amounts of P, but they are low in K.

Our first gardener has a typical New England soil in his backyard. From tests and observation he thinks his soil contains moderate amounts of N and P, but is low in K. A test indicated a pH of 5.8. He plans to start preparing his ten-foot-square plot (100 sq.ft.) in the fall, before frost. By planting time, he expects his backyard garden to have a pH of 6.7 and a balanced, fertile soil.

From Figure 59 he finds that the soil requires about 8.1 lbs of lime. He has decided to adjust the pH by using dolomitic limestone (with a calcium carbonate equivalent of 0.45) because farmers in the area sometimes complain of Mg deficiencies. Dividing 8.1 by 0.45, he finds that the soil requires 18 lbs of limestone. (Lime requirements divided by calcium carbonate equivalent equals the amount of limestone needed.)

He guesstimates that the N content of his soil rates between fair and medium, and figures the soil can use almost 0.2 lbs of N. He has decided to spread fresh manure from a nearby stable mixed with lime. In the spring he will turn this into the soil; at the same time, he will add manure composted with hay and table scraps. The fresh horse manure contains about 0.44 percent N. To find out how much manure he needs, he divides 0.2 (the amount of N required) by 0.0044. The total comes to about 45.5 lbs. (Nutrient required divided by percentage in fertiliser equals amount of fertiliser needed.) The manure also contains 0.17 percent phosphoric acid (P₂O₅) and 0.35 percent potash (K₂O), referred to hereafter in this chapter as P and K, respectively. Multiplying 0.17 percent (0.0017) and 0.35 percent (0.0035) by 66 lbs, he finds that he has added 0.11 lbs of P and 0.23 lbs of K. (Lbs of fertiliser times percentage of nutrient in fertiliser equals amount of nutrient in fertiliser.)

BOX F

Chemical fertilisers usually supply P in the form of superphosphate or triple superphosphate. These chemicals are manufactured by mixing rock phosphate with acids. Potassium is supplied by means of muriate of potassium (K and chlorine) or sulfate or potash, which are mined in the Southwest and purified. All these chemicals are soluble and are available to the plant. But a portion of them gradually reacts with the soil and becomes fixed or unavailable. As this portion becomes unavailable, it increases the total reserve in the soil, which reaches a new balance of available to unavailable nutrients than before fertilisation.

Bone meals and rock phosphate, the most commonly used organic sources of P, and granite dust, a source of K, are not readily available, but increase the total reserve of nutrients and gradually increase the total amount of available nutrients. However, there is some time lag before these nutrients are available to the plant. They are usually

applied in large amounts, at about three times the weight calculated for fertilisers of that concentration. But one treatment lasts four years or more, because the fertilisers remain fixed in the ground until they are used. {Table 24}

From Table 23 he finds that the soil requires about five ounces of P. How many ounces of P is 0.11 lbs? He multiplies 0.11 by 16, the number of ounces in a pound, and finds that the total is about 1.75 ounces. The soil requires another 3.25 ounces. Bone meal is about 20 percent P. To supply three ounces of P, about a pound of bone meal is required. But bone meal breaks down slowly, and is therefore applied at three times the rate used for other fertilisers; so our cultivator uses 3 lbs.

Since the K content of this New England soil is poor, about 0.3 lbs of K is required. The manure has already supplied 0.2 lbs; so the soil requires another 0.1 lb. Our cultivator decides to use wood ashes from his fireplace. Wood ashes are about 7.0 percent K. He divides 0.1 by 7 percent (0.07) and finds that the soil can use at least 1.4 lbs of ashes. He adds this in the spring just before planting, because the ashes are highly soluble. Over the winter, such highly soluble nutrients would leach away or become unavailable.

Our grower knows that some of the N in the fresh manure that was added in the fall will leach away during the winter. But the manure compost that he adds in the spring will more than make up for any losses.

A New England farmer not far from the cultivator has been rotating his field from corn and marijuana to alfalfa and pasture for the past ten years. Each fall he adds 7 tons of manure per acre. Except for occasional additions of lime, no other fertilisation is necessary.

A rural New England grower has decided to plant in a remote mixed-forest area. The first 10 inches of soil is a rich compost of humus. It is full of life: insects, worms, and other creatures. The grower has decided to increase the fertility of the soil by using chemical mixes and dolomitic lime. He is cultivating in three clearings with a total area of about 1,000 sq.ft. He guesstimates that the soil is medium in N and P, but poor in K. It is also acid. He applied enough lime to correct the soil's natural acidity and the pH of the fertiliser.

Using Table 23, he decides that he should purchase a mix with a ratio of 50 parts of N, 10 parts of P (reading from the medium line), and 120 parts of K (from the poor line), that is, a ratio of 5-1-12. A local nursery sells commercial fertiliser with nutrient percentages of 10-5-25, close enough to the desired ratio. By taking the total amount of N required for a medium soil as listed in Table 23 (19 ounces), and dividing it by the N in the fertiliser (10 percent or 0.10), the rural grower finds the total amount of fertiliser required (190 ounces, or a little less than 12 lbs). The other nutrients are automatically added in the same ratio.

Kansas: A cultivator in Kansas decides to plant along a hidden stream bank. The banks are covered with lush vegetation as a result of runoff that contains soluble fertilisers used on nearby farms. The cultivator feels that additional fertilisers are not necessary, since the vegetation is so lush.

Another grower in Kansas found that her soil was very low in N and P, but high in K, typical of dry midwestern and western soils that support scrub vegetation. It had a nearly ideal pH. She started to prepare her 200 sq.ft. garden in the spring after the rain season ended. Using Table 23, she found that it required 3.5 lbs of N, 6 ounces of P, and no K. Activated sludge (5-3-0) was available at the local garden centre. To find out how much sludge her garden required, divide 3.5 by 5 percent (or 0.05). The total comes to 70 lbs.

Florida: A grower planting 500 sq.ft. on a deserted ranch in central Florida started with a very sandy soil whose pH was 4.9 because of sulphurous water in the ground. From Figure 59, she found that the soil required about 35 lbs of lime. To adjust the pH, she used 14.0 lbs of a limestone with a calcium carbonate equivalent of 2.5.

The soil had virtually no organic matter, and she was not sure she could use the same location next year; so she decided to apply soluble mixes throughout the growing season. From Table 23, she found that "poor" required 28 ounces of N, 4 ounces of P, and 24 ounces of K. A chemical fertiliser with nutrient percentages of 15-5-10 was on sale at a local discount store. To find out how much fertiliser is needed to supply 28 ounces of N, divide 28 by 15 percent (or 0.15); the result is about 186 ounces of N, or about 11.5 pounds. Since the other nutrients are supplied at the same proportions or at higher proportions than are required, no supplements are needed at planting time. But additional feedings will be required periodically during the growing season.

13.7 Techniques for Preparing Soils

Each garden situation is unique, and many factors help determine which garden techniques you should use. These include the soil's condition, the size and location of the garden, commitment, and personal preferences. Each technique affects the microecology in its own way. Home gardeners may use techniques that are impractical for a farmer or guerilla planter. But all growers have the same goal when they prepare soil for planting: to create a soil environment conducive to growing a healthy, vigorous plant.

BOX G Fertilising Cannabis Depends on the Crop

Historically, Cannabis is known to require high fertility. In a fertile soil, Cannabis can outgrow practically any annual plant. Cannabis also is a known depleter of soils. This is true particularly with marijuana, since seeds, flowers, and leaves comprise the harvest. Hence it's necessary to fertilise the plants each year. Hemp, on the other hand, comes from the Cannabis stem, and the fibre consists primarily of cellulose (C₆H₁₀O₅)_n. When hemp is grown, all plant parts except the fibre are returned to the soil; so the nutrients are also returned. Moderate fertilisation, if any, is all that's required for hemp farmers.

If you are already growing a vegetable garden, the chances are that your soil is in pretty good shape for growing marijuana. However, vegetable

gardens may be a little acidic, particularly east of the 100th meridian. The soil should be prepared in much the same way that it is prepared for corn cultivation, with the addition of lime to raise the pH to near neutral.

Tilling

Gardens which may not have been planted recently (in the last three or four years) require more work. It is best to begin preparing the soil in the fall, before the first frost. This can be done using a spade or shovel. The ground is lifted from a depth of six or eight inches and turned over so that the top level, with its grass and weeds, becomes the bottom layer. Large clumps are broken up with a blade or hoe. Larger areas can be turned with a power hoer or rototiller. Conditioners, such as fresh leaves, composts, mulching materials, pH adjusters, and slow-release fertilisers are added and worked into the soil, so that they begin to decompose during the winter. It is especially important to add these materials if the soil is packed, mucky, or clay-like. Soluble fertilisers should not be added in the fall, since they leach to the subsoil with heavy rains.

In the spring, as soon as the ground is workable, turn it once again. If the soil still feels packed, add more conditioners. If you are using manure or other organic materials, make sure that they are well decomposed and small clean and earthy. Fresh materials tie up the N in the soil while they cure, making this nutrient unavailable to the plants. Commercial fertilisers and readily soluble organics, such as blood meal and wood ash, are added at this time.

The ground can also be seeded with clover or other legumes. Legumes (alfalfa, clover, vetch, etc.) are plants which form little nodules along their roots. The nodules contain bacteria which live in a symbiotic relationship with the plant. As part of their life processes, these bacteria absorb gaseous nitrogen from the air and convert it into a chemical form the plant can use. During its life cycle, clover uses up most of the N, although some leaks into the surrounding soil. But when the plant, or any of its leaves, die, the contents become part of the soil. The process of growing a cover crop and turning it into the soil is sometimes called green manuring.

After the last threat of frost, at about the same time that corn is planted, the soil should be worked into rows or mounds, or be hoed. At this time, the seeds should be planted. If any concentrated fertiliser is added to the soil, it should be worked into the soil and should not come into direct contact with the seeds.

The actual amount of tilling that a given soil requires depends on soil condition. Sandy soils and light loams may need no turning, since they are already loose enough to permit the roots to penetrate. Turning may break up the soil structure, damaging its ecology. These soils are easily fertilised, by using soluble mixes or by the layering technique described below. Soils which are moderately sandy can be adjusted by "breaking" and levered or pushed, but the soil is not raised. This is done about every six inches, and can be accomplished quickly. Farmers can loosen sandy soil by disking at five or six inches.

Some gardeners mulch the soil with a layer of leaves or other materials to

protect it from winter winds and weather. This helps keep the soil warm so that it can be worked earlier in the spring. In states that border west of the 100th meridian, this helps prevent soil loss due to erosion from dry winds. Soil often drains well in these areas, and the ecology of the soil is better served when it is left unturned. At season's end, marijuana's stem base and root system are left in the ground to help hold topsoil. The next year's crop is planted a cover crop, such as clover, or alfalfa, which holds the soil and also enriches the nitrogen supply.

Layering

Layering is another method of cultivation. The theory behind this program is that in nature the soil is rarely turned, but builds up, as layer after layer of compostable material falls to the ground. This material, which contains many nutrients, gradually breaks down, creating a rich humus layer over a period of years.

The layering method speeds up the natural process. Since gardens are more intensely cultivated than wild fields, new material is required to replenish the soil nutrients. Gardeners like Ruth Stout "sheet compost," that is, they lay down layers of uncomposted material and let it decompose at the same time that it serves as a mulch. But most gardeners prefer to use material which is already composted. The compost shrinks and builds the topsoil layer about an inch for every six inches of compost. After several years, the soil level will be raised considerably, and the top layers will be an extremely rich, porous medium which never needs turning. In order to prevent a spillover of the soil, gardeners usually construct simple beds (using boards) to contain the garden areas.

Layering is most successfully used on porous soils, especially sands, which contain little organic matter. It can also be used with clay soils. However, experienced growers say that clays should be turned several times before the technique is used, or the first couple of harvests will be small.

Planting a cover crop such as clover will give the soil structure. As more compost is added, the clover is covered and the new seed planted. The clover, with its N-fixing properties, remains a permanent cover crop. When marijuana seeds are to be planted, a planting row is easily tilled with a hoe. The clover protects the soil from sun-baking and its resulting water loss, and makes it harder for weed seeds to get started.

Tilling and layering are basic methods which are used with many variations. In some ways, there almost seem to be as many gardening techniques as there are gardeners. For instance, one gardener bought three cubic yards of topsoil and a cubic yard of composted steer manure. He mixed the material and filled raised beds with it to a depth of 18 inches, and had an instant high-power garden. Another grower made compost piles in his raised troughs during the winter. By planting time, the compost was complete and filled with earthworms. The beds became warmer earlier, and he could plant sooner.

A midwestern gardener used marijuana as a companion crop in much the same way Indians used corn. In between the marijuana, she planted beans and squash. She didn't get many stringbeans and only a few squash. But she believes that the beans gave the plants extra N, especially during the first

six weeks, and the broad squash leaves protected the soil from the hot August sun.

A gardener in Georgia had such a sticky clay soil that a shovel once got stuck in it. He dug holes two feet deep and two feet wide with a power auger and filled them with a fertile mix of two parts sand, one part clay, three parts topsoil, and one part chicken manure. He claimed that his plants grew six feet in 10 weeks. Filling holes with a rich soil mixture is popular with guerilla farmers, who often must plant in poor native soils.

Mulching

Mulching is a labor-saving technique that many gardeners and farmers use for a multitude of reasons. A mulch placed on the ground before fall frosts helps the soil retain heat and protects it from winds and freezing temperatures. In the spring the mulched soil becomes warmer earlier in the season, and can be planted several weeks sooner than usual. A mulch cover keeps the seedlings' roots warm and eliminates a lot of weeding, since most weed seedlings cannot pierce the cover.

During the summer, mulches keep the ground cooler and more moist by absorbing and reflecting light and reducing surface evaporation. These are important points for farmers in dry areas. The water savings can be 50 percent or more.

Any plant or animal material will do for mulch. Gardeners use hay or straw, leaves, composts, manures, sawdust, bark, or plant clippings in two- to six-inch layers. A barber in Palo Alto uses hair. Baled hay is inexpensive and easy to use as a mulch. Round hay bales unroll in a long sheet that is easy to spread over the ground, and square bales can be pulled apart into tile-like squares.

Mulches create an ideal environment for earthworms and microorganisms which condition and enrich the soil. These organisms require a relatively cool, moist, dark environment. The mulch develops a dry outer crust which reflects light, keeping the underlayers cool and moist. Materials such as leaves, bark, and sawdust decay slowly because they do not contain enough nitrogen to maintain dense populations of decomposing microorganisms. Manures and composts contain more nitrogen and decay more quickly.

With few exceptions, mulches can be applied practically any time of the year, but the best time is probably in the fall, after the crop is harvested and before the ground has frozen. Leaves, plant clippings, and straw are applied in a thick layer from six to ten inches deep. Hay is layered two to six inches deep. Denser substances, such as manures and composts, should be mixed with straw and leaves to aid decomposition. This mixture is spread in an even layer, about two to four inches deep, over the entire surface of the garden. If winds pose a problem by blowing the mulch away, you can cover it with newspapers or sheets of plastic held down with rocks. If your area is dry, give the mulch a good soaking once before frosts.

By the spring, much of the material will seem to have disappeared. But underneath the top layer, you will find a soft-textured, earthy-smelling humus, teeming with worms, insects and other small animals. This is a sign

of a healthy ecosystem and a fertile soil.

Some people apply mulch in the spring, placing it between rows as they sow the seeds. The mulch keeps weeds from competing with the seedlings, absorbs the sun's warmth, and releases nutrients to the soil.

In cold areas, such as Montana, New England, and Alaska, growers place black plastic sheets over the soil. These absorb the sun's heat, allowing the soil to be planted sooner. The seedlings develop quickly in the warmer soil. The plastic is removed once the seedlings are well-established.

Newspapers and white plastic can be used to decrease water loss during the summer. They also reflect light back to the plants.

One innovative grower from western Colorado placed a sheet of white plastic over her garden and cut out holes wherever she plant the seeds. Though it is quite dry where she lives, she didn't need to water the plants until late July. And she had no problems with any weeds.

Containers

Containers are another option open to grower. Plants can be grown full-size in containers which are at least five gallons (larger would be better). Fill them with high-grade topsoil, or a plating mixture as described in section 6. Planters are a convenient compromise where the soil is particularly poor or for the home gardener who does not wish to get into large-scale gardening. But remember, eight good-sized plants can yield over four pounds of grass.

Plants in pots need to be watered frequently, but require much less total water than a garden. The gardener can also move the plants. Some gardeners use this technique to maximise the amount of sun the plants get during the day, or as the sun's position changes with the season. And growers can easily induce early flowering by moving the plants to a darkened area. {Figure 61. Containers are convenient for outdoor gardens.}

Almost any large container that can withstand the weight of moist soil and which has holes for drainage is suitable. Containers which held toxic chemicals, herbicides, insecticides, or other possibly harmful substances should be avoided.

We have seen all kinds of ingeniously made containers. Some growers use old bathtubs, and others use wooden packing crates or bushel baskets. A simple wood container 18 inches wide, eight feet long, and 18 inches deep was made by a New Jersey grower, who grew six plants in it. Trash cans, plastic containers, barrels, and even rubber tyres have been used. One grower grew plants in one-cubic-foot bags of soil by cutting a five-inch-diameter hole in the top and poling holes for drainage. To assure drainage, growers sometimes fill the bottom of each container with a six-inch layer of stones or gravel; is you are planning to move such container, lightweight perlite would be more suitable.

13.8 Guerilla Farming

Guerilla growers often use the same techniques as home gardeners. But the soil that they start with is sometimes marginal, and the gardens are in remote, hard-to-get-to areas; so they modify the techniques to fit their needs. When it is impractical to carry bulky organic fertilisers to the growing site, guerilla farmers use highly concentrated commercial mixes. Compost and soil adjusters are gathered from the surrounding area, and the simplest, most light-weight tools are used. Some growers use horses or mules to carry equipment and material, and then use the animal to plough. The animals are quiet and, naturally, require no external power source. Experienced growers say that the animals can work as fast as or faster than a rototiller.

It is hard to generalise about details of guerilla farming, since much depends on the specific circumstances, which can vary greatly. For instance, a grower who plants along the fertile bank of a midwestern stream may not need to do more than pull out weeds and till the actual planting area. But a grower planting on a mountain slope may have to "build a soil," since soil and nutrients are washed from the slopes and down to the valleys by rainfall. For this reason, we will cover several situations separately: forest; washed-out steep areas; swamps and marshes; stream banks; grasslands and fields; and arid soils.

Forest Clearings

Clearings in forests have always been popular places to plant because they offer security from detection. They vary greatly in drainage qualities, fertility, and pH. The drainage qualities of forest soils depend on the depth of the humus layer and the structure of the underlying subsoil. But most of the forest remaining in the U.S. is sloped, and water that is not absorbed by the soil runs off.

Soils are created in forests from the leaves, branches, animal droppings, etc., which accumulate on the forest floor. The first trees to grow are long-leaf pines, such as jack pines, which can grow in relatively infertile soils. Their roots penetrate deep into the subsoil to obtain some nutrients. Short-leaf pines, conifers, and firs appear as the humus accumulates, since they require a more fertile soil than long-leaf pines. Pine-forest soils vary in fertility from poor to fair, and are usually quite acidic. In the Northeast their pH may be as low as 3.5, but generally the pH ranges from 5.0 to 6.0. In order to support a high-energy, lime loving crop like marijuana, they require fertilisation and liming. Long-leaf pines sometimes grow in compacted clay soils, which also requires tilling.

As the soil evolves, deciduous trees (tree that drop their leaves each winter), such as oak and maple, may begin to grow. Deciduous forests, sometimes called broad-leaf or hardwood forests, have the best soils. These forest floors are covered with bushes, grasses, mosses, and other small plants. They have an adequate rainfall and a humus-rich soil, which is porous, holds water well, and can support a healthy marijuana crop, although additions of nitrogen fertilisers would probably spur growth. Hardwood forest soils have a pH range from 6.0 to 7.5. The soil in timbered forest land has a much smaller humus content, especially if it has been clearcut.

Mountain Soils and Washed-Out Steep Areas

Mountain slopes characteristically have little soil matter; their surface is composed largely of rocks, gravel, and sand. For longterm use they could be terraced so the newly formed soil is not washed away, but most growers are interested in more immediate results. These "soils" do not provide much of an anchor for marijuana's taproot and do not permit a network of lateral roots to form. Many of these soils also suffer from a low water table, since they drain rapidly. But there may be some sand and a bit of organic matter built up along gullies or in depressions or other natural traps. Such soil has usually had most of its nutrients leached out, but may contain some phosphates and potassium and considerable amounts of trace elements. The easiest way to adjust these soils is to use a well-balanced, slow-release, concentrated fertiliser. Bloodmeal, with its high N, works well with these soils.

One grower in the badlands of North Dakota used a timed-release 32-9-26 fertiliser in his "rock garden." He spread it just below the surface at the beginning of the growing season. Every time that it rained, his plants received nutrient-rich water. Toward the middle of the season, he noticed the lower leaves begin to pale, so he fertilised them periodically with urea. Heavy rains leach soluble fertilisers away, and in rainy areas they need to be applied three to four times during growth.

Containers can also be used in this environment. Growers use plastic bags or folded milk cartons instead of backpacking with a column of containers. When they get to the site, they fill the bags with a mixture of sand, as much as they can find, and gravel. The greater the ratio of sand to gravel, the longer the container will hold water.

One grower doublelayers heavy-duty polyethylene bags, and lines them with heavy-duty paper cement sacks or burlap bags. He fills the bag with gravel, then pours in sand and shakes it. He says that the mix is just about right when it looks like a can filled with gravel with sand in the spaces. He carries on a watering and feeding program much as he would for any hydroponic system.

Swamps, Marshes, or Bogs

These soils are very high in fibrous organic material, but are low in calcium and in available N, P, K, and Mg, which are leached from the soil or are insoluble because of the low soil pH. Since these soils are constantly wet, Cannabis roots cannot come in contact with air; as a result, the plant's growth is stunted, and the lower stem becomes susceptible to stem rot. These soils need to be adjusted to support a healthy crop of marijuana; they must be drained, fertilised, and limed. On a small scale, the easiest way to modify them is by constructing raised mounds, hills, or rows, at least one foot wide at the top and two feet high. The raised areas drain well, leaving relatively dry soil. Wood chips, chopped brush, sawdust, or perlite may be added to keep the mound light and the soil loose and aerated.

Wet soils are usually highly acid and should be limed. Once the lime interacts with the soil, nutrients which were locked up become available to the plants. Since these soils are rich in organic matter and have a high rate of microbial action after they are loosened and limes, they may need

little fertilisation.

Grasslands and Fields

These soils are usually fairly fertile and can support a worthwhile crop with little effort. They are usually well-drained, although they may be a little too dry or too wet. (If they have unusually large numbers of earthworms, they are probably a little too wet.) Their pH is usually between 5.5 and 6.5, although it may range up to 7.0. These soils are usually loams, which need only tilling in a two-foot radius, three or four inches deep, around each plant. All weeds and grass should be pulled from the area. Some growers mulch the cultivated area with newspapers, leaves, or dead grass. A grower in the Midwest adds crushed eggshells and a commercial timed-release fertiliser when he plants. He feels that this "extra boost" makes the difference between an adequate crop and a bountiful crop. Other growers periodically fertilise with soluble mixes. Some of these soils have to be irrigated during the long summer droughts. If they aren't, the plants won't die, but they will not grow to full size.

Stream Banks and Canal Ditches

These are some of the most convenient areas for growers to plant, since they provide an ample supply of water, which may contain fertiliser runoff. Stream banks are an area that marijuana naturally colonises, and the planter usually needs only to cultivate the area to be sown, and cut surrounding bush so that the young plants can compete with established plants. If the surrounding vegetation looks pale and stunted rather than lush green and vigorous, the soil should be fertilised. These soils are sometimes low in calcium, which dissolves readily in water. Lime should be added to correct for acidity.

Sometimes the ground is a little too wet early in the growing season, although it dries out later on. Planting on hills or mounds is often used to solve this problem.

Arid Areas

Soils which have a low water table and dry out by June or July need to be irrigated to grow marijuana successfully. When irrigation is not feasible, growers plant along drainage ditches, streams, and canals, or look for green spots which indicate springs or underground reservoirs. Other growers use containers to minimise water loss. One grower in Arizona dug holes two feet wide and three feet deep, and lined the sides with thin polyethylene. He said that when he watered during the summer drought, he did not lose much water to the surrounding soil.

Arid soils usually have little organic matter, and drain quickly with extensive runoff. Some of them have a subsurface layer of clay, and therefore hold water on the surface until it evaporates. In any case their texture can be improved greatly by working in organic matter. The soil should be loosened at least two feet down. This loosening allows the taproot to develop deeply so that it can reach underground water during the drought.

Arid soils more often drain well, are alkaline, and contain P, K, and trace

elements, but are low in N. Fish meal, cottonseed meal, blood meal, or manure may be the only additive the soil needs.

Chapter 14

PLANTING AND TRANSPLANTING

After the soil is adjusted, you are ready to prepare it for planting the seed. Sowing is an important process, since the post-germination or seedling stage is the most critical for Cannabis. You can increase the seedlings' chance of survival by sowing the seeds properly.

14.2 When to Plant

Most hemp-growing manuals advise that the seeds should be planted about two weeks after the last threat of frost, which is the same time that corn is planted. As a rule of thumb, you need not plant until this time in areas that have a growing season of five months or more. These areas include most of the United States, except for Zone One (see Figure 62) and mountainous areas of the country.

Growers in northern areas report that plants have survived light evening frosts with little or no damage. We think of marijuana as a tropical plant, experiencing no chills in its native climes. But the mountainous areas of marijuana cultivation in Mexico and Colombia often have frosts during the growing season. One grower, describing spring (April) conditions in Nebraska, reported "plants (from tropical seed) three and four inches tall were covered with snow in the evening. By midafternoon all the snow had melted, and those little sprouts were healthy as could be."

Early-season sprouts do face more risks than later-germinating plants do. A lingering freeze or chill can weaken or kill them. Sometimes seeds or seedlings get washed away by heavy rains or flooding, or become infected from wet soil. They are also prey to hungry herbivores, who savour the tender young shoots, especially in the early spring, before the native plants have sprouted. These predators include rabbits, groundhogs, rats, mice, and possibly squirrels and cats, as well as large animals, such as deer, cattle, and sheep. Birds frequently eat the seeds and young shoots, especially if the ground looks planted. Snails and insects, such as cutworms and leafhoppers, also eat seedlings. Don't let this impressive list of dangers dim your enthusiasm. Although these problems do occur, they can be controlled or prevented with a little bit of planning (see section 16). {Figure 62. Average date of last expected spring frost for US.}

As you can see in the Spring Thaw map (Figure 62), the last date of expected frost varies from early February in parts of Florida, Louisiana, Texas, California, and Nevada to mid-June in the coldest regions of New England and the Midwest. Planting time varies locally, as well as regionally. Fields which receive direct sun warm faster than partially shaded ones. Fields covered with a layer of compost or fresh manure, or with black plastic sheets, retain more heat and are ready to plant sooner than other fields. Mountainous areas often vary considerably in planting time. Higher ground usually stays cold longer than low-lying areas. Since soil is dark, it heats

quickly when exposed to sunlight. Soil is usually warmer in the late afternoon.

The time that the soil warms also depends on the weather. During severe winters, a deeper layer of soil becomes frozen than during mild winters; so it will take longer to thaw. Soil below this layer is insulated by the ice and remains unfrozen. Spring weather, rainfall, flooding, and cloud cover also affect the soil's temperature.

Actually, the only way to know whether or not a field is ready to plant is to feel it and look at it. Examine the soil in early morning. It should be easy to work, rather than hardened from ice. There should be no large frozen clods of soil or other organic matter. There should also be no fine crystalline ice particles which glimmer in sunlight.

For fall harvest, sow outdoors after March 21, the first day of spring and the turn of the Equinox, when there are equal lengths of sun-up and sun-down. There are an additional 20 to 30 minutes of light before dawn and after sunset, for a total of 13 hours of daylight. When plants are started earlier, they may flower prematurely because of the short days. The plants may also be subject to sex reversal, and more males may develop.

There is little advantage to starting Cannabis before April. Each plant has a certain genetically defined potential for growth and size. As long as the plants have enough time to grow and develop, usually five or six months, this potential is realised (some Colombian and Asian varieties may need longer to develop). Plants started before spring grow no larger in size than plants started during April. The younger plants are virtually indistinguishable from the older ones by harvest, and plants which are started earlier face more risks of detection and destruction. {Figure 63. Average date of earliest expected fall frosts for the US. Information about Australia can be found in an Atlas.}

However, if you are faced with a short growing season, you can get a head start by germinating the seeds a week to six weeks before the local planting time, and transplanting the seedlings outdoors at about the same time seeds would be planted in your area. You can also hasten planting time by covering the area to be sown or planted with a clear (or black) plastic sheet, which will warm the ground by the greenhouse effect.

14.3 Preparing to Sow

Growers use three basic techniques to sow marijuana: rows, hills, and broadcast. Each method is suitable within a certain range of conditions and has its own advantages and disadvantages.

Rows

Rows are convenient to use, especially for large areas. They are constructed easily using a hoe, plough, or tiller.

Rows facilitate the care of gardens and fields by setting up an organised space in which the plants and surrounding area can be reached easily by the gardener. Weeding, watering, thinning, pruning, and harvesting can be

accomplished very quickly. Larger fields are planted in rows to accommodate ploughs, planters, and cultivators. They are essential when fields are flood-irrigated. Furthermore, they provide a way to use space in the most efficient possible manner. But rows make detection easier, since they have an orderliness that plants do not exhibit in nature.

On sloping and hilly ground rows are a major factor in soil conservation: such soil is easily carried away in windstorms and in the runoff after rain. For this reason, rows on hilly and sloping ground are contoured: curved to run perpendicular to the slope.

Space rows two to six feet apart; plant seeds every four to eight inches ((In any description of planting which we give, we refer to 100 percent viable seeds. In this case, for example, if seeds are tested (see section 3) and have a viability of 50 percent, sow the seeds two to four inches apart. If they have a viability of 33 percent, sow them one to two inches apart.)) (See Box H.)

To construct a row, break up any large clods on the surface of the soil. In a garden-size area this is easily done by striking them with the tongs of a rake. In larger areas a tiller or externally powered cultivator can be used. Then level the soil.

If you need to irrigate or have problems with excessive moisture, use a hoe to raise the soil in alternate rows of hills and trenches. Pat the crests of the hills with the hoe or a shovel so that they are an inch or wider at the top, and four to eight inches high than the trenches.

BOX H Plant Size and Spacing

Plants vary tremendously in size and branching habits because of many factors, including variety, soil fertility, length of growing season, amount of light received by the plant, water, spacing, and pruning. As a result, one can have no firm rule about how far apart plants should be spaced.

An individual full-grown plant may have a diameter at its base as wide as ten feet or as small as 18 inches. Most conical-shaped varieties (Colombian and Jamaican) grow between seven and 12 feet tall, and have a width between four and six feet. Mexican plants are somewhat taller and thinner, with a base diameter of three to five feet. Some exotic Indian, Central Asian, and Central African plants may have a diameter only one or two feet across. The descriptions are generalisations; there are many varieties within each country, and much variation within each variety.

Pruned plants have a much wider base than unpruned ones. Plants pruned at the fourth internode and again a month later sometimes grow twice as wide as an unpruned plant.

In order to catch as much sun as possible, rows should be orientated along a north-south axis, perpendicular to the course of the sun. The advantage of lush rows is more pronounced in southern than northern latitudes, but the solar-energy differential in north-south versus east-west rows is significant at all latitudes in the United States, and becomes more important on steep slopes. Another factor is the orientation of the garden as

a whole. Plants sown in a square plot whose sides point northeast and southeast get about 10 percent more light than ones in a plot whose sides point due north and due east.

Hills

Hills and mounds are especially convenient for small plots. Low hills are often camouflaged to look like natural or wild stands, and are very useful in areas in which the land is too wet in the spring, because the hills drain above the ground level. They are easily adapted to meet unusual requirements. For example, a grower in New Mexico planted a doughnut-shaped hill eight feet in diameter and two feet thick, leaving a centre hole four feet in diameter. He placed a portable plastic tub in the hole after punching pinholes around the edges. To water he just filled the tub. In the swampy Everglades, two industrious farmers constructed a giant hill-row three feet thick and three feet high. The hill had such a good drainage that it kept the plant roots well-drained even during the rainy season.

Hills are usually constructed between two and five feet in diameter. Small hills are usually planted with 15 to 20 seeds, and large ones may be sown with as many as a hundred. The hills are spaced three to 10 feet apart, so that each groups of plants gets a maximum amount of light. Hills can grow more than you would at first suspect. For instance, if you were to grow a hill three by three feet, you could harvest six to nine large plants. Their foliage would extend two and a half feet beyond the hill, for a total of about thirty square feet of foliage space.

Broadcast Seeding

Broadcast seeding is the fastest and easiest way to sow, but is not an efficient way to use seed. Seeds are simply tossed or shaken onto the prepared ground, at the rate of about forty per square foot, and are then usually pressed into the soil with a light roller or by foot. This method is most effective in moist soils. Many of the seeds never germinate or die immediately after germination. The faster growing ones naturally stunt the others by shading them. This method is often used by guerilla farmers who want the stands to look natural and who wish to plant large areas quickly. An experienced grower can sow several acres a day by hand using this method.

Seed Count

There are approximately 2,300 medium-sized seeds in an ounce, or about 85 per gram. An acre is about 43,000 sq. ft., or a square 208 feet on side. To plant an acre in rows two feet apart with a seed every four inches requires about 90,000 seeds or 39 ounces (1,100 grams, or two pounds, seven ounces). At this rate, a ten-by-ten plot requires about 2.5 grams of seed.

A typical hill field has four-foot-wide hills spaced about seven feet apart. A typical hill and surrounding area accounts for approximately 100 square feet. There are approximately 430 hills in an acre. If each of these is planted with 100 seeds, the field requires about 43,000 seeds, which weigh about 18 ounces.

Broadcasting requires a lot more seed. At the rate of 40 seeds per square

foot, a grower uses about 2.3 ounces in a ten-by-ten plot. An acre requires about 47 pounds, or 21 kilograms of seed.

How to Plant

Finally, after the soil is adjusted, and the rows or hills are built, it is time to actually plant the seeds and watch your garden begin to grow. If you are growing with clover as a cover or companion plant, dig it up to a depth of four inches and chop up the soil. Water the soil to the point that it feels almost wet. Drill a hole with a seed drill, stick, or pencil, then drop one seed into the hole, cover it gently, and pat the soil down again. Marijuana seeds are large enough to handle individually; so each one can be planted separately.

How deep one digs the holes depends on the kind of soil in which one is planting. Light woody or organic soils are planted 1/2 to 3/4 inch deep, so that the stem is held firmly in an upright position. Sands and light loams are planted 1/2 inch deep. Heavy loams and clay are planted 1/4 to 1/2 inch deep, so that the sprout's energy is not expended before it breaks through the soil.

If you are broadcast seeding, you can increase the germination rate tremendously by screening a layer of soil over the seeds to help keep them moist. Seeds that dry out weaken or die.

In a garden that has been mulched, lift away the mulch cover at each place you plant, and sow the seed in the underlying soil.

In soft-textured soils, instead of digging or poking holes, press each seed to the desired depth, and cover or pat the soil smooth.

14.4 Germination

The seeds need constant moisture in order to germinate. Therefore, the ground should be well-watered. Keep the soil moist by watering it with a light spray whenever it begins to feel dry. This may mean watering the immediate area once a day. You can keep the soil moist and hasten germination by covering the planted area with transparent glass or plastic. Most of the seeds should sprout in a period ranging from three days to two weeks. This variation depends on variety, age and condition of seed, and soil temperature; the warmer the soil, the faster the rate of germination.

Once they have germinated, the seedlings should be kept moist until the roots grow deep enough to absorb an adequate supply of water from the subsoil. If the ground is still moist from spring rains, as it is in many of the eastern regions, you may not have to water at all. On the other hand, there are sections of the West which are completely dependent on irrigation.

When the seedlings are only an inch or two tall, you can protect them from heavy rains or frosts by using drinking glasses, jars, or paper or plastic cups. You can protect larger plants with containers from which the bottoms have been removed. Transparent containers warm the soil by the greenhouse effect, capturing light and turning it into heat. In warm weather, use white or translucent containers, which prevent burn by reflecting some light and

diffusing the rest. Containers also keep the soil moist, serve as plant markers, and protect the plants from some enemies. A grower in Berkeley, California, used cracked fish tanks to protect plants in the early spring. A guerilla farmer in the Poconos puts up four posts, one at each end of a row. She uses them as a frame for clear polyethylene covering, creating a small greenhouse.

Growers in Zone Five sometimes harvest a spring crop by transplanting indoor-grown, two-month-old plants outdoors right after the last frost date. The naturally short days and long nights trigger the plants into flowering. (See Transplanting below, and the discussion of the photoperiod in section 3.)

If started after May 15, marijuana may not have time to reach its full size or flower. This problem mainly affects growers in Zone One and in mountainous areas. But even if the plants do not grow to full size or flower, you can still harvest a potent crop of preflowering tops, which may be almost as potent as ripe buds. The harvest is not as large as a crop of buds, but it is more than worth the effort.

14.5 Transplanting

Seedlings and young plants are transplanted after the last threat of frost. If the growing season in your area is less than five months, you may want to start the plants indoors, or in cold frames, transplanting when the weather permits. A 10-by-four foot cold frame can easily hold 60 two-month-old plants. The cold frame can be constructed with two-by-two's or branches gathered at the site. Cover the frame with a double layer of six- or eight-mil polyethylene plastic or similar material. Attach the plastic to the frame with tacks or staple-gun tacks. If the area is unprotected from the elements, slant the roof so that rain will run off. If the area is windy, place rocks or branches along the frame to add weight. Orient the cold frame to face the south.

In areas with a growing season of six months or more, plants will not necessarily get larger if they are started earlier than normal. Plants started at normal planting time catch up to the older plants by season's end. It serves no purpose to start plants before about March 21, the spring equinox.

Where there is no threat of frost (in Hawaii, southern Florida, and parts of Texas, Louisiana, and California), growers can raise a winter crop. Grow the plants for two or three months under artificial light. Plants get off to a faster start under artificial lights than natural light during the winter months. Move or transplant them before the beginning of March. Most strains will flower because of the short days (less than 12 hours of light) and fill out to well formed plants by the end of May when they are ripe.

For the normal summer crop, seedlings should be transplanted after the last threat of frost. The best time to transplant is on a rainy or cloudy day, which allows the plants to adjust to the new environment without the strain of intense sunlight. Plants grown in a cold frame or sunny window adjust more easily than plants grown under fluorescent lights. Plants grown under artificial light usually show evidence of shock when they are moved to

sunlight. Near sea level they may lose some of their green colour and appear pale or yellowed. At high altitudes, such as mile-high Denver, the leaves may actually burn, turn brown, and fall. Healthy plants usually recover quickly by adjusting the new growth to the changed conditions. However, plant can be conditioned to the new environment by being placed in a partially sunny area, preferably where they are shaded during the middle of the day and receive either morning or late-afternoon sunlight. The plants need about a week to adjust.

Seedlings grown in planting pellets for up to 10 days after germination can be placed directly in the soil. Peat pots should be scored with a knife so that the lateral roots can penetrate the pot more easily. Seedlings started in milk cartons or flower pots should be removed from the container so that the roots are disturbed as little as possible. Plan on using a pot size which is root-bound by the time that you transplant. (For the relationship between pot size and number of weeks, see Table 17.) To transplant, water the area to be transplanted and the plant. Then dig a hole a bit larger than the pot and loosen the surrounding and underlying soil. Place the plant in the hole, and pack the soil so that the stem base is at the same depth that it was growing at before. Firm the soil and water the area.

In areas where ripoffs are expected, such as parts of Hawaii and California, some guerilla farmers transplant individual plants (one to each site) to sites which are widely spaced over the countryside. In this way they may lose some, but at least not all, of their plants to ripoffs.

Each plant (one to three months old) is transplanted to a cone-shaped hole, two to three feet deep by two feet across the top. This strategy is well-suited to areas with poor soil. Since much of the hole is taken up by rootbound soil, it is easy to gather enough topsoil and sand to fill the hole. The gathered soil should also be mixed with organic or slow-release fertilisers which provide ample N and P.

Chapter 15
CARING FOR THE GROWING PLANTS

15.2 Weeding

Marijuana is a fast-growing annual whose survival depends on its ability to compete with other fast-growing weeds. At the end of each season, plants growing in a wild stand may cover the ground with thousands of seeds per square foot. Many of these are relocated by wind, runoff, and birds, and some are destroyed or die. Other never receive the conditions they need to germinate; and of those that do germinate, many die as seedling. The remaining plants compete with each other and with other weeds for the available light, nutrients, and water. Even so, wild stands may be as dense as forty plants per square foot. In order to survive the competition, Cannabis expends a great deal of its energy during the first two month growing a main shoot which is taller than the surrounding vegetation. Then it develops lateral branches which shades the shorter plants. With their source of energy - light - cut off, the shaded plants stop growing and often die.

When you cultivate - that is, eliminate weeds - the rate of germination and survival of your plants is increased enormously. Growers using clover, sheet composting, or mulch as ground cover can expect very little interference from weeds during seedling development. But plots of fertile, aerated, and cleared soil are open to colonisation by a wide range of plants; so you may have to weed several times before the marijuana's dominance is assured.

When you weed, make sure not to pull out any weed seedlings which may have roots in the same area as the Cannabis roots. Instead, cut the weeds slightly below the surface with a clipper, scissors, or your fingernails. Weeds more than six inches away can be safely pulled. Leave them to dry right on the soil. As they dry and decay, they return the soil's nutrient to it.

Growers plagued with weeds can cover the soil with mulch, paper, or polyethylene sheets. One grower found that two computer sheets fit exactly between the rows. Another used torn drapes as a temporary ground cover.

Once Cannabis has established dominance over an area, the other weeds are not able to interfere with its growth. But if there is wide spacing between the plants, the weeds may have open space and start to grow rapidly. Keep these weeds clipped short if water or nutrients are scarce.

15.3 Watering

Marijuana requires an ample supply of water to live and grow. The actual quantities that it needs depend on the plant's size, the gardening techniques, type of soil, temperature, wind, humidity, and intensity of light. A vigorous plant may transpire several gallons of water a day during the hot summer months. If it receives less water than it needs, it stops growing, wilts, and then dries out. {Figure 66 Areas with less than 30 inches of rain usually require some irrigation.}

Seedlings

Marijuana germinates best in a moist soil. Within a week, it grows a taproot three or four inches long. By the end of the first month, the root system may stretch over an area a foot and a half in diameter and go more than one foot down. Until then, the soil should not be allowed to dry out. Plants which have germinated during warm, sunny weather may need to be watered until the roots have grown deep enough to reach sub-soil moisture. When the soil three inches below the surface feels dry, seedlings should be watered, preferably by using a watering can or the spray setting on a hose. Gently water the soil, making sure not to disturb the seedlings or the soil surrounding. The soil should be thoroughly saturated so the moisture percolates down, encouraging the roots to grow deep. If the surface is only lightly watered, the roots may grow near the surface, leading to water problems as the soil gets drier during the summer.

After the first month, Cannabis does best when the soil goes through alternating moist and dry periods. This alternation allows the lateral roots to come into contact with air. By the end of the growing season, the root system may penetrate the soil to a depth of six feet or more. As long as

they are not blocked by solid rock or dense clay, the roots grow by following a trail of moisture. If the trail leads deep, the roots follow. The deeper layers of soil are less likely to dry out during hot, dry weather.

Older Plants

As a rule of thumb, Cannabis over a month old should be watered when the soil about six inches deep feels dry. But this rule provides only a rough indication that the plants need water, because there may be deeper sources of water that are not apparent. The most obvious indication of a problem is wilting. A more subtle one is slow growth during the (ordinarily fast-growing) vegetative stage.

Since you want to wet the lower layers, you should thoroughly saturate the soil. If the soil is completely saturated, it should hold water for a minimum of a week. Usually only two or three waterings a month are required by a garden that is completely dependent on irrigation.

The most efficient way to water is to let the water slowly seep into the soil, so that all the organic particles which hold the water are saturated. If the soil is very dry, and the water beads or runs off and is not absorbed, add household laundry detergent at the rate of one or two grams per gallon of water. It acts as a wetting agent, which breaks the surface tension. Once the soil is treated with a wetting agent, it usually absorbs water throughout the growing season.

In drier areas where corn, cotton, and other deep-rooted crops are irrigated, marijuana also requires an additional source of water. But in areas where there are patches of wild hemp or where deep-rooted crops grow by using available ground water, marijuana does not need to be watered, although additional water may increase its growth.

Box I

Water in General

Deep soil layers retain water much longer than the top layers. To encourage the development of a deep root system, saturate the ground when you water. The roots follow the moisture trail.

Water conditions also vary from field to field. For instance, many mid-western farmers plant along the banks of meandering streams. Even in dry areas, these plants have a natural source of water. Mountainous areas are usually well-drained and dry out before valleys do. Low-lying fields remain moist later, and are saturated by runoff from higher ground. In browned areas, farmers look for green spots which indicate underground streams, springs or runoff. Planters look for deserted wells or active water mains with leaks. Fields high in organic matter retain moisture longer than other fields, and mulching may cut water evaporation by 50 percent.

Watering Techniques

Gardeners may supply water by using a bucket, can, or water-hose. But growers with larger plots often rely on waterpumps to deliver river, lake,

or well water to their gardens. Irrigation canals, drainage pipes and ditches, and water mains are sometimes convenient sources of water. The two most efficient methods of watering are the drip hose, which seeps water around the plant, and hand watering into an enclosed area around the plant's stem.

There are several kinds of drip hoses. Some have perforations every three to six inches along their length. These are useful when marijuana is planted in rows or large hills. Another kind is actually a kit, consisting of a main feeder hose and several side hoses two to four feet long. Each side hose has a metal bulb at the end which can be adjusted to regulate water flow. The bulb lies near the plant stem. A drip bottle was invented by a grower in the dry area of Nebraska who was only growing a few plants. He punched pinholes in the bottom of several one-gallon milk jugs and placed a jug near each plant. The jugs slowly watered the garden. Every few days, he refilled the jugs from a nearby irrigation ditch. As the plants grew larger, he placed more jugs around them. The drip method moistens the soil slowly, but does not flood it; so the soil and its nutrients are not washed away. Since this method allows you to decide exactly where the water goes you need not waste any on non-productive land.

Growers sometimes use elaborate setups, such as battery-electric, hand- or foot-powered, ram- or windmill-driven pumps. Foot-powered pumps are probably the most convenient for small plots. They are extremely lightweight (just a little heavier than a bicycle), inexpensive, easy to construct and disassemble, and virtually silent. Since you have much more power in your legs than in your arms, foot-powered pumps can do more work, and do it faster, than hand-powered pumps.

Electric pumps are relatively quiet and pump an enormous amount for their small size. But they require a source of electricity. They cannot be used unless there is a power line available, although there are car alternators available which produce 110-volt current.

Gasoline pumps and electric generators are heavy and noisy. Even with a muffler, they can be heard for miles in some country areas. They require a source of fuel, and often an elaborate setup, including rigid feed tubing, fuel tank, and platform. But once they are in place, they can deliver a tremendous amount of water. They are usually used by farmers growing large plots. Sometimes growers dig a hole in which they store and run the equipment. This setup helps muffle the sound and keeps the machinery in good working order.

Ram- and windmill-powered pumps use running-water and wind energy, respectively. They come in many sizes and are often used to fill water tanks for later use. They can also be used to generate electricity to run electric pumps. They require no fuel, are usually silent, and can be constructed inexpensively.

But some farmers have devised other methods for getting water to their plants.

A farmer growing near Tucson, Arizona, trucks water to her plants twice a week using a pickup truck and four 55-gallon barrels. She attaches a garden

hose to her tanks, and siphons the water to her garden, 200 feet downhill.

Two foresighted farmers in Texas carried twenty 30-gallon plastic trash cans and lids to their garden. During the spring rains, they filled the containers from nearby gullies. By the end of the rainy season, they had collected enough water to carry them through the summer drought.

A homesteader in Oregon's dry eastern section dammed a gully by using an earth stabiliser, plastic, wood and cement, and pipe. During the winter his private reservoir filled.

Farmers near Atlanta tapped into a city water main. The pressure from the water main allowed them to pipe water uphill.

15.4 Thinning

If the soil is kept moist during germination, most of the viable seeds that you planted will germinate and the seedlings will soon start to crowd each other. This happens frequently when the plants grow on their own. Then they grow into a dense hedge-like mass dominated by a few plants. The dominant plants typically have long internodes and a long sturdy stem with little branching. The shorter, bushier plants are shaded by the taller ones and become stunted from the lack of light. By thinning, you give the plants that are left enough room to grow to their full potential, and you choose the ones that you think will grow to be the best for smoking. Leave the plants that have dense foliage, are branching, and, later in the season, the ones that are the most potent.

Thin the plants as soon as they begin to touch or crowd each other. This should be repeated as often as necessary. Seeds sown six inches apart in rows two feet wide require thinning several times during the season. But guerilla farmers sometimes let the plants compete so that the garden looks more like a wild stand.

There are two methods used to thin: cutting the stem at the base so that the entire plant is destroyed, and cutting just the tops so that the plant's growth is thwarted, and the uncut plants shade it. The cut plants remain relatively inactive, and do not use much water or nutrients, but they do shade the ground and use otherwise wasted space.

15.5 Staking

Outdoor-grown plants rarely need staking. When the stem bends from the wind or rain, tiny tears in the structure develop. These are quickly mended by the plant: it grows new cells which increase the girth of the stem and make it stronger. But plants which are suffering from nutrient deficiencies or are top-heavy because of competition may need to be staked. Heavy rain sometimes cause the plants to fall over, especially if they have shallow root systems which cannot hold the added weight.

To stake, drive a sturdy rod six inches from the stem and deep enough into the ground to be able to give the plant support. Then tie the stem to the stake with wire twists or string.

If the stem or the branch is cracked, pinched, or bent at the base, its position should be corrected and held firmly with a splint. The splint can be held with masking tape. In a few days the plant grows tissue to support the damaged area.

15.6 Pruning

Growers prune (clip or top) their plants to increase productivity, prevent detection, or to harvest early smoke. In the near future, new laws will decriminalise or legalise marijuana cultivation. These laws will probably limit legal cultivation either by the total gardening area or by the number of plants an individual or group may cultivate. Gardeners limited by space will maximise yield by cultivating a dense stand of tall, unclipped marijuana. Growers permitted to grow only a few plants will grow the largest, most productive plants possible. This is done by giving the plants the best possible growing conditions and a lot of space between plants to maximise light and minimise competition for water and nutrients.

Unpruned marijuana develops in one of three classic shapes, depending on variety. Many Mexican and Thai varieties develop into a tall, narrow bush no wider than three feet and shaped like a poplar tree. Colombian, Cambodian, Indian, and some south Mexican and Vietnamese varieties are Christmas-tree shaped. Some Moroccan and Afghani varieties have complex branching and naturally grow into small, dense bushes, about five feet tall. Marijuana usually grows to its full height by early September. Most of the marijuana plants you are likely to cultivate will grow to between eight and fifteen feet tall. Some Hawaiian and Thai varieties average between twelve and twenty feet tall.

Increasing Yield

When marijuana is clipped to increase the number of growing shoots, the total yield at season's end may not be increased. Provided that soil and water are not limiting to growth, each plant can reach a maximum size when given enough room. The more surface area the plant presents to light, the closer it will get to its maximum potential. Where the plants are grown with much space between them, clipped plants can yield more than unclipped plants, especially if the branches are spread out to maximise the light on the plant. When the plants are grown close together, the taller a plant is, the more sunlight it will receive, and hence the larger the possible yield.

Some growers prefer to harvest a top stem that is thick with buds (colas). The largest colas form on the main growing shoot of unclipped plants. When the growing shoot is clipped from a plant, the new shoots and leaves grow slower and smaller than the main shoot of an unpruned plant because the capacity for growth is spread out over several shoots. When a plant is clipped early in the season, most of the difference in lead and bud size is made up by harvest time.

Marijuana can be pruned at any time during the seedling or vegetative growth stage, but you should prune plants when they are young if you plan on harvesting growing shoots during the season. A seedling clipped anywhere from the fourth to sixth node will usually form at least six strong growing shoots that can be harvested during the third or fourth month. If these

shoots are cut again while the plant is still young, marijuana often develops into a small, very compact, hedge-like bush.

Yield can be increased by spreading the plant's branches so that more light reaches the inner growth. Cannabis stems are bent most easily when they are still green and fleshy, nearer to the new growth, but the whole plant can be bent to form a gentle arch with the top of the main stem in a horizontal position. Within a few days the side branches along the top will begin to grow vertically, competing with the main stem. They will soon develop their own horizontal side branches. To bend a plant, tie the main stem loosely with a cloth or heavy string. Tie the other end of string to a heavy weight or anchor on the ground. Don't put too much pressure on the stem as this tears some of the roots and weakens the plant. You can bend the plant a little each day until the plant is in the desired position.

You may also increase yield by bending only the growing tip. This encourages the side branches to develop sooner than they naturally would. Only the flexible part (about the last foot) is bent. To bend the top, use stiff wire or wire twists used for plastic bags and wrapping vegetables. Fasten the other end of the wire lower in the stem to hold the tip in position. {(See Figure 49.)}

A common mistake that cultivators make is pulling off the large leaves on the main stem (sun or fan leaves), when the plants are young. These leaves are removed by cultivators who believe that their removal will cause the undeveloped side shoots to grow. But fan leaves are net producers of sugar and energy, which are used by the side shoots to begin growth. Rather than encouraging new growth, the removal of fan leaves slows growth. The plant will also be more susceptible to attacks from pests and predators.

When the plant is several weeks old and growing well, the difference between plants with their leaves removed and those left intact may not be large. The biggest difference can be seen when leaves are removed from branches just prior to, or during, flowering. The buds that form from leaf axils with leaves removed are noticeably smaller than those where the leaves have been left on the branch.

Detection

Cannabis can be detected from both the ground and the air. From the ground, marijuana is revealed by its familiar shape, unmistakable leaves, and odour. Tall plants are usually more conspicuous than shorter ones. From the air, stands may have a different colour than the surrounding vegetation, especially where natural vegetation is not as lush as marijuana. Individual plants usually have a circular profile when viewed from above; this can be altered by bending or pruning the plant. Varieties which are naturally tall-growing may need to be cut several times during the season to keep them hidden.

Plants are sometimes cut back severely, to much as half their height when they get too tall, but this may damage the plant. A less drastic topping technique is to remove the top foot of growth. Whenever new shoots get too tall they are clipped. But the plants should not be severely pruned late in the season when the growth rate has slowed (preflowering), because there

will be fewer branches left on which buds can develop.

If you are trying to conceal plants behind a fence or wall, start bending or pruning the plants early, at about one month of age. By starting early and continuing to prune during the vegetative growth stage, you will train the plant to branch and fill up the area. If you wait until the plants are already tall, you may have to cut the plants back severely or clip shoots continuously.

15.7 Gardening Tips

Transplant Older Plants

A friend of ours was warned that his garden had been spotted by local authorities. Rather than cut down his four-month-old plants, he decided to transplant them. He dug the plants out, leaving a ball of soil about two feet square around the roots of each one. He wrapped each soil ball tightly in a plastic bag to transport it, and placed the plants in newly dug holes in a different spot. He kept the plants well-watered. After a few days, they recovered from transplant shock and started to grow once again. Transplanting large plants is not easy to do, but it could save a crop. The marijuana root system is not very extensive when the plants are in fertile soil with plenty of water; the tap root may only be six inches long on a ten-foot plant.

Wind Protection

Hemp Cannabis planted closely together has been used by farmers to form a windbreak to protect other crops. If you are growing in an especially windy area such as the Midwest, you may wish to plant a perimeter of tightly spaced Cannabis to protect your garden. Construct a rope and stick fence against the windbreak to hold the plants upright and prevent them from falling into the central garden. Simply keeping the plants clipped short is a simpler approach.

Inducing Flowering

Growers may wish to induce their plants to flower early, especially in the North, where the growing season is short. Plants in containers can be moved to a dark area for 12 hours of darkness or more per day. Black sheets of polyethylene film, dark plastic bags, and large appliance cartons can be used to provide periods of uninterrupted darkness. Use the dark treatment nightly until the plants are flowering (usually after one to two weeks of long-night treatments).

Winter and Spring Crops

In southern parts of the U.S., Hawaii and parts of California, you can grow more than one crop in a season. Greenhouses that stay above freezing can also be used for year-round growing. Plants started during the winter or early spring get naturally long nights and flower early, when they are relatively small, usually no more than four feet tall. Flowering can be postponed by breaking the long nights with short periods of light. This extends the vegetative growth period, yielding older, larger plants at

flowering. Start breaking the night period with artificial light when the plant is about a month old. Continue the treatment until you want the plants to flower. (See the discussion of photoperiod in section 3.)

Spring crops can be trimmed of buds when mature. The plant is left in the ground, and as the daylength increases, the plant will renew vegetative growth and flower once more in the fall. Plants can also be started in November or December indoors under lights and planted outdoors in February for harvest in April or May. The plants will grow faster under lights than they would outdoors under the weak winter sun. When they are placed outdoors, the long nights will induce flowering. By April the sunlight gets much stronger, perfect for flower development. Plants placed outdoors in February adjust easily to sunlight. Even so, they should be conditioned so that they do not suffer severe burn, as described in the Transplanting section in section 14.

Rejuvenation

Plants grown in areas where the weather is mild can survive winter when there are no heavy freezes. During the winter the plants will grow very slowly, but as soon as the weather warms, and the light gets more intense, the plants respond. This technique can also be used to obtain a second growth crop during Indian summers. The second growth is not as vigorous as the original, but it does increase the total harvest.

To prepare plants for rejuvenation, leave three or four pairs of lower branches with leaves on the plant when you harvest. The leaves need not be large, but they must be green. Water and fertilise the plants. Within a few days the plants will show new growth.

The authors observed an outdoor container composed entirely of plants which survived a mild San Francisco Bay Area winter. These developed healthy second growth the following summer and flowered again in the fall. Some growers in Hawaii claim that their plants are three years old and that the plants have yielded as many as six crops of buds. Perennial marijuana plants also grow in Jamaica and Thailand.

Water Deprivation

Many cultivators begin to limit the amount of water their plants receive as soon as the flowers start to appear. Other growers give their plants as little water as possible after the middle of the plant's life. The plants are given small amounts of water only when they begin to wilt. (See section 9 on the reasons for stressing the plants.)

Under water stress many of the leaves may die and fall from the plant. Sometimes the plants appear "burned," and turn brown or gold. At harvest, water-stressed plants may only have buds left on them and these may have the colour, resin, and harshness typical of Colombian grass. These plants yield less grass at season's end. Not only are they smaller overall, but many of the leaves will have fallen away.

Water stress can be difficult to control in areas with heavy summer rain. Water-stressed plants often make up for their smaller size by a rapid burst

of growth after a heavy rain. One method of control is to cover the ground with plastic sheets when it rains so that most of the water runs off.

Tacks and Nails

Some growers hammer nails or tacks into the stems of plants several weeks before harvest. Many growers use long thick nails; others prefer to use several half-inch-long tacks. The nails are usually placed at the base of the stem. This is supposed to "increase potency." {Figure 72. Wilted plant. Unless watered it will die.}

Stem Splitting

This is a popular way to stress used by cultivators in the United States. The stem is split (not cut) at the base to form a space through the stem. Growers place a rock, small piece of wood, an old Cannabis stem, or piece of opium (in Africa) in the split. Sometimes the wound is bound with cloth or plastic. We don't recommend this procedure, and advise you to be careful not to kill the plants and ruin the harvest.

Varieties

Outdoor growers are well-advised to plant several varieties of marijuana, because some varieties adapt to their new environment better than others. Also, each variety (and to small extent, each plant) has its own bouquet. By planting several varieties, cultivators assure themselves a varied selection of smoking material.

In areas with short growing seasons, many tropical varieties do not have a chance to flower. But immature material from these varieties may be more potent than mature flowers of a plant grown from seed of lower-quality grass. For instance, compare a flowering Mexican with a Colombian that doesn't. The Colombian may be better because the difference in varieties is so great. On the other hand, the Mexican may be better because it is flowering and has reached its full potential.

Intercropping

It is well-known that certain plants may be antagonistic to other species of plants, and that there are also beneficial relationships between species. Cannabis is known not to grow well among spinach 222. Although tomatoes and tobacco have been recommended as crops to avoid when growing marijuana, because of pests and diseases that these plants may harbor 67, marijuana grows very well in healthy tomato patches. Growers have also commented on how well marijuana grows when planted with corn, sugarcane, and beets.

Chapter 16 INSECTS AND OTHER PESTS

Outdoors, where it functions as part of an ecological system, marijuana is less susceptible to insect attacks than it is indoors. In an outdoor environment, insects are subject to the vagaries of the weather, food

supply, and predators. And marijuana grows so fast that insects usually do little damage. Plants, plant eaters, and predators usually maintain an equilibrium which minimises damage. But this balance is disturbed by tilling and gardening, and may take a while to re-establish itself.

The soil surrounding your plants may be teeming with insects, and it would be unnatural not to see some on your plants. Most insects do not eat marijuana. The few that do are the food which helps to keep a small population of their predators alive. Insects in the garden need to be controlled only when there is a real threat of damage.

Marijuana is most vulnerable in its early stages. After the plant increases production of the cannabinoids and resins at the eighth or ninth week, most insects are repelled. When the plants are small, an occasional munch affects a relatively larger part of the plant. That same bite affects a relatively smaller part when the plant is larger.

The insects that infect marijuana indoors - aphids, mealy bugs, mites, and whiteflies - do best in humid conditions with constantly warm temperatures. Outdoors they rarely inflict much damage on marijuana. The pests that are most likely to damage marijuana are leafhoppers, treehoppers, cucumber beetles, thrips, flea beetles, several kinds of caterpillars, snails, and slugs. The younger the plants are, the more susceptible they are to attack. Your prime goal is to protect the plants during the first two vulnerable months. You need to keep the pest population low, so that the damage is relatively light. The pests don't have to be eliminated, only kept under control.

There are many ways to keep pests from damaging your crops. These fall into one or more of several categories: biological control; capture traps and barriers; home remedies; and chemical insecticides.

16.2 Biological Control

The theory behind biological controls is that methods for control of pests can be found within nature. These methods are safer to humans and less damaging to the environment than commercial insecticides. Gardeners have many forms of biological control at their disposal, including companion planting, use of predators, and sprays made from plant extracts or ground-up insects.

Companion Planting

Some plants, including marijuana in its later stages, produce resins or essences which repel or kill plant pests. Some of them are general repellents that affect a broad range of plant pests; others affect specific species. Generally, the heavily scented plants, such as spices, mints, and other herbs, are most likely to have these qualities.

Some of the more familiar plants used to protect gardens are the Alliums, or onion family, with garlic, chives, green onions, and other oniony-type plants as members. This group repels a broad range of plant pests such as aphids, spider mites, flea beetles, potato bugs, bean beetles, and many other insects, as well as rabbits and some deer. They are easily planted

around the garden or between the marijuana plants. Just plant onion bulbs or the cloves from a garlic bulb so that the top of the bulb is about one inch deep. One garlic bulb yields quite a few cloves; so a large garden requires only a few bulbs.

Geraniums are reputed to repel leafhoppers and many kinds of beetles. These plants prefer a dry soil, thrive in full light, and usually grow two feet tall. Geraniums should be interspersed with the marijuana, or potted geraniums can be set out if problems develop. Tansy (*Tanaetum vulgare*) is a tall, fragrant, woody perennial which grows five feet tall. It protects against cut-worms, beetles, cucumber beetles, and other eaters and borers.

Mints repel many insects and are sometimes used as mouse repellents. They are especially useful for the control of the flea beetle. They thrive in semi-shaded areas with rich soil.

Marigolds can be planted to eliminate nematodes. They are fast-growing annual plants which flower profusely. They come in many varieties, ranging in height from six to 30 inches. They grow in a wide range of soils and do best in the sun. The scented varieties - usually nonhybrids - offer the most protection.

All companion plants must be planted close to the plants to be protected, since their repellent qualities spread only a short distance beyond their circumference. They are effective when they are planted before the damage is apparent, and offer long-term protection. They are used when a pest is expected. For instance, growers in the San Francisco Bay Area expect rose leafhoppers to attack their plants. Since geraniums grow in the area as perennial plants, some growers plant them permanently in the garden. As the geraniums develop into small bushes, the hoppers leave, never to return.

Predators

Many of the insects in your garden are called beneficials, because they perform a useful service in the garden. Some of them eat decaying matter; others help in the pollination process; and some pry on insects which damage crops. Almost everyone is familiar with the ladybug, which eats aphids and insect eggs and has a voracious appetite. They are available commercially by the pint. The praying mantis eats slow-moving insects. When it first hatches, it starts out on aphids and mites. But as it grows larger, it eats bigger insects and worms. Mantis-egg cases are foam-like, straw-coloured masses which contain 100 to 300 eggs. These cases are sold commercially but can also be found in the late fall in bushy areas. Another insect which is sold commercially as a plant protector is the green or brown lacewing. It has golden eyes, looks fragile, and flies erratically. But in their larval state, lacewings eat thrips, mites, caterpillar eggs, scale, leafhopper nymphs, aphids, and mealybugs. The trichogamma wasp is an egg parasite which lays its eggs in the eggs of over 200 species of insects, including many moths and butterflies which hatch into worm pests. *Cryptolaemus* is used to destroy mealybugs. Adults are released when mealybugs appear in the spring. They seek out the mealybug colonies and lay their eggs. When the eggs hatch the larvae wander around the infested area and eat the young mealybugs.

The use of commercially bred or gathered predators is most feasible in large

gardens or fields. The insects may not have much effect on small gardens, since they wander off to find food and may never return. Try to buy from manufacturers who intentionally do not feed their product before shipping. Hungry predators are more likely to stay and eat the pests.

Insects are just one groups of predators. Birds such as purple martins, robins, blue jays, chickadees, and even starlings and English sparrows eat large quantities of insects and other small pests. They can be attracted to the garden by placing a feeder, bird houses, and water in the area. When plants get larger, some gardeners let chickens, ducks, or geese run through the garden. In a short time, they pick it clean of pests and weeds. Reptiles and amphibians, including frogs, toads, snakes, lizards, and turtles, all eat garden pests and should be encouraged to make a home in the garden.

Homemade Repellents and Insecticides

Another way to control garden pests is to make sprays from plants which repel insects by using a juicer or blender or by baking a tea. Ingredients can be found in most kitchens. Chile pepper, garlic, coffee, horseradish, radish, geranium, and tobacco are the usual mainstays of herbal sprays, although most strong-smelling herbs and spices have some repellent qualities. Many gardeners experiment to see what works in their garden. For instance, if an insect which bother marijuana stays clear of a nearby weed, a tea or blended spray made form that plant may control the pest. But try it on only one plant (or part of a plant) first, because the spray may also be harmful to the marijuana.

Garlic is probably the most popular ingredient for general-purpose sprays made from kitchen ingredients. A typical formula is to soak three ounces of chopped or minced garlic in a covered container of mineral oil for a day. Then, slowly add a pint of lukewarm water in which a quarter ounce of real soap (Ivory will do) has been dissolved. Stir and let stand several hours, than strain. Use as a concentrate, adding between 20 to 100 parts water to one part concentrate.

Other recipes call for boiling the garlic or for grinding or juicing it. Some brewers add other spices to the basic formula. One recipe calls for one clove garlic, three cayenne peppers, one onion, a quarts ounce of soap, and sufficient water to blend. Let it sit for three or four days before using, and use one part concentrate to 20 parts water. Homemade tobacco teas are sometimes used as insect sprays. Use one cigarette in a quart of water. Let it brew 24 hours before using.

Snails and slugs are attracted by yeast solutions, which are easily prepared from cooking yeast, sugar, and water. This is also why gardeners have success trapping these leaf munchers in bowls of stale beer. Place deep-sided containers at the soil level. The pests slide in and drown.

Gardeners should not overlook handpicking as a viable method of pest control. The foot or a quick thumb and forefinger can eliminate large numbers of pests and can keep a small garden pest-free. Collect the bugs and drop them in a tin can with some alcohol to kill them. Early morning is the best time to collect pests, since they are slower-moving until the sun warms them.

Snails, slugs, earwigs, and some other insects gather in cool, moist areas during the heat of the day. By providing just such a space in a garden, many of these pests can be located and destroyed. Place pieces of cardboard or boards around the garden; look under them each day.

Home Remedies

Gardeners and farmers have discovered and invented ingenious ways to control insects without harming the environment. Some of the more popular ones are listed here, but there are many more, each suited to a particular situation.

Soap and water is an effective control measure for mealybugs, mites, leafhoppers (nymph stage), leaf miners, and aphids. Simply wash the plants thoroughly with a solution of two tablespoons of soap dissolved in a gallon of water. Rinse the soap off thoroughly. (Some growers feel that the addition of kerosene or alcohol makes the solution more effective, but these can harm the plants and dissolve THC.) This treatment does not eliminate all of the pests, and may need to be repeated weekly, but it does keep them under control.

Sprays are sometimes made from healthy insects, which are caught, ground up, and then sprayed back onto the plants. When the pests come in contact with the spray, they become infected with the pathogen and get sick. This method is very effective, and is considered safe, but it is not easy to capture sick insects. A variation in this technique was described in the October 1976 Organic Gardening and Farming Magazine, in which a spray was made from healthy insects. In a followup article in the May 1977 issue, the authors theorised that any population of insects contains pathogens. If enough insects are collected, some of them are sure to be sick, and they contain enough germs to spread the disease. To make an insect spray, capture about a hundred pests. (Make sure not to include any beneficial insects or the spray may also work against them.) Using a blender, mix them with a cup of spring water, strain, and dilute with enough water to spray your garden.

Whenever making or storing sprays, use a glass container. Metal or plastic ones may react with the chemicals that the liquids contain.

Another home remedy for the control of mites and aphids is a mixture consisting of a half cup of milk in four cups of wheat flour, added to five gallons of water. When it is sprayed on the undersides of the leaves, it suffocates the insects and then flakes off as it dries.

Some growers use mulches to control insects. Cedar chips repel beetles, moths, mites, and mealybugs. Aluminium foil is used for aphid and thrip control on small plants; the reflected light disorients them and they do not land on the plants. A sprinkling of cream of tartar eliminates ants, and boric acid kills roaches. Sulfur powders, available at nurseries, are used to control mites and fungus infections.

Organic Insecticides

Pyrethrum, rotenone, and ryania are effective insecticides which come as powders (dusts) or sprays. They are concentrated form of naturally occurring

plant substances, and are considered harmless to warm-blooded animals when used as directed.

Ryania, which is found in the roots of a tropical shrub, is most effective against chewing insects, worms, and larvae, which it incapacitates, rather than kills.

Rotenone is a general-purpose insecticide with little residual effect; that is, it breaks down soon after application, and is therefore one of the safest insecticides. Two or three dustings during the seedling stages afford protection against most insects and bugs.

Pyrethrum is one of the most powerful natural insecticides, and is effective against a wide range of pests. It is also relatively nontoxic to bees and ladybugs. Pyrethrums are found in the pyrethrum plant as well as in chrysanthemums. They are non-persistent, and in small doses may make the insects sick without killing them. These insecticides are available at many nurseries and may provide the surest, easiest form of protection against serious insect attack.

Barriers and Traps

In gardens and small farms, insects and other pests are sometimes controlled by the use of traps and barriers that prevent them from reaching the marijuana. When the plants are young, they can be protected from cutworms, caterpillars, snails, and slugs by a collar that is buried an inch into the ground and is six inches high. Some growers face it with aluminium foil, which many insects seem to dislike. One ingenious grower painted collars with molasses to capture the crawlers. She also caught a significant number of leafhoppers. Commercial stickums such as Tanglefoot can also be used to trap insects.

Snails, slugs, and some crawling insects are repelled by a border perimeter of lime, potash (wood ash), sulfur, sharp sand, or cinders. Place a thin layer, six inches wide, around the perimeter of the garden, or around each plant. Flea beetles and some other flying insects are repelled by wood ashes dusted on the leaves. The powders are water-soluble; so they should be replaced after a heavy rain. Crawling pests sometimes have a hard time reaching plants grown in containers or raised beds.

Flying insects, such as leaf and treehoppers, can be prevented from getting to plants by barriers made from cheesecloth. Other growers place cardboard sticky with glue between plants, and then shake the plants. The cardboard catches a good proportion of them. One innovative grower in Palo Alto, California, placed a furniture crate, with the top cut off and with Tanglefoot spread on the inside, around each of his six plants. He said that by shaking the plants, he eliminated leafhoppers in four days.

16.3 Chemical Insecticides

Insecticides were developed as an easy way to control pests. They have an immediate dramatic effect, but the long-range damage that they do to the entire ecological system is sometimes overlooked. The chlorinated hydrocarbons, such as DDT, DDC, Aldrin, Kelthane, and Dieldrin, were the

most dangerous commercial insecticides. They affect warm-blooded animals and are no longer available. (In no case should any of these be used.)

Diazinon, Sevin, and Malathion are three insecticides which are often used in nurseries to protect vegetable crops. They are considered safe for warm-blooded animals and have a limited residual effect, since they break down in a few days. But these insecticides are not too selective and may kill beneficials as well as pests. Sevin is the most toxic and kills the widest range of insects, including bees.

These chemicals come as sprays, powders, and baits, formulated for specific pests. They should be used only when an intolerable situation has developed. Plants should be harvested only after the required safety period has passed since application. This period is from two to 35 days, and is specifically listed on all insecticides that can be safely used. Insecticides should be used and handled carefully, following instructions, wearing protective clothing, with no children or pets around. It is advisable to use a mask when applying dusts and to work upwind.

16.4 Common Pests

Cucumber Beetles

Cucumber beetles are about a quarter-inch long and look a lot like ladybugs. There are several species of cucumber beetles. The striped beetle is found east of the Rocky Mountains. It is yellow, has two or three black stripes running down its back, and has a black head. The spotted cucumber beetle has a yellow-green back with 11 or 12 black spots and a black head. There are related species, such as the banded cucumber beetle, throughout the United States. The larvae of all varieties are white, turning brownish at the ends, slender, about one-third inch long.

Cucumber beetles do the most damage in the early spring, when the adults come out of hibernation and begin to eat the new growth and leaves. These leaf-eating adults damage young marijuana, especially when there is a scarcity of other food. They also transmit bacterial diseases and viruses to the plants. Within a few weeks after they come out of hibernation, they lay their eggs at the base of plant roots. The larvae of the striped cucumber beetle feed only on melon- and cucumber-type plant roots. The spotted-beetle larvae are fond of corn, and are known as the "Southern cornroot worm" in some places.

The best way to prevent cucumber-beetle attacks is to keep the areas that you plant isolated from corn and melon plantings. Heavy mulching or tilling destroys the pests when they are hibernating. Late plantings minimize damage inflicted by cucumber beetles.

Cucumber beetles can be controlled by use of Rotenone or Malathion. Dust several times during seedling growth. These beetles are also prey to many insects, including the common garden soldier beetle, predator flies, wasps, and nematodes. Hand picking is also an effective control for cucumber beetles.

Thrips

Thrips are slender, yellow or brownish, winged insects about 1/25 inch long. They have fragile wings which keep them aloft while they are blown by the wind. Thrips have a cone-shaped mouthpart, which they use to cut stems in order to suck plant juices. The larvae look like adults, but are smaller and wingless. Most thrips feed on a range of plants, especially onion and other bulbs, and marijuana is at most a marginal part of their diet. A well-cultivated marijuana plant can outgrow and damage that thrips are likely to inflict.

Thrips hibernate in plant debris during the winter and begin sucking in early spring. They lay eggs during warm weather, and can produce a new generation every two weeks. Since thrips eat a varied diet, keeping the garden area clear of weeds is an effective control. Thrips can also be controlled by turning debris under, so that their nesting sites are destroyed.

Thrips can be controlled by use of tobacco sprays. Rotenone, or Malathion. Aluminium-foil mulches are effective thrip repellents. The light reflected from the foil confuses their sense of direction.

Flea Beetles

There are many species of flea beetles. The adults range in size between one-twentieth and one-fifth of an inch, and are usually black or metallic green or blue. They are called flea beetles because they use their enlarged hind legs to jump like fleas when disturbed. Many flea beetles are host-specific, and probably only a few species munch on marijuana.

Flea beetles hibernate in plant debris. By ploughing the debris under, their hibernation places are eliminated, and there should be few pests the following spring. Flea beetles are repelled by a mixture of equal parts of wood ashes and limestone sprinkled on foliage every few days. Containers of the mixture may also be placed around the plants. Garlic sprays also repel flea beetles. The chemical poisons used specifically for flea beetles are stomach poisons, which break down slowly and may not be safe to inhale. Home remedies are best for flea beetles.

16.5 Vertebrate Pests

Mammals Until it develops a hard fibrous main stem, usually at about two months, the young marijuana plant attracts rodents, including mice, rabbits, moles, squirrels, groundhogs, and rats, as well as raccoons. Cats are probably the best means of rodent control. They stalk small prey, go after any movement, and are active at night, when most of these animals forage. Young plants are often protected from rodents by placing a coffee can with top and bottom removed around each plant. When the plants get bigger, they can be protected from rabbits and other animals with a wire fence three feet in height. A double layer of one-inch chicken wire is most effective. But many animals can climb or burrow; so more ingenious methods are needed to protect the plants. Rodents, especially moles, are repulsed by castor beans and castor oil. A formula that gardeners sometimes use is two parts castor oil, one part detergent, mixed to a consistency of shaving cream in a blender. Use a tablespoon of concentrate per gallon of water. Spray or mist

the solution on the plants.

Rabbits shy away from blood, bloodmeal, and tankage. To use, sprinkle the powder around the perimeter of the plot in a band about a foot wide. They can also be mixed into a concentrated solution and applied as a spray. However, the smell of blood may attract mongoose or other predators, which dig up the garden in search of flesh. Noise from radios, chimes, and bells deter some animals, and human smells such as hair and urine may also deter some animals. In dry areas, a half-filled bucket of water is an effective rodent trap. The animals fall in and drown.

Deer seem to go out of their way to munch on tender marijuana leaves, but generally don't bother marijuana after it has grown for a few months. Gardeners and farmers use many ingenious techniques to keep them away from crops. Sturdy fences are the best deterrent. The fences should be about 10 feet high: the bottom five feet should be made up of single strands of wire string at two-foot intervals. The wire strands prevent deer from jumping the fence. Some growers use fresh blood, dried blood, or bloodmeal to deter them, placing it in either powder or liquid form around the perimeter of the garden. Other growers claim that human hair, or manure from predators such as wolves, bears, lions, and even dogs, keeps them out. Lion urine (glans extract) is available commercially, and is said to be an effective deterrent against many animals. {Figure 73. Tin cans protect against cutworms and many other plant eaters.}

{Figure 74. Fat rat munching marijuana.}

{Figure 75. Problem solved; or, never underestimate the power of a peanut.

{Rat caught in mouse trap.}}

Birds

On the whole, birds are beneficial, rather than harmful, in the garden. Most of the common species, including English sparrows, robins, swallows, wrens, finches, bluejays, bluebirds, and starlings, eat insects and other garden pests as a substantial portion of their diet. The only time that birds may be harmful is during planting, when they sometimes feed on the planted seed. The main culprits seem to be starlings, sparrows, and crows. They can be kept off the planted areas physically, by means of plastic netting or fencing, which is sold commercially for the purpose, or by using scarecrows, aluminium strips, or noise makers. Once the plants have germinated, birds are no longer a threat and should be encouraged to nest in the area, since they are an ideal biological control for plant pests.

Chapter 17

GENETICS AND SEX IN CANNABIS

Sex is an inherited trait in Cannabis, and can be explained in much the same terms as human sexuality can. Like a human being, Cannabis is a diploid organism: its chromosomes come in pairs. Chromosomes are microscopic structures within the cells on which the genes are aligned. Cannabis has 10 pairs of chromosomes ($n=10$), for a total of 20 chromosomes ($2m=20$).

One pair of chromosomes carries the primary genes that determine sex. These chromosomes are labelled either X or Y. Male plants have an XY pair of sex chromosomes. Females have XX. Each parent contribute one set of 10 chromosomes, which includes one sex chromosome, to the embryo. The sex chromosome carried by the female ovule can only be X. The one carried by pollen of the male plant may be either X or Y. From the pollen, the embryo has a 50/50 chance of receiving an X, likewise for Y; hence, male and female progeny appear in equal numbers (in humans, the sperm carries either an X or a Y chromosome.)

17.2 Flowering

Male Plant

Under natural light, males usually start to flower from one to four weeks before the females. Where the photoperiod is artificially controlled, as with electric lights, males respond quickly (in about a week) to a change to short photoperiods and usually show flowers sooner than the females.

Male flowers develop quickly, in about one to two weeks on a vigorous plant, not uniformly. Scattered flowers may open a week or more before and after the general flowering, extending the flowering stage to about four weeks.

The flowering stage continues to demonstrate the male's tall, relatively sparse growth. Most of the flowers develop near the top of the plant, well above the shorter females. The immature flower buds first appear at the tips of the main stem and branches. Then tiny branches sprout from the leaf axils, bearing smaller clusters of flowers. The immature male flowers are closed, usually green, and develop in tight clusters of knob-like buds. The main parts of the male flowers are five petal-like sepals which enclose the sexual organs. As each flower matures, the sepals open in a radiating pattern to reveal five pendulous anthers (stamens).

Inside the ovoid, sac-shaped anthers, pollen grains develop. Initially, pollen sifts through two pores near the top of the anther; then, starting from the pores, longitudinal slits slowly open (zipperlike) over the course of a day, releasing pollen to the wind. Once a flower sheds pollen, it shortly dies and falls from the plant. Normally, male plants begin to die one to two weeks after the bulk of their flowers have shed pollen. Healthy males may continue to flower for several more weeks, but secondary growth seldom has the vigour of initial bloom.

Female Plant

The female plant generally starts to flower later than the male, under either natural light or an artificially controlled photoperiod. Female marijuana plants flower when the average daily photoperiod is less than about 12 to 13 hours. However, some varieties and individuals may flower with a photoperiod of over 14 hours. Some Colombian varieties may not respond until the photoperiod falls below 12 hours for a period of up to three weeks.

The duration of flowering also depends on the particular rhythm of the variety, as well as growing conditions, and whether or not the plant is

pollinated. Within these variables, females maintain vigorous growth and continue to rapidly form flowers for a period that ranges from 10 days to about eight weeks.

Females generally do not grow much taller during flowering. Growth emphasises a "filling out," as flower clusters develop from each leaf axil and growing tip. Normally, the flowers arise in pairs, but the pairs form tight cluster of 10 to over 100 individual flowers that are interspersed with small leaves. These clusters are the "buds" of commercial marijuana. Along the top of the main stem and vigorous branches, "buds" may form so thickly that the last foot or more of stem is completely covered. Usually the leaves that accompany the flowers tend toward simpler structure, until each leaf has one to three blades. {Figure 76. Female in full bloom.}

The visible parts of the female flower are two upraised stigmas, one-quarter to one-half inch long, usually white or cream, sometimes tinged with red, that protrude from a tiny, green, pod-shaped structure called the floral bract. This consists of modified leaves (bracts and bracteoles) which envelop the ovule or potential seed. The mature bract is a tiny structure, about 1/8 inch across and 1/4 inch long. When fertilised, a single seed begins to develop within the bract, which then swells until it is split by the mature seed.

Bracts are covered more densely with large resin glands than is any other part of the plant, and are the most potent part of the harvest. Resin glands may also be seen on the small leaves that are interspersed among the flowers.

The differences between male and female Cannabis become more apparent as the plants mature. The same can be said of the differences between varieties. Often, two varieties may appear to be similar, until they actually flowers and fill out to different forms. These appear in many ways: some varieties maintain opposite phyllotaxy with long internodes throughout flowering; bud sizes vary from about one-half inch to about three inches, with a norm of about one to two inches; buds may be tightly arranged along the stem, yielding a "cola" two feet long and four inches thick; and some varieties only form buds along their main stem and branch tips, with a few "buds" forming along the branches.

{Figure 77. Upper left: Buds form thickly into colas along the top of the main stem and branches (full bloom). Upper right: A cola about two feet long. Lower left: A huge leafy cola. Lower right: Long, slim buds form late in the year when light is weak. (these four colas are from Mexican plants.)}

When a female is well-pollinated, growth slows and the plant's energy goes into forming seeds and thus into the continuation of the species. Some plants (but only the more vigorous ones) will renew flowering even when pollinated. Females that are not well-pollinated continue to form flowers rapidly. This extends the normal flowering period, of 10 days to four weeks, up to eight weeks or more.

Individual flowers are pollinated by individual pollen grains. In a matter of minutes from its landing on a stigma, the pollen grain begins to grow a

microscopic tube, which penetrates the stigma and reaches the awaiting ovule wrapped within the bracts. The pollen tube is a passageway for the male's genetic contributions to the formation of the embryo (seed).

The union of the male and female complements of genes completes fertilisation and initiates seed formation. The stigmas, having served their purpose, shrivel and die, turning rust or brown colour. On a vigorous female, the seeds reach maturity in about 10 days. When growing conditions are poor, the seed may take five weeks to ripen to full size and colour. Naturally, all the flowers do not form, nor are they pollinated at the same time - and there will be seeds that reach maturity weeks before others do. Although each flower must be individually fertilised to produce a seed, a single male plant can release many millions of pollen grains. A large female plant can produce over 10,000 seeds.

17.3 Sexual Variants in Cannabis

Cannabis has been studied for many years because of its unusual sexuality. Besides the normal dioecious pattern, where each plant bears exclusively male or female flowers, it is not uncommon for some plants to have both male and female flowers. These are called hermaphrodites, or monoecious plants, or intersexes. Hermaphroditic plants form normal flowers of both sexes in a wide variety of arrangements, in both random and uniform distributions.

Natural Hermaphrodites

Some hermaphrodites seem to be genetically determined (protogenous). That is, they naturally form flowers of both sexes given normal growing conditions. Possibly genes carried on the autosomes (the chromosomes other than the sex chromosomes) modify the normal sexual expression. Monoecious varieties have been developed by hemp breeders in order to ensure uniform harvests.

It is also possible that these particular are polyploid, which means they have more than the usual two sets of chromosomes. This kind of hermaphrodite may have XXY (triploid), or $XXYY$ or $XXXYY$ (tetraploid) sex chromosomes. However, no naturally occurring polyploids have ever been verified (by observation of the chromosomes) in any population of Cannabis. Polyploids have been induced in Cannabis by using mutagens, such as the alkaloid colchicine.

Whatever then genetic explanation may be, one or more of these natural hermaphrodites may randomly appear in any garden. They are sometimes faster-maturing, have larger leaves, and are larger in overall size than their unisexual siblings. They usually form flowers of both sexes uniformly in time and distribution, and in some unusual patterns. For example, from Mexican seed, we have seen a plant on which separate flowering cluster consisted of both female and male flowers: and upper section of female flowers had upraised stigmas, and a lower section of male flowers dangled beneath the female flowers. In other plants from Mexican seed, the growing tips throughout the plant have female flowers; male flowers sprout from the leaf axils along the main stem and branches. Plants from "Thai" seed sometimes form male and female flowers on separate branches. Branches with female flowers tend to predominate, but branches having mostly male flowers

are located throughout the plant.

Abnormal Flowers, Intersexes, Reversals

Gender is set in the new plant at the time of fertilisation by its inheritance of either the X or the Y chromosome from the male (staminate) plant. With germination of the seed, the environment comes into play. Heritage sets the genetic program, but the environment can influence how the program runs. (Sexual expression in Cannabis is delicately balanced between the two.) The photoperiod, for example, controls the plant's sequence of development. Also, the plant's metabolism and life processes are dependent on growing conditions. When the environment does not allow a balance to be maintained, the normal genetic program may not be followed. This is mirrored by abnormal growth or sexual expression.

{Figure 78. Upper left: Abnormal flowers. Lower left: Male flowers on a female plant. Upper right: Sexes on separate branches. Lower right: Male flower in female bud (reversing).}

Abnormal Flowers

Abnormal sexual expression includes a whole range of possibilities. Individual flowers may form abnormally, and may contain varying degrees of both male and female flower parts. For instance, a male flower may bear a stigma; or an anther may protrude from the bracts of a female flower. Abnormally formed flowers are not often seen on healthy plants, although if one looks hard enough, a few may be found in most crops. When many of the flowers are abnormal, an improper photoperiod (coupled with poor health) is the most likely cause. Abnormal flowers sometimes form on marijuana grown out of season, such as with winter or spring crops grown under natural light.

Intersexes and Reversals Much more common than abnormally formed flowers is for the plant's sex to be confused. One may find an isolated male flower or two; or there may be many clusters of male flowers on an otherwise female plant, or vice versa. These plants are called intersexes (also hermaphrodites or monoecious plants). Intersexes due to environment causes differ from natural hermaphrodite in having random distributions and proportions of male and female flowers. In more extreme cases, a plant may completely reverse sex. For example, a female may flower normally for several weeks, then put forth new, sparse growth, typical of the male, on which male flowers develop. The complete reversal from male flowering to female flowering also happens.

All other things being equal, the potency of intersexes and reversed plants is usually less than that of normal plants. If there are reversals or intersexes, both of the sexes will usually be affected. Female plants that reverse to male flowering show the biggest decline. Not only is the grass less potent, but the amount of marijuana harvested from male flowers is negligible compared to the amount of marijuana that can be harvested from a normal female. Plants that change from male to female flowering usually increase their potency, because of the growth of female flower bracts with their higher concentration of resin. Female flowers on male plants seldom form as thickly or vigorously as on a normal female. Between the loss in

potency and the loss in yield because of females changing to males, a crop from such plants is usually inferior, in both yield and potency, to one from normal plants.

Environmental Effects

Many environmental factors can cause intersexes and sexual reversals. These include photoperiod, low light intensity, applications of ultraviolet light, low temperatures, mutilation or severe pruning, nutrient imbalances or deficiencies, senescence (old age), and applications of various chemicals (see bibliography on sex determination).

The photoperiod (or time of planting using natural light) is the most important factor to consider for normal flowering. In 1931, J. Schaffner (105) showed that the percentage of hemp plants that had confused sexual characteristics depended on the time of year they were planted. Normal flowering (less than five percent of the plants are intersexes) occurred when the seeds were sown in May, June, or July, the months when the photoperiod is longest and light intensity is strongest. When planted sooner or later in the year, the percentage of intersexuals increased steadily, until about 90 percent of the plants were intersexual when planted during November or early December.

Marijuana plants need more time to develop than hemp plants at latitudes in the United States. Considering potency, size, and normal flowering, the best time to sow for the summer crop is during the month of April. Farmers in the south could start the plants as late as June and still expect fully developed plants.

If artificial light is used, the length of the photoperiod can influence sexual expression. Normal flowering, with about equal numbers of male and female plants, seems to occur when the photoperiod is from 15 to 17 hours of light for a period of three to five months. The photoperiod is then shortened to 12 hours to induce flowering. With longer photoperiods, from 18 to 24 hours a day, the ratio of males to females changes, depending on whether flowering is induced earlier or later in the plant's life. When the plants are grown with long photoperiods for six months or more, usually there are at least 10 percent more male than female plants. When flowering is induced within three months of age, more females develop. Actually, the extra males or females are reversed plants, but the reversals occur before the plants flower in their natural genders.

Some plants will flower normally without a cutting of the photoperiod. But more often, females will not form thick buds unless the light cycle is cut to a period of 12 hours duration. Don't make the light cycle any shorter than 12 hours, unless the females have not shown flowers after three weeks of 12-hour days. Then cut the light cycle to 11 hours. Flowers should appear in about one week.

Anytime the light cycle is cut to less than 11 hours, some intersexes or reversed plant usually develop. This fact leads to a procedure for increasing the numbers of female flowers indoors. The crops can be grown for three months under a long photoperiod (18 or more hours of light). The light cycle is then cut to 10 hours. Although the harvest is young (about five

months) there will be many more female flower buds than with normal flowering. More plants will develop female flowers initially, and male plants usually reverse to females after a few weeks of flowering.

Of the other environmental factors that can affect sexual expression in Cannabis, none are as predictable as the photoperiod. Factors such as nutrients or pruning affect the plant's overall health and metabolism, and can be dealt with by two general thoughts. First, good growing conditions lead to healthy plants and normal flowering: female and male plants occur in about equal numbers, with few (if any) intersexes or reversed plants. Poor growing conditions lead to reduced health and vigour, and oftentimes to confused sex in the adult plant. Second, the age of the plants seems to influence reversals. Male plants often show female flowers when the plant is young (vigorous) during flowering. Females seven or more months old (weaker) often develop male flowers after flowering normally for a few weeks.

Anytime the plant's normal growth pattern is disrupted, normal flowering may be affected. For instance, plant propagated from cuttings sometimes reverse sex, as do those grown for more than one season.

17.4 Sexing the Plants

The female plant is more desirable than the male for marijuana cultivation. The female flowering clusters (buds) are usually the most potent parts of the harvest. Also, given room to develop, a female generally will yield twice as much marijuana as her male counterpart. More of her weight consists of top-quality buds.

Because the female yields marijuana in greater quantity and sooner you can devote your attention to nurturing the females. Where space is limited, such as in indoor gardens and small outdoor plots most growers prefer to remove the males as soon as possible, and leave all available space for the females. To harvest sinsemilla (seedless female buds), you must remove the male plants before they mature and release pollen.

Differences in the appearance of male and female Cannabis become more apparent toward maturation. During the seedling stage, gender is virtually impossible to distinguish, although in some varieties the male seedling may appear slightly taller and may develop more quickly.

We know of no way to discover gender with any certainty until each plant actually forms either pollen-bearing male flowers or seed-bearing female flowers. However, certain general characteristics may help. Using guidelines like the following, growers who are familiar with a particular variety can often predict gender fairly accurately by the middle stage of the plant's life.

Early Vegetative Growth

After the initial seedling stage, female plants generally develop more complex branching than the male. The male is usually slightly taller and less branched. (Under artificial light, the differences in height and branching are less apparent throughout growth.)

Some plants develop a marked swelling at the nodes, which is more common and pronounced on female plants.

Middle Vegetative Growth

In the second to fourth months of growth, plants commonly form a few isolated flowers long before the actual flowering stage begins. These premature flowers are most often found between the eighth and twelfth nodes on the main stem. Often they appear near each stipule (leaf spur) on several successive nodes, at a distance two to six nodes below the growing tip. These individual flowers may not develop fully and are often hard to distinguish as male or female flowers. The fuzzy white stigmas of the female flower may not appear, and the male flowers seldom opens but remains a tightly closed knob. However, the male flower differs from the female; it is raised on a tiny stalk, and the knob is symmetrical. The female flower appear stalkless and more leaflike.

The presence of premature female flowers does not assure that the plant is a female, but premature male flowers almost always indicate a male plant. Unfortunately, it is much less common for male plants to develop premature male flowers than for female flowers to appear on either plant. For example, in one garden of 25 mixed-variety plants, by age 14 weeks, 15 plants showed well-formed, premature female flowers with raised stigmas. Eight of these plants matured into females and seven became males. Only two plants showed premature male flowers and both of these developed into males. The eight remaining plants did not develop premature flowers or otherwise distinguishable organs until the actual flowering stage at the age of 21 weeks. From these eight, there were four females, three males, and one plant bearing both male and female flowers (hermaphrodite). It does seem, however, that plants bearing well-formed female flowers, on several successive node, usually turn out to be females.

Preflowering

In the week or two prior to flowering and throughout flowering, many common marijuana varieties follow two general growth patterns which depend on gender. With these varieties, you can tell gender by the spacing between the leaves (internodes). For the female, the emphasis is on compact growth. Each new leaf grows closer to the last, until the top of the plant is obscured by tightly knit leaves. The male elongates just prior to showing flowers. New growth is spaced well apart and raises the male to a taller stature. This may be the first time the male shows its classic tall, loosely arranged profile.

{Figure 79. Premature flowers are found on the main stem next to the leaf spurs. Upper left: Early female flower without stigmas. Lower left: Undifferentiated (indistinguishable). Centre: Early male flower. Upper and lower right: Well-formed female flowers on successive nodes usually indicate a female.}

17.5 Sinsemilla

Sinsemilla ((The word "sinsemilla" comes from the Spanish, and means without seeds. It is also spelled "sansimilla.")) is any marijuana

consisting of seedless female flower buds. Sinsemilla is not a variety of marijuana; it is the seedless condition that results when the female flowers are not fertilised with pollen.

In the United States, most sinsemilla comes in the form of Thai sticks that are imported from Southeast Asia and Japan. Thai sticks are made up of seedless buds wrapped around a sliver of bamboo or a long wooden matchstick. The buds, which may be on one or more stems, are secured with a hemp fibre wound around the stick. A growing amount of fine sinsemilla now comes from domestic sources, such as Hawaii and California. The grass is usually boxed or bagged with pure buds that are manicured (extraneous leaf removed). Infrequently sinsemilla comes from Mexico and, rarely, from Colombia.

Sinsemilla has a reputation as high-potency marijuana, with a sweet taste and mild smoke. It doesn't have the harsh, gagging qualities of the usual Colombian and Mexican grasses. These qualities, however, have nothing to do with sinsemilla as such. The potency of any grass depends primarily on the variety and development of the plant, and the taste and mildness of the smoke depend on the condition of the plant when harvested and the cure. Heavily seeded grass can be as mild and sweet-smoking as sinsemilla when it is properly handled.

When buying grass, remember that sinsemilla indicates a conscientious effort on the grower's part to bring you the best possible product. Sinsemilla is almost pure smoking material with no wasted weight in seeds. An ounce of sinsemilla has about twice as much smoking material as a typical seeded ounce. Also, any marijuana that is fresh, with intact buds, indicated less deterioration of cannabinoids. {Figure 80. Thai Sticks.}

Sinsemilla is becoming a preferred form of grass with homegrowers, many of whom believe that a seedless female is more potent than a seeded one, reasoning that the plant's energy goes to the production of resin rather than seed. There seem to be no scientific studies on this point. Many experienced growers believe the difference is small, perhaps 10 percent.

From observing the resin glands on the bracts, one sees that they continue to develop in size after pollination. Any difference from the unseeded state is not apparent. Whether pollination does in fact hamper or lessen resin production or potency is questionable. but the effect on the plant as a whole can be dramatic. Usually when the female is well-pollinated, growth noticeably slows, and the plant enters the last phase of life, which is seed set. Seed set is a period of incubation, in which the seeds grow and reach their mature state. New growth forms more slowly and lack the vitality of the bloom before pollination. The plant's reaction to pollination is relative. The more thoroughly pollinated the female is, the more pronounced the change in rhythm from vigorous to incubation. A plant on which only a few flowers have been fertilised continues to actively form flowers as sinsemilla.

Not all plants react alike to pollination. When the weather is good and the plant vigorous, even a well-seeded plant may bloom a second or third time before the rate of growth starts a final decline.

To put this in perspective, the main advantage to growing sinsemilla is that

the plant remains in a flowering state for a longer period of time. Flowers may rapidly form for four to ten weeks. The flower buds develop larger and more thickly along the stems, yielding more top-quality grass (more buds) than in the seeded condition.

Anyone can grow sinsemilla. Simply remove the male plants before they release pollen. Given a normal spring planting, males usually flower in August and September, but may begin to flower as early as mid-July. Under artificial lights, males sometimes flower after only three months, and before the grower has shortened the photoperiod. Even though the females are not flowering, remove the males from the room before any flowers open. Indoors, the pollen will collect as dust and can fertilise the females weeks later.

Male flowers mature quickly, in about one to two weeks after the immature buds are first visible. Check each plant about twice a week to make sure you harvest all the males before any shed pollen. If you can't visit your garden consistently, then thin the garden, using the preceding section on "Sexing" as a guide. Even though you may not get all the males, the females will be more lightly seeded. Actually, even in carefully watched gardens, the females may have a few seeds. Pollination may come from an occasional male flower on a basically female plant, or a female may reverse and form male flowers. And pollen may come from a neighbour's garden, a problem that is becoming more common. But in practical terms, an occasional seed makes no difference. The female can form thousands of flowers, and when only a few are pollinated, there is little impact on the plant's growth.

Chapter 18 PROPAGATION AND BREEDING

18.2 Producing Seeds

Marijuana is naturally prolific. It has been estimated that a single male plant can produce over 500 million pollen grains⁴¹. A large female plant can bear tens of thousands of seeds. In nature, pollen is carried from the male flowers to the stigmas of the female flowers by air currents or the wind. Indoors or out, if the plants are simply left on their own, most gardens produce many more seeds than are needed for the next crop.

Seeds usually become viable within two weeks after pollination, although they may not have developed good colour by this time. The colour can take several more weeks to develop, particularly indoors or late in the year, when the light is not as strong. Once seeds are plump, well-formed, and of a mature size, most of them will be viable. When seeds have also developed good colour, their viability should be over 90 percent.

Pollination may also be carried out artificially. Pollen can be collected and transferred to the female flowers with a cotton swab or artist's brush, or shaken directly over the flowers. Store pollen in a clean, open container and keep in a dry area at moderate temperature. Remove any flowers or vegetative matter from the pollen, because they encourage fungal attack.

Once advantage of artificial pollination is that only the flowers on certain plants need be pollinated. This allows you to harvest most of your grass as sinsemilla, while developing seed on part of the plant. If you have only a few plants, pollinate a single branch, or perhaps only a few lower buds, in order to leaves the most potent buds seedless.

A good way to insure a thorough pollination, and to avoid contaminating other females, is to loosely tie a transparent bag containing pollen directly over individual buds, branches, or whole plants. Shake the bag to distribute the pollen and carefully remove it from several hours to a few days later.

To avoid contaminating a sinsemilla crop, you must remove any males from the garden before their flowers open. Males in pots can simply be moved to another area or room if you want to keep them growing. Male plants can complete development even in low light; so they do not need artificial light. Otherwise, the best procedure is to harvest the males intact by cutting them at their base after some flowers have formed distinct (but unopened) buds. Hang the whole plants upside down in a sheltered area where there is moderate light and where temperatures and humidity are not extreme. Place clean plates or sheet plastic beneath the plants to catch falling pollen. Generally there is enough stored water in the plant for the unopened flowers to mature and drop pollen. Well-formed flowers may open the next day. Usually all the flowers that are going to open will do so within two weeks.

Pollen gradually loses viability with time, but pollen that is about three weeks old generally has sufficient viability for good seed production. However, the age of the pollen may influence the sex ratio of the next generation.

For instance, in a 1961 study with hemp plants 97, the percentage of females in the next generation was 20 percent higher than in the control plants (natural pollination) when pollen 14 to 17 days old was used. A small increase in female-to-male ratios also occurred when pollen was fresh (six hours or less). The age of the stigmas appeared not to affect the sex ratio.

18.3 Producing Female Seeds

If it were possible to know which seeds are female and which are male, marijuana growing would be even simpler than it is. There is not practical way to discern the gender of a seed - but there is a simpler procedure for producing seeds that will all grow into female plants.

To produce female seeds, the plants are fertilised with pollen with male flowers that appear on a basically female plant. Such flowers appear on intersexes, reversed females, and hermaphrodites (see section 17). Female plants have an XX complement of sex chromosomes; therefore, the pollen from the male flowers that form on female plants can only carry an X chromosome. All seeds produced from flowers fertilised with this "female" pollen will thus have an XX pair of sex chromosomes, which is the female genotype.

Although the male Cannabis plant can produce female flowers, it cannot produce seed; so there is no chance of mistakenly producing seed on a male

plant. It is possible to use pollen from an intersexual plant that is basically male (XY); the resulting crop of seeds will have the normal 1:1 ratio of males to females. For this reason, choose a plant that is distinctly female as a pollen source. A female plant with a few random male-flower clusters, or a female plant that has reversed sex are both good pollen sources. The seed bearer can be any female, female intersex, or reversed-female plant.

In most crops, careful inspection of all the females usually reveals a few male flowers. And often, when females are left flowering for an extended period of time, some male flowers will develop. If no male flowers form, you can help to induce male flowers on female plants by severe pruning. One such procedure is to take the bulk of the harvest, but to leave behind some green leaves to maintain growth (as described in the section on "Double Harvests" in section 20). Most of the plants will continue to form female flowers, but male flowers are also likely to form. At times, the plants may not grow particularly well, and may in fact form distorted and twisted leaves, but they will produce viable seeds as long as some stigmas were white when pollinated. (Remember, it only takes a few fertile buds to produce hundreds of seeds.) Pollinate the female flowers by hand as soon as pollen becomes available.

{Figure 82. A solitary male flower on a female plant provides "female" pollen. (Also see Figure 84 for a female reversing sex.)}

{Figure 83. Growth may not be vigorous, but seeds will form if stigmas are white when pollinated.}

Under artificial lights, turn the light cycle down to eight hours after cutting the plants back. The short cycle helps to induce male flowers on female plants.

Male-free seed can also be produced by pollen from a natural hermaphrodites. The progeny, however, may inherit the hermaphroditic trait, resulting in a crop with some hermaphrodites as well as females. This could be a problem if you want to grow sinsemilla the next crop.

18.4 Breeding

Breeding Cannabis is done simply by selecting certain plants to be the pollinators and the seeds bearers. Characteristics such as fast growth, early maturation, and high potency might be the reasons for choosing one plant over another. Selection can be by means of the male plants, the females, or both. A simple procedure would be to harvest all male plants, sample each for potency, and use the most potent plant for the pollen source. At harvest, compare the seeded females for potency, and use seeds from the most potent plant for the pollen source. At harvest, compare the seeded females for potency, and use seeds from the most potent plant for the following generation.

There are two basic approaches to breeding. One is inbreeding, and the other is outbreeding. Inbreeding involves starting with a single variety and crossing individuals to produce seeds. In this way, certain desirable characteristics that the parents have in common will probably be perpetuated by the offspring.

Certain variants with unusual characteristics, such as three leaves to a node instead of the usual two leaves, can be inbred continuously until all progeny carry the trait. One problem with inbreeding is that other desirable characteristics may be lost as the new population becomes more homogeneous. Inbreeding plants indoors seems to lead in a loss in potency by the fourth generation. (Preceding generations were considered comparable to the original imported grass.)

Outbreeding is crossing two different varieties. Offspring from parents of two different varieties are called hybrids. Cannabis hybrids exhibit a common phenomenon on plants called "hybrid vigour." For reasons not wholly understood, hybrids are often healthier, larger, and more vigorous than either of their parents. {Figure 84. Upper left: An old female reversing to male flowering. Lower left: Three leaves to a node (trifoliate). Upper right: A plant with three leaves to a node alternating with one leaf on next node. Lower right: Three-leafed plants sometimes split into two growing shoots.}

A reference to cannabinoid content of hybrids from crosses between chemotypes was made in a 1972 study by the Canadian Department of Agriculture: "The ratio of THC to CBD in hybrids was approximately intermediate between the parents ... there was also occasionally a small but significant deviation toward one of the parents - not necessarily the one with the higher or lower ratio of THC to CBD." 51 This means that a cross between a midwestern weedy hemp (type III) and a fine Mexican marijuana (type I) would yield offspring with intermediate amounts of THC and CBD, and which hence would be considered type II plants.

Homegrowers have mentioned that inbreeding plants often led to a decrease in potency after several generation. Outbreeding maintained potency, and sometimes (some growers claimed) led to increases in potency.

One area in which breeding can be useful for homegrowers is the breeding of early-maturing plants for northern farmer. Farmers in the north should always plant several varieties of marijuana. Mexican varieties generally are the fastest to mature. Individual plants that mature early and are also satisfactorily potent are used for the seed source in next year's crop. This crop should also mature early. Some growers cross plants from homegrown seed with plants from imported seed each year. This assures a maintenance of high-potency stock.

Potency Changes Over Generations

It is well-established that plants of the P1 generation (parentals, or the first homegrown plants from imported seed) maintain their chemical characteristics. (For example, type I plants yield type I progeny whose cannabinoids are about equal both quantitatively and qualitatively to those in their native grown parents.) This fact is shown by Table 25.

In the study 66 from which Table 25 has been adapted, individual plants within varieties differed by more than four times in CBD content and by more than three times in THC content. The researchers also noted that illicit marijuana samples contained proportionately less leaf material and

proportionately more stem and seed material than samples grown in Mississippi. (Mississippi samples may be more dilute.) New Hampshire and Panama samples were nearly equal in terms of the sum of THC plus CBN.

One of the questions that persists in marijuana lore is what effect if any a change in latitude has on the plant chemotype over a period of generations. Non-drug types of Cannabis usually originate above 30 degrees latitude in temperate areas. Drug types of Cannabis usually originate in tropical or semitropical areas below the 30-degree parallel. Whether this is due entirely to cultural practices is questionable. More likely, the environment (natural selection) is the prime force, and cultural practices reinforce rather than determine chemotype.

Cannabis is notorious for its adaptability. Historically, there are many statements that the drug type of Cannabis will revert to the "fibre" type when planted in temperate areas, whereas the fibre type will revert to the drug type after several generations in a tropical area. That a change in chemotype is actually caused by transfer between tropical and temperate areas has not been verified scientifically. (Such studies are ongoing in Europe.) If such changes occur, it is also not known whether the change is quantitative (the plant produces less total cannabinoids) or whether it is qualitative (succeeding generations, for example, change from being high in THC and low in CBD to being high in CBD and low in THC).

We believe that qualitative changes can occur within a few generations, but can only guess what environmental factor(s) might be responsible for such a change. Probably the change has more to do with adaptation of general growth and developmental characteristics than with particular advantages that production of either CBD or THC may bestow upon the plants.

The reason we suspect a change in chemotype is that these changes occur rapidly in evolutionary terms, in a matter of several generations. This rapidity implies that some very strong selective pressures are acting on the plant populations. Also, changes in the chemotype seem to occur globally, which implies that the selective pressures responsible are globally uniform rather than local phenomena. Such globally uniform pressures might be light intensity, daylength, ambient temperatures, and the length of the growing season. For example, in populations adapting to temperate areas, those plants that are able to grow well under relatively lower light intensity and cooler temperatures, and which are able to complete development in a relatively short growing season, would be favoured over siblings with more tropical characteristics.

Adaptation acts on populations by means of whole organisms which are reacting to a total environment. Shifts in the chemotype of the population are probably linked genetically to the strong selective pressures exerted on the populations by the need to adapt general growth and maturation to either northern (temperate) or southern (tropical) conditions. {From the northern hemisphere.}

18.5 Cuttings

Marijuana growing often transcends the usual relationship between plant and growers. You may find yourself particularly attached to one of your plants.

Cuttings offer you a way to continue the relationship long beyond the normal lifespan of one plant.

To take a cutting, use scissors or a knife to clip an active shoot about four to six inches below the tip. Cannabis does not root easily compared to other soft-stemmed plants. Cuttings can be rooted directly in vermiculite, Jiffy-MIX, a light soil, or in a glass of water. The cutting is ready to plant when roots are about an inch long, in about three to four weeks. A transplant compound such as Rootone can be used to encourage root growth and prevent fungi from forming.

Keep the mixture consistently moist but not too saturated. Roots need oxygen as well as water in order to grow. Change the water daily if the cutting are in a glass of water. Cuttings root best in moderate light, not in intense light (HID's) or direct sunlight. The best light is fluorescent set on constant light (24 hour photoperiod).

{Picture. Comparing rooting mediums. Left to right: One, roots both in and removed from rockwool cube; two, perlite; three and four, perlite vermiculite mixture; five, vermiculite; not shown: cuttings died in peat-pellets. Best rooting was in perlite-vermiculite mixture. Pure vermiculite also worked well.}

Cuttings taken from the same plant are genetically identical and are clones. Clones eliminate genetic differences between individuals, and hence are particularly useful in scientific experiments. By using clones, one can attribute variations between individuals specifically to outside factors. This would be particularly useful when testing, for example, the effect of fertilisers on potency. In the 1980's, scientists finally began to use this useful tool in Cannabis experiments.

18.6 Grafting

One of the most persistent myths in marijuana lore concerns grafting Cannabis to its closest relative, *Humulus*, the hops plant of beer-making fame. The myth is that a hops scion (shoot or top portion of the stem) grafted to a marijuana stock (lower stem and root) will contain the active ingredients of marijuana. The beauty of such a graft is that it would be difficult to identify as marijuana and, possibly, the plant would not be covered under marijuana statutes. Unfortunately, the myth is false. It is possible to successfully graft Cannabis with *Humulus*, but the hops portion will not contain any cannabinoids.

In 1975, the research team of Crombie and Crombie grafted hops scions on Cannabis stocks from both hemp and marijuana (Thailand) plants 205. Cannabis scions were also grafted to hops stocks. In both cases, the Cannabis portion of the graft continued to produce its characteristic amounts of cannabinoids when compared to ungrafted controls, but the hops portions of the grafts contained no cannabinoids. This experiment was well-designed and carried out. Sophisticated methods were used for detecting THC, THCV, CBD, CBC, CBN, and CBG. Yet none of these were detected in the hops portions.

The grafting myth grew out of work by H.E. Warmke, which was carried out for the government during the early 1940's in an attempt to develop hemp strains

that would not contain the "undesirable" drug 58. The testing procedure for the active ingredients was crude. Small animals, such as the water flea *Daphnia*, were immersed in water with various concentration of acetone extracts from hemp. The strength of the drug was estimated by the number of animals killed in a given period of time. As stated by Warmke, "The *Daphnia* assay is not specific for the marijuana drug ... once measures any and all toxic substances in hemp (or hop) leaves that are extracted with acetone, whether or not these have specific marijuana activity." Clearly it was other compounds, not cannabinoids, that were detected in these grafting experiments.

Unfortunately, this myth has caused some growers to waste a lot of time and effort in raising a worthless stash of hops leaves. It has also led growers to some false conclusions about the plant. For instance, if the hops scion contains cannabinoids, the reasonable assumption is that the cannabinoids are being produced in the *Cannabis* part and translocated to the hops scion, or that the *Cannabis* root or stem is responsible for producing the cannabinoids precursors.

From this assumption, growers also get the idea that the resin is flowing in the plant. The myth has bolstered the ideas that cutting, splitting, or bending the stem will send the resin up the plant or prevent the resin from going down the plant. As explained in our discussion of resin glands in section 2, these ideas are erroneous. Only a small percentage of the cannabinoids are present in the internal tissues (laticiferous cells) of the plant. Almost all the cannabinoids are contained and manufactured in the resin glands, which cover the outer surfaces of the above-ground plant parts. Cannabinoids remain in the resin glands and are not translocated to other plant parts.

We have heard several claims that leaves from hops grafted on marijuana were psychoactive. Only one such case claimed to be first hand, and we never did see or smoke the material. We doubt these claims. Hops plants do have resin glands similar to those on marijuana, and many of the substances that make up the resin are common to both plants. But of several species and many varieties of hops tested with modern techniques for detecting cannabinoids, no cannabinoids have ever been detected 212.

The commercially valuable component of hops is lupulin, a mildly psychoactive substance used to make beer. To our knowledge, no other known psychoactive substances has been isolated from hops. But since these grafting claims persist, perhaps pot-heads should take a closer look at the hops plant.

Most growers who have tried grafting *Cannabis* and *Humulus* are unsuccessful. Compared to many plants, *Cannabis* does not take grafts easily. Most of the standard grafting techniques you've probably seen for grafting *Cannabis* simply don't work. For example, at the University of Mississippi, researchers failed to get one successful graft from the sixty that were attempted between *Cannabis* and *Humulus*. A method that works about 40 percent of the time is as follows. (Adapted from 205)

Start the hops plants one to two weeks before the marijuana plants. Plant the seeds within six inches of each other or start them in separate six-inch

pots. The plants are ready to graft when the seedling are strong (about five and four weeks respectively) but their stem has not lost their soft texture. Make a diagonal incision about halfway through each stem at approximate the same levels (hops is a vine). Insert the cut portions into each other. Seal the graft with cellulose tape, wound string, or other standard grafting materials. In about two weeks, the graft will have taken. Then cut away the unwanted Cannabis top and the hops bottom to complete the graft. Good luck, but don't expect to get high from the hops leaves. {Smoking any plant's leaves will give a short, slight buzz.}

18.7 Polyploids

H.R. Warmke also experimented with breeding programs during the war years. Polyploid Cannabis plants were produced by treatment with the alkaloid colchicine. Colchicine interferes with normal mitosis, the process in which cells are replicated. During replication, the normal doubling of chromosomes occurs, but colchicine prevents normal separation of the chromosomes into two cells. The cell then is left twice (or more then) the normal chromosome count.

Warmke's experiments concluded that polyploids contained higher concentrations of the "active ingredient." However, the procedure for measuring that ingredient was much the same is described for grafting, with probably similar shortcomings.

Polyploid Cannabis has been found to be larger, with larger leaves and flowers. Recent experience has shown that polyploids are not necessarily higher in potency. Usually they are about equal to diploid siblings.

Colchicine is a highly poisonous substance. The simplest and safest way to induce polyploids is to soak seeds in a solution of colchicine derived from bulbs of winter or autumn crocus (*Colchicum*). Mash the bulbs and add an equal part of water. Strain through filter paper (or paper towels). Soak seeds in the solution and plant when they start to germinate. Cultivate as usual.

Only some of the seeds will become polyploid. Polyploid sprouts generally have thicker stems, and the leaves are often unusually shaped, with uneven-sized blades. Leaves also may contain more than the usual number of blades. As the plant grows, leaves should return to normal form, but continue to be larger and with more blades.

If no polyploids sprout, use less water in preparing the solution.

Colchicine is also a prescribed drug for treatment of gout and is taken in pill form. These usually contain .6 mg per tablet. Use 10 tablets per ounce of water, and soak the seeds as described above.

Colchicine is also sold by mail-order firms which advertise in magazines such as *Head* or *High Times*.

Because colchicine is a poison, it should be handled carefully. It is not known if plants from seeds treated with colchicine will contain a harmful amount of colchicine when plants are grown. Harm is unlikely, because the

uptake by the seed is so small, and because the colchicine would be further diluted during growth, as well as diminished by smoking. But we cannot guarantee that you can safely smoke colchicine-treated plants.

Chapter 19 EFFECTS OF THE ENVIRONMENT ON POTENCY

This chapter deals only with the influence of the environment on the potency of your crop. Differences or changes in potency can also result from inherent differences between plants, such as in their variety or growth stage, from chemical degradation of the harvested marijuana, and from genetic processes that take place over several generations of plantings ((For discussion of these other causes of differences in potency, see the following sections: "Cannabis Chemotypes" in section 2; "Inherent Variations" in section 3; "Breeding" in section 18; "Potency and Decomposition" in section 20; and "Storage" in section 21.))

We have emphasised the heredity is the most important factor that determines potency. Potent marijuana grows from seeds of potent marijuana. A healthy, mature plant bears an abundance of flowers, guaranteeing you a potent harvest.

Some researchers have investigated the impact of the environment on relative potency, since this question is of interest to officials concerned with marijuana control as well as to marijuana growers. Their primary goal has been to discover the gross effects of different environments rather than to single out the effects of any particular factor. A consensus is that the impact of environment on potency is small relative to that of the plant's heredity. Nevertheless, where scientists have commented on this question, the common denominator for higher potency has been stress.

19.2 Stress

Stress is anything that detracts from the plant's health or vigour. Environmental factors such as competition from other plants, low water availability, and poor soil conditions are examples of stress factors.

In many marijuana-growing cultures, farmers have practices that are stress-related; splitting the base, severe pruning, bending or contorting the stem, and water deprivation are common examples. Of course, the fact that marijuana-growing cultures have such practices does not mean that these practices actually increase potency, or that this is, or ever was, their intent. This original meaning may well have been forgotten centuries ago. For instance, cultivation of sinsemilla has been practiced for centuries, not for potency, but because the seedless product is easier to process or smoke.

There does seem to be some underlying relationship between stress and higher potency. Stress factors may slow growth in general, but at the same time, may not slow the synthesis of cannabinoids. Potency may be affected in much the same way by growth factors that are not considered stressful. As described previously, marijuana plants grow more compactly and have smaller

leaves under conditions of relatively warm temperatures, or strong sunlight, or a dry atmosphere; they grow taller and have larger leaves when grown under cool temperatures, moderate light, or a humid atmosphere. Higher relative potency seems to correlate with conditions which favour compact development of the plant and its parts.

The rate of cannabinoids synthesis relative to photosynthesis may be affected in ways not apparent. Sunlight, for instance, is a growth factor. In almost all cases, the more sunlight the plants receive, the faster and larger they will grow. Yet plants grown with intense sunlight seem to maximise potency. Intense sunlight can raise plants' internal temperatures to levels that interfere with the photosynthesis cycle. Absorption of light energy and conversion to biochemical energy continues unimpeded, but the synthesis of sugars is impeded. (Under a midday sun, this phenomenon has been observed in other field crops. (206)) In marijuana, cannabinoids synthesis may continue unaffected at these higher temperatures. This might account, in part, for the slightly higher potency of plants grown in tropical zones.

The subject of potency is mired in confusion and mystery, largely because of fertiliser and soil ads, marijuana-growing books, and individuals who promise ways of increasing potency or growing super grass. There are no magic formulas or secrets to divulge that will make or break the potency of your crop. We have tried to play down this type of thinking throughout this book. Choice of seed, and a harvest of well-developed buds, far outweigh any other factors in determining potency.

We know of no one who has demonstrated that manipulation of any particular environmental factor leads to higher potency. This lack of demonstration probably exists for two reasons: (1) environmental effects on potency are relatively small compared to the effects of inheritable traits, and hence are not easy to discern; and (2) "increased potency" is difficult to prove ((Most scientific experiments are observations, and test effects or compare results rather than try to prove something.)) The variations in potency within any variety, and within each plant, require stringent methods of sampling for comparative tests. And since potency also changes with time, meaningful comparisons can be difficult to make. Scientific papers reflect this difficulty.

An experiment on potency must account for inherent variations in potency before environmental effects can be analysed. Samples would need to be equivalent in terms of variety, growth stage and development, sex, plant part, and the position of the part on the plant. A simple way to do this would be to harvest females when each reached full bloom and then compare the uppermost buds from each plant.

Most of the research on potency done to date either has not reported sampling techniques or did not account for certain inherent variations. In the extreme case, all vegetative matter from one plant was mixed together, and the THC concentration in a sample of this matter was compared with that in a similar sample of mixed marijuana from another plant. Such practices can give misleading results. Consider the fact that an unhealthy plant will have dropped many of its lower, less-potent leaves. A healthy plant has more leaf overall and retains more of its lower leaves. There is a good chance

that the unhealthy plant will test higher in average THC content, because proportionately shoots, which are relatively more potent. Such a sampling error could create the impression that stress is positively correlated with potency.

Marijuana scientists have recognised the need for testing equivalent samples and for setting standards for testing. In 1974, the English scientist John Fairburn (68) published a number of well-controlled experiments concerning potency and light. This is a hopeful sign that more meaningful experiments will be forthcoming.

We have said that the common denominator for increasing potency is stress. Let's put that in perspective.

You cannot go wrong if you grow the largest and healthiest plants possible. Our experience has been that the most potent plants are more often the healthiest and most vigorous in the garden.

Factors that limit growth rate are probably related to potency, and if growth rate is relatively slower, cannabinoids concentrations may be higher. Plants whose average yield is six ounces may be slightly more potent than plants whose average yield is eight ounces. Factors related to potency affect growth rate rather than ruin the plant's health. When a plant is so traumatised that it is barely surviving, potency as well as growth rate declines.

Obviously, if the growth rate is slower, the harvest will be smaller. Any difference in potency due to stress is quite small, but the difference in yield can make the difference between harvesting an ounce and harvesting several pounds (ie., don't get carried away with the practice of stressing the plants). If you wish to stress the plant, wait until it is firmly established and growing well.

Outdoors, don't stress the plant until at least the middle of its life. You want the plant to be large enough to bear a good harvest of buds. Water deprivation is a good method of limiting growth outdoors. However, wilted plants must be watered, or they will die.

Competition from other weeds has been correlated with higher potency in two recent studies (71,74). You might prefer not to weed your patch after the seedling stage. (Initially, weeding is necessary because indigenous weeds generally outgrow marijuana seedlings.)

Another safe way of applying stress is to remove all large leaves from the plant once it has begun to flower.

Indoors, the plants are already in a delicate state. We advise indoor growers to grow the largest and healthiest plants possible for best results.

19.3 Nutrients

Most growers show a keen interest in fertilising, since it is one factor over which they have some control. Most growers also feel that nutrients, which play such an important part in plant growth, probably have a

relationship to the potency, and this is a reasonable assumption. In marijuana lore, potency is sometimes attributed to particular soil types (for instance, red dirt, which is iron-rich) or to presence or lack of certain nutrients (for examples, nitrogen or potassium deficiency).

The relationship of potency to soil conditions, in particular the nutrient content, has been looked at recently by several research groups. In two such studies, (71,74) the cannabinoid content of naturalised weedy hemp stands in the Midwest was examined. Variations in potency were then correlated to soil properties, such as N, P, and K content. The two papers came to similar conclusions. First, stands growing in areas where they were under stress tended to produce less biomass (yield) but were more potent overall. Second, when nutrients or other growth factors, such as height and weight of plants or root size, were correlated with potency, potency was almost always correlated positively with positive growth factors. That is, higher potency occurred when the plants were growing with adequate or high amounts of nutrients present, not when nutrients were inadequate.

What appears to be a contradiction (stress leads to higher potency, or good growing condition lead to higher potency) may be explainable in terms of what these experiments actually measured.

A basic assumption in these studies was that all the plants were relatively homogeneous genetically, since they may have originated from a single stock of hemp grown during World War II. Assuming this is true, then variations between stands would be due to differences in local environmental factors. However, since environmental condition differed locally for separate stands, one cannot tell whether variations in potency between stands are due to present environmental factors (phenotypic responses) or reflect thirty years of adaption by each stand to its local environment (genotypic shifts).

It may be that positive growth factors are associated with higher potency in phenotypes (plants now growing), whereas stress leads to higher potency in succeeding generations, because of selective pressure. It is interesting that both papers reported strong positive correlations between higher potency and competition from other weeds, since competition between plants does exert strong selective pressures.

The following list of possible effects of nutrients on potency has been adapted from these four studies. (63,71,74,231)

Nitrogen

Nitrogen was positively correlated with higher potency. Once controversy in marijuana lore is whether a nitrogen deficiency during flowering increases potency. We have grown plants with N deficiencies, and they seemed no more potent than those grown with high amounts of nitrogen available. However, the N-deficient plants did produce a much smaller harvest.

Phosphorus

P has been correlated positively with higher potency in all studies that have examined this factor. Phosphorus is necessary for good flower development and seed production. Give the plants a steady supply of

phosphorus throughout growth and in particular during flowering.

Potassium

K has been correlated both positively and negatively with potency. More often, it has been found to be negatively correlated. As discussed previously, plants that show some potassium deficiencies may grow well; so you may choose not to treat minor symptoms of K deficiency often grows vigorously with little harm other than the spotting and the loss of some lower leaves. It should not be necessary to fertilise with potassium during flowering unless deficiency symptoms are severe and the plant has ceased growing.

Calcium

Abundant Ca levels have been consistently correlated with higher potency.

Magnesium

Mg has been negatively correlated with potency. However, this may have been due to the interaction of Ca and Mg, and may reflect Ca's strong positive correlation to potency, rather than the negative effects of Mg per se. Plants that show Mg deficiencies must be fertilised, or they will quickly lose most of their leaves and barely remain alive.

Chapter 20 HARVESTING

Figure 30 is a hypothetical plot of the increase in potency of a male plant and a female during the course of their growth. (Potency is measured by the percentage by weight of THC in a dried sample of the uppermost leaves or growing shoots until flowers appear.) It shows that generally potency increases as the plant develops. Cues such as phyllotaxy changes and rate of growth are helpful indicators to changes in development and the chronological age of the plant has little significance.

The development of the cannabinoids, resin glands, and, in practical terms, the potency in the living plant is not clearly understood. We believe that, for the most part, potency does not increase steadily throughout the entire plant. Rather, each plant part reaches a point of maximum potency as it individually develops. A leaf that is formed when the plant is four weeks old does not increase in potency during the rest of the season. To say that potency is increasing means that the leaves that are now forming are more potent than those previously formed.

We also believe that cannabinoid formation is very fast as each plant part forms. Once matured (for example, when a leaf is fully expanded), cannabinoids are decomposing. This is one reason why the potency can decrease as well as increase during growth, especially late in the season, after the flowers have formed. The practical aspects of these points are detailed in the following sections.

20.2 Harvesting During Growth: Leaves and Growing Shoots

Leaves

We have emphasised that you should harvest grass during the course of the season. One reason is to assure yourself a return for your efforts. It is a sad commentary on our times that the greatest danger in growing marijuana outdoors is that the plants may be ripped off. On a more positive note, vegetative shoots and leaves can be surprisingly potent and should be sampled.

The potency of each new set of leaves is higher than the last pair until a plateau is reached, usually during the middle of vegetative growth. Thereafter potency of new leaves stays about the same as in those preceding. Often there is a noticeable decline in potency just prior to flowering. Leaves that form during flowering are usually more potent than those formed during the vegetative plateau. Leaves that form after the bloom are less potent.

Of course, not all varieties or individual plants will follow this rhythm. Faster-developing plants may reach the plateau sooner, and slower plants later. Potency of plants that have a longer life cycle may stay at the vegetative plateau for several months. Some plants do not seem to experience any drop in potency before flowering. Potency of these plants continues to increase gradually after the initial quick increase during early vegetative growth.

Whenever you harvest green leaves during growth, you should always take the uppermost leaves, since these are the most potent. Also, the smaller leaves that form on the branches are more potent than the large leaves on the main stem. These large stem leaves (fan, shade, or sun leaves) are often the first leaves that growers pick. But these are the least potent of all leaves, and they may not get you high at all. As long as these leaves are healthy and green, let them stay on the plant for the plant's growth. Many growers simply use these leaves for mulch or compost as they die.

Don't think that you should harvest each leaf as soon as it appears; this procedure would seriously affect normal growth and result in a small harvest of buds. The potency of individual leaves does not increase during the course of the season, but the decrease in potency is not great. Some of the loss in potency may even be made up for by the loss in tissue weight that a leaf experiences as it dies. Many growers prefer to harvest leaves during growth only after they lose colour, preferring the taste of the smoke to that of green leaves.

Leaves should always be harvested if they die; with indoor gardens, remove any leaves that show signs of insects or other pests.

Do keep yourself supplied with grass (that is the reason you are growing the plant); just don't overdo it. The main harvest is made up of buds, and you want a large, healthy plant that can support vigorous flowering. The larger and healthier a plant is, the more leaf you can harvest without seriously affecting the plant.

Growing Shoots

You may prefer not to clip the growing shoot of the main stem. This forms the largest and most potent cola by harvest time. Plants grown close together usually are not clipped, so that the plants may grow as tall as possible. Where there is much space between plants, the main shoot is clipped to encourage the plant to develop its branches, which fill the available space.

The potency of growing shoots follows the rhythm described for new leaves. However, growing shoots can be the most potent parts of the harvest when picked at the right time. Shoots sometimes reach a very high peak of potency during the middle of vegetative growth. Outdoor gardens should be sampled from mid-June through July, since this is the period in which shoots usually reach their peak.

Potency also fluctuates according to local weather conditions. Try to harvest after a period of clear, sunny weather. Potency may decline for several days after a period of cloudy weather or heavy rainfall. After a heavy rain, harvest the shoots a week or two later, since the shoots often peak in potency during a burst of fast growth.

Growing shoots can be harvested from each plant at least twice during growth. The first clipping may not give you much worthwhile grass, but it is done when the plants are young (roughly six weeks old) to force the plant to develop several growing shoots which are harvested about six to eight weeks later. The main shoot is clipped, leaving about four or five nodes below the cut. Two shoots should start to grow from each node, the strongest at the top of the plant and the weakest at the bottom. (This difference is more pronounced under artificial light, since the light is strongest on the top of the plants.) Each plant should produce at least six strong growing shoots after this first clipping. The yield from growing shoots can be considerable (especially during the summer marijuana drought) and will probably keep you supplied until the main harvest.

A third harvest of shoot can be made later if the plants have a long growing season or are indoors. You don't want to clip shoots from the plants just prior to or during flowering, since doing so cuts down on the harvest of buds. Each plant should have at least twelve growing shoots after being clipped twice previously. You might harvest only a few shoots from each plant if the time for flowering is near.

20.3 Male Plants

Male plants usually do not have the dramatic increase in potency during flowering that the females do. Male flowers take about two weeks to mature, from the time they are first visible as tiny knob-like buds. New flowers continue to appear for several weeks.

When male flowers open and are about to release pollen, they reach their maximum potency. Since all flowers do not mature at the same time, for maximum potency the plants should be harvested after the first few flowers have opened.

Male flowers actually make up little of the total weight of the harvest, and few new leaves form once flowering begins. There is no significant loss in either potency or yield if the male is harvested before its flowers open. Once male flowers appear, there is little change in their potency. Also, once the flowers do open and release pollen, they shortly fall from the plant and are lost to the harvest.

Males should therefore be harvested before any flowers open unless you want the females to produce seeds. In a small garden, male flower clusters can be individually harvested as they mature. Most growers treat male flowers more as a novelty. Potency of male flowers is quite variable, and seldom are they as good as the female flowers. To remove male plants, cut them near the base of the stem. Don't rip them up by the roots if they are near females that will be left to grow.

Male plants normally begin to lose their vigour after the initial bloom. When the weather is mild, or the plants are indoors, they can be encouraged to bloom a second and sometimes a third time before they finally die.

20.4 Harvesting Female Buds

The decision of when to harvest females can be simplified by understanding that you want to pick the buds after they have developed fully, but before degradation processes begin to lower potency. There are two criteria you can use to tell when the plants have reached full bloom. The first is recognising the rhythm, with which the plants are blooming. A second is the condition of the flowers as judged by the health of the stigmas and the colour of the resin.

Sinsemilla

Since sinsemilla flowers are not pollinated, the flowering period may last for many weeks. The most common rhythm for sinsemilla is that plants go through a stage of rapid bud formation, and the plants do indeed bloom. This bloom often lasts four to five weeks. The bloom ends when the rate at which new flowers form noticeably declines. At this time you should be able to sense that the bloom is completed. Buds are at their peak potency about one week after flower formation slows. This is the time to harvest. True, the plant may continue to grow slowly, but the main harvest is ready and should be taken.

With sinsemilla, some marijuana varieties have an extended bloom that may last more than two months. With this rhythm, the rate at which the buds form is drawn out, and progresses at a slower but steadier pace. The point at which the bloom is essentially over may not be as obvious as in the first case. Here, use the condition of the buds to make your decision. Stigmas wither first at the base of the buds (older flowers). Those stigmas at the top of the buds (younger) will still be white and healthy, although their tips are often brown. Harvest the plants when about half the stigmas in the buds have withered. The coating of resin glands should still be clear or white, with only a few golden or browned gland heads.

A third type of flowering rhythm is sometimes seen on plants from Thai seed. Flower buds bloom and ripen at different times. These plants also have an

extended flowering stage that can last for over two months. You may choose to harvest individual buds, colas, or branches as they ripen.

Seeds

If your primary interest is seeds, the plant should be harvested after the seeds have developed their mature colour. Mature seeds can be seen splitting their sheaths or bracts. When enough seeds have ripened, the plants should be harvested. If the plants are left in the ground and die, many of the seeds will fall from the plant.

For most growers, potency will be of primary interest, seeds only a secondary. With seeded marijuana, flowering is initially rapid until the plant is well-pollinated. If pollination occurs early in flowering, the plants often bloom for another week or two. Generally, you want the plants to flower for at least four weeks before picking, and usually longer, about six to seven weeks.

With seeded marijuana, the bloom is of shorter duration than with sinsemilla. Once growth slows, wait another two to three weeks before harvesting. All the seeds may not be matured, particularly at the top of the bud. But potency of the buds should be about maximum at this time.

20.5 Weather

Because of such variables as variety and growing conditions, there can be so much variation in the ripening process that no one criterion for judging when maximum potency is reached will be reliable for all cases.

Warm, sunny weather encourages rapid flowering and a long period of receptivity by the stigmas. Cool, rainy weather can wither the stigmas and dampen the vigour of the bloom.

If brief frost or long, cool rain has withered the stigmas, use the plants' growth as a guideline, because ultimately this is the most important criterion. You want the buds to reach a mature size, and to ripen for about another week. You do not want the buds to be left on the plant longer than necessary.

Ideally, harvesting should follow a period of warm, sunny weather. In northern and mountainous parts of the country, many tropical varieties will not flower until late in the season, when the weather has cooled and night-time frosts are threatening. Most mature plants can withstand mild frosts and continue to grow well if daytime temperatures are mild. In this case, let the plants mature, since formation of the buds is more important than the weather in determining potency. Watch the plants carefully, and harvest when the buds reach mature size. Marijuana killed by frost may smoke harshly, but potency does not seem affected. Well-formed buds should be picked if heavy rains are expected. Cannabinoids are not water-soluble, but gland heads will be washed away.

Barring a catastrophe, such as a long frost, death to Cannabis is usually not sudden. The plants will continue to grow, and may in fact rejuvenate the next year if the stalks are left in the ground. But after the main bloom,

the growth that follows is usually much less vigorous and sometimes forms abnormally. Leaves at this time are simplified, and have one blade. Later leaves are smaller, and tend to have entire margins (no serrations). Sometimes they are twisted or misshaped, as are the flowers that form along with them. This slow growth that follows the initial bloom will contribute little to the weight of the harvest. Additionally, this post-bloom growth is much less potent than the original bloom. Resin glands on these plant parts are feeble and poorly developed. When this abnormal growth forms, the time for harvesting is past. {See Figure 83.}

When a plant seems to persist in growing, and you are not sure bloom is past, the best procedure to follow is to try for a double harvest.

Double Harvests

Most marijuana plants take at least five months to reach maturity. Once the plant has reached maturity, it is forming its most potent marijuana, and should not be cut down completely. You can often induce the females to flower a second (and sometimes a third) time, especially if the plants are indoors or if the weather is expected to stay mild for several more weeks.

To encourage a second bloom, first take the bulk of the harvest: all but the smallest buds, and most of the leaf. Some green leaves should be left on the plant to maintain the plant's growth. After harvesting, give the plants a thorough watering, and water with a soluble, complete fertiliser that provides a good supply of both N and P. This will encourage new growth and continued flowering.

Indoors, the best procedure is to treat the plants like a hedge. Cut all the plants back to equal heights, about two to three feet tall. Remove most of the grass, but again leave a few green leaves on the plant. Don't remove lower branches even if they are leafless, since these will sprout again. Lower the light system to the tops of the plants, and maintain the daily cycle at about 12 hours. The second crop of buds will be ready for harvest in four to eight weeks. With this system, the plants appear like dense hedges of buds. If the second crop of buds forms quickly, you should try for a third crop. Continue to fertilise the plants regularly, and watch for signs of magnesium deficiencies, which often show up when the plants have been growing for an extended time.

Double and triple harvests are one of the benefits of indoor growing. Although plants are relatively small indoors, the original harvest of buds can be triples in the next four months.

20.6 Potency and Decomposition

We have said that when buds are picked too late, the potency may decline because of decomposition of the cannabinoids, especially THC.

In section 21, Tables 26-29 give measured rates of decomposition of the major cannabinoids due to exposure to light and air. Light rapidly decomposes THC into unknown products (possibly polymers (122,164)). Light also converts CBD to CBS and CBC to CBL. Air (oxygen) slowly converts THC to the less active CBN. Conversion to CBN is hastened by higher temperatures.

Degradative processes do not occur as quickly in the living plant as when the cannabinoids are purified or in solution, as is shown by the data in Tables 27-30 in section 21 {Tables on disk only}. Resin glands seem to function well in storing the cannabinoids in dried plant material. However, the rates of decomposition in Tables 27 and 28 are for samples exposed to north light and a maximum of 80F temperatures. Temperature would be higher, and light stronger, under full sunlight.

Studies with fresh plant material usually show negligible CBN content in fresh marijuana from immature plants. When mature buds are tested, their CBN content is generally equal to at least five percent of their THC content. When growing temperatures are higher, such as in the tropics, CBN content can account for more than 20 percent of the original THC. Even if we assume a low figure, such as five percent conversion of THC to CBN, there is actually a much greater decline in THC content because of the simultaneous degradation of THC by light.

When the slow rate at which THC oxidises to CBN is considered, five percent decomposition in a period of less than two months represents considerable exposure of the THC to air, and most of this exposure occurs in the last critical weeks when the resin glands begin to degenerate. Plates 8 and 11-13 show the condition of the resin glands on several different kinds of marijuana.

Stalked glands that cover the female flower bracts sometimes rupture or secrete cannabinoids through pores in the glands head. Secretion is not a continuous flow, but more of an emptying of the glands' contents. At this time, gland heads may dehisce. Also, because of their abundance and raised positions, resin glands on the female bracts are exposed to strong sunlight and possible physical damage. These conditions may explain the significant decline in potency of buds that are overripe.

Leaves are also affected by decomposition of the cannabinoids, but not as quickly or seriously as the buds, probably because the resin glands on the leaves are most numerous on the undersurface, where they are somewhat protected from light. These glands rarely rupture or secrete cannabinoids. Often they are intact, clear, and apparently unchanged for many weeks on the living plant.

As the plates show, one can, with the naked eye, see the glands change colour, from colourless or white to golden, and then to reddish or brown. THC is colourless. If the colour changes of the resin do indicate decomposition of THC, then decomposition in the stalked glands that cover the buds can be considerable.

We have smoked buds that seemed to lose about half their potency when left on the plant for an addition three weeks. Colour changes are after the fact. If many of the glands are beginning to brown, the grass should be harvested.

20.7 Timing the Harvest

Many growers will disagree with us on when the best time is to harvest the buds (female plants). When the plants are left in the ground, and are alive

but past the main bloom, the resinous qualities of the plant may become more apparent. The bracts and tiny leaves may swell in size, and the leaves feel thicker. The coating of resin glands will change colour. Leaves often yellow and fall from the plant. Much of the green colour in the flowering buds may also be lost. Harvests of these buds more closely resembles commercial Colombian grass than typical homegrown. The resin content of the dried buds may be higher, and the grass will smoke more harshly than if the buds were younger when picked. You may prefer these qualities in your grass, and some growers insist this grass is stonier. We feel that the grass will give you the highest high when it is picked as described previously. Smoking is a personal experience, and you should try different approaches and come to your own conclusions.

The first time you grow marijuana is largely a learning experience. Most growers can't wait to start their second crop, because they are certain that they'll improve on both the quantity and the quality of their crop, and this is usually true. The wise grower will not put all his proverbial eggs in one basket. It is a good idea to monitor potency by taking samples every few days when harvest time is drawing near, just as such monitoring is for deciding when to harvest growing shoots during vegetative growth.

In any garden, some of the plants will mature sooner than others. Use the plant(s) that is earliest to mature to decide at what point in its development the plant reaches maximum potency. This finding then serves as a guide for harvesting the rest of the plants.

Try to use buds from approximately the same position on the plant each time you sample. Take only enough to make a joint or two. The more you standardise your testing (and this includes your smoking evaluation), the more accurate your results may be.

20.8 Final Harvesting

The time of harvest is a time of joy. It is also a time for caution. Unless the safety of your garden is assured, you will want to harvest quickly, quietly and as efficiently as possible. Ideally, each plant is harvested as it matures, but some of you will have to harvest all at once.

It is best to take cardboard boxes or large, sturdy bags to carry the harvest. You want to harvest the plants with as little crushing or damage to the flowers as possible.

Bring a strong knife, heavy shears, or clippers for cutting the stalks. The quickest way to harvest is to cut each plant at its base. Once the plants are on the ground, cut the stalks into manageable lengths for boxing or bagging. Separate large branches as needed for packing.

The bagged or boxed material should be moved to the curing or drying area as soon as possible. If you let the plants sit in the trunk of a car or in plastic bags, they will start to ferment and smell in less than a day.

AFTER THE HARVEST

Once the marijuana plant is harvested, it ceases to produce cannabinoids and resins, and the main changes in potency that occur are degradative. However, when the material is handled carefully, dried or cured properly, and then stored well, little degradation will occur. During drying or curing, the resin content may seem to increase, as the plant's tissues shrink away from their resinous coating.

More than 70 percent of the fresh weight of the plant is water. Drying is done to evaporate most of this water, so the marijuana will burn evenly and smoke smoothly. Additionally, the cannabinoids in fresh plant material are mostly in the acid forms, which are not psychoactive. The acid cannabinoids decarboxylate (they lose the gas, carbon dioxide) during the drying or curing processes, which convert them to their psychoactive neutral forms. Decarboxylation is complete if the marijuana is actually smoked. For this reason, no special procedures are needed to decarboxylate the marijuana unless it will be eaten. In that case, the recipe should include a period of dry heating. The heat converts the cannabinoids to their psychoactive neutral forms, and also melts the sharp-pointed cystolith hairs that cover leaves, stems and petioles. Cystolith hairs can cause stomach pains if you eat uncooked marijuana or chew on raw marijuana, which we strongly advise you not to do.

Commercial marijuana is usually composed of just the flower tops (colas), which have been stripped, manicured, cured, and dried. Homegrowers often do not cure their crop before drying, and if the smoke is smooth, there is no reason not to dry it directly. But harsh-smoking marijuana can be cured so that the smoke is smoother. Curing has little effect on potency when done properly.

21.2 Stripping

Stripping, the removal of large leaves, is usually done soon after harvesting. Fan leaves are stripped because they are much less potent than the colas that they cover, and do not cure as well as the prime material. In commercial growing areas, the fan leaves are often stripped in the field and form a green manure. But fan leaves are sometimes quite potent, especially if they are recent growth. The lower leaves are usually weak, but they can be used in cooking or concentrated in an extract.

The easiest time to strip fan leaves is after they have wilted, because they are easier to pull off when they are limp than when they are turgid. Wilting takes place in less than an hour if the plants are in a well-ventilated space. Plants placed in a plastic bag in a cool area may take a day or more to wilt.

Some growers leave the fan leaves on until the plants have dried. After the buds are removed, they strip the remaining leaves by running their (gloved) hands from the base of stems and branches toward their tips. The fan leaves disintegrate into shake.

21.3 Grading and Manicuring

Grading and manicuring are important steps in preparing fine grass. Grading is done by separating the plants according to variety, sex, and the particular stash uniform, and the quality of the better grades is not diluted. Plant parts are usually graded as follows: main top colas, small side colas, immature buds, leaves accompanying flowers, and fan and stray leaves. This is important, because the differences in potency will be considerable. For instance, the buds on a Colombian homegrown will be top quality, but the lower leaves will be more like a low-grade commercial Mexican.

Manicuring is done to remove the extraneous leaf from the colas. First the large fan leaves are stripped. The exposed colas are then trimmed with scissors to remove the ends of leaves that stick out from the colas. Plants should be manicured and (usually) graded before drying, since dried material crumbles into shake when handled. Also, leaves dry much more quickly than buds, and different plant parts cure at their own rates.

Male flowers are often treated as a novelty by growers, who make individually rolled sticks from them, as follows. Hang the plants upside down; the leaves will wilt and hang down, covering the male flower clusters. Then roll each cluster within its leaves between the palms of your hands, to compress the cluster into a joint-shaped mass. Dry the "stick" in a warm dark place. Rolling the grass ruptures many of the glands; so dried sticks should be stored carefully until each is used.

Hashish

When you handle your crop, you may notice a resin build-up on your hands and the tools you are using. This resin can be collected by rubbing and scraping it into a ball. It makes a quality hash that is several times as concentrated as the grass.

Small quantities of hash can be made by rubbing resinous plant parts across a thin, fine mesh screen. The resin is then scraped off the screen and rolled into finger shapes. Hash can also be made by thrashing fresh plants over a mesh screen inside an enclosed box whose floor is lined with sheet plastic. A box about one yard square is a suitable size. On one side of the box a hole is made large enough for the colas to be shaken by hand. In this way, the resin glands are knocked loose, but are contained by the box and settle on the plastic.

Plastic or paper should be placed beneath the marijuana during manicuring, grading, or drying. Besides fallen grass, a considerable amount of glands and fine shake can be caught and compressed to a hash-like mass.

21.4 Curing

Curing is a process employed to naturally enhance the bouquet, flavour, and texture of marijuana. Curing does not lower potency when done correctly, although poor curing methods often result in some loss of THC.

Curing is not an essential procedure, and many growers prefer the "natural" flavour of uncured grass. Sweet sinsemilla buds usually are not cured.

Curing is most successful on plants which have "ripened" and are beginning to lose chlorophyll. It is less successful on growing tips and other vigorous parts which are immature. These parts may only lose some chlorophyll.

Curing proceeds while the leaf is still alive, for until it dries, many of the leaf's life processes continue. Since the leaf's ability to produce sugars is thwarted, it breaks down stored starch to simple sugars, which are used for food. This gives the grass a sweet or earthy aroma and taste. At the same time, many of the complex proteins and pigments, such as chlorophyll, are broken down in enzymatic processes. This changes the colour of the leaf from green to various shades of yellow, brown, tan, or red, depending primarily on the variety, but also on growing environment and cure technique. The destruction of chlorophyll eliminates the minty taste that is commonly associated with green homegrown.

There are several methods of curing, most of which were originally designed to cure large quantities of tobacco. Some of them can be modified by the home grower to use for small marijuana harvests as well as large harvests. The methods used to cure marijuana are the air, flue, sweat, sun, and water cures.

Air Curing

Air curing is a technique developed in the United States for curing pipe and cigar tobacco. It was originally done in specially constructed barns made with ventilator slats which could be sealed; a small shed or metal building can easily be adapted for this use. However, this method of curing works only when there is enough material to keep the air saturated with moisture.

Wires are strung across the barn, and the marijuana plants or plant parts are hung from them, using string, wire twists, or the crooks of branches. The plants material should be closely spaced, but there should be enough room between branches (a few inches) so that air circulates freely. The building is kept unventilated until all the material loses some chlorophyll (green colour). This loss occurs rapidly during warm sunny weather because heat builds up, which hastens the cure. In wet or overcast weather, the temperature in the chamber will be cooler, and the process will proceed more slowly. If these conditions last for more than a day or two, unwanted mould may grow on the plants. The best way to prevent mould from forming is to raise the temperature to 90F by using a heater.

After the leaves have lost their deep green and become pale, the ventilator or windows are opened slightly, so that the temperature and humidity are lowered and the curing process is slowed. The process then continues until all traces of chlorophyll are eliminated. The entire process may take six weeks. Then the ventilators are opened, and an exhaust fan installed if necessary, to dry the material to the point that it can be smoked but still is moist, that is, bends rather than crumbles or powders when rubbed between thumb and forefinger.

Flue Curing

Flue curing differs from air curing in that the process is speeded up by

using an external source of heat, and the air circulation is more closely regulated. This method can be used with small quantities of material in a small, airtight curing box constructed for the purpose. Large quantities can be hung in a room or barn as described in Air Curing.

A simple way to control the temperature when curing or drying small amounts of marijuana is to place the material to be cured in a watertight box (or a bottle) with ventilation holes on the top. Place the box in a water-filled container, such as a pot, fish-tank, or bathtub. The curing box contains air and will float. The water surrounding the box is maintained at the correct temperature by means of a stove or hotplate, fish-tank or water-bed heater, or any inexpensive immersible heater. Temperature of the water is monitored.

With the marijuana loosely packed, maintain water temperature at 90 degrees. After several days, the green tissue turns a pale yellow-green or murky colour, indicating yellow or brown pigments. Then increase temperature, to about 100 degrees, until all traces of green disappear. Raise the temperature once again, this time to 115 degrees, until a full, ripe colour develops. Also increase ventilation at this time, so that the marijuana dries. Plants dried at high temperature tend to be brittle; so lower the temperature before drying is completed. This last phase of drying can be done at room temperature, out of the water bath. The whole process takes a week or less.

Marijuana cured by this technique turns a deep brown colour. Immature material may retain some chlorophyll and have a slight greenish cast. Taste is rich yet mild.

Sweat Curing

Sweat curing is the technique most widely used in Colombia. Long branches containing colas are layered in piles about 18 inches high and a minimum of two feet square, more often about ten by fifteen feet. Sweat curing actually incorporates the fermenting process. Within a few hours the leaves begin to heat up from the microbial action in the same way that a compost pile ferments. Then change in colour is very rapid; watch the pile carefully, so that it does not overheat and rot the colas. Each day unpack the piles, and remove the colas that have turned colour. Within four or five days, all the colas will have turned colour. They are then dried. One way to prevent rot while using this method is to place cotton sheets, rags, or paper towels between each double layer of colas. The towels absorb some of the moisture and slow down the process.

Sweat curing can be modified for use with as little marijuana as two large plants. Pack the marijuana tightly in a heavy paper sack (or several layers of paper bags), and place it in the sun. The light is converted to heat and helps support the sweat.

Another variation of the sweat process occurs when fresh undried marijuana is bricked. The bricks are placed in piles, and they cure while being transported.

A simple procedure for a slow sweat cure is to roll fresh marijuana in plastic bags. Each week, open the bag for about an hour to evaporate some

water. In about six weeks, the ammonia smell will dissipate somewhat, and the grass should be dried. This cure works well with small quantities of mediocre grass, since it concentrates the material.

Sun Curing

A quick way to cure small quantities of marijuana is to loosely fill a plastic bag or glass jar, or place a layer between glass or plastic sheets, and expose the material to the sun. Within a few hours the sun begins to bleach it. Turn the marijuana every few hours, so that all parts are exposed to the sun. An even cure is achieved in one to two days {(see Plate 16)}. Some degradation of THC may occur using this method.

Water Cure

Unlike other curing methods, the water cure is performed after the marijuana is dried. Powder and small pieces are most often used, but the cure also works with whole colas. The material is piled loosely in a glass or ceramic pot which is filled with luke-warm water. (When hot water is used, some of the THC is released in oils, which escape and float to the top of the water.) Within a few hours many of the non-psychoactive water-soluble substances dissolve. An occasional gentle stirring speeds the process. The water is changed and the process repeated. Then the grass is dried again for smoking.

THC is not water-soluble; so it remains on the plant when it is soaked. By eliminating water-soluble substances (pigments, proteins, sugars, and some resins), which may make up 25 percent of the plant material by weight, this cure may increase the concentration of THC by up to a third.

Marijuana cured by this method has a dark, almost black colour, and looks twisted and curled, something like tea leaves. The water cure is frequently used to cure dried fan leaves and poor-quality grass.

21.5 Drying

Living marijuana leaves are 80 percent water; colas are about 70 percent water. Marijuana dried for smoking contains only eight to 10 percent water, or about 10 percent of the original amount. There are several methods used to evaporate water; these have little effect on potency, but can affect the taste, bouquet, and smoothness of the smoke. Generally, the slower the dry, the smoother the taste. Excess drying and drying methods that use heat will evaporate some of the volatile oils that give each grass its unique taste and aroma.

Grasses which are dried as part of the curing process usually have a smooth, mild taste, because of the elimination of chlorophyll and various proteins. Cured marijuana may also be a little sweeter than when first picked, because the curing converts some of the plant's starch to simple sugars.

Some grasses are tasty and smooth-smoking when they are dried without curing, especially fresh homegrown buds which retain their volatile oils and sugar. Many homegrowers have acquired a taste for "natural" uncured grass, with its minty chlorophyll flavour; such marijuana is dried directly after

harvesting. {Figure 89, Male plants drying on a tree. Cheesecloth holds loose leaf for drying.}

Slow Drying

Slow drying is probably the method most commonly used to dry marijuana. Because of the slowness of the dry, a slight cure takes place, eliminating the bite sometimes associated with quickly dried grass.

There are many variations of the technique, but most commonly whole plants or separated colas are suspended upside down from a drawn string or from pegs on a wall in a cool dark room, closet, or other enclosed space. A large number of plants may take a week or two to dry. The drying time for small numbers of plants can be increased (for a slight cure) by placing the plants in large, open paper sacks that have ventilation holes cut in their sides. The drying room should have no heavy drafts, but mould may form on the plants if the air is stagnant. If weather is rainy or the air humid, increase ventilation and watch for any mould. Plants should be dried quickly under moderate heat if any mould appears.

Many experienced growers prefer slow drying to curing. There is little chance of error with this method, and buds usually smoke smooth and develop a pliable consistency. Slow-dried ripe buds retain their delicious, sweet aroma and taste.

Fast Drying

The fast dry-method produces a harsher smoke than slow drying, but it is often the most convenient method to use. The plants are suspended in the same way as for slow drying, but the temperature in the drying area is increased to between 90 and 115 degrees, often by means of electric or gas heater. The drying area is kept well-ventilated with a fan. As the plants dry, they are removed from the drying area. By this method, plants in a tightly packed room can be dried in less than four days, but the exhaust will contain the deliciously pungent odour of drying marijuana.

Indoor growers often hang plants to dry over radiators or stream pipes. Leaves are dried by placing them on a tray over a radiator or on top of the light fixture.

Marijuana that is fast-dried retains its original green colour and minty taste.

Oven Drying

Oven drying is often used by gardeners to sample their crop. Small quantities of material can be quickly dried by being placed in a 150 to 200 oven for about 10 minutes. Larger quantities can be dried in trays that contain a single layer of material or in a dehydrator. Oven-dried and dehydrator-dried marijuana usually has a harsh taste and bite, and loses much of its bouquet. The method is often used to dry marijuana which has been cured and dried but is too moist to smoke, or to dry marijuana which is to be used for cooking or extractions. It is an adequate method for obtaining dry material for testing and emergencies, but the main harvest

should not be dried in this way. Oven drying works best with leaves. When leaves are dried together with buds or shoots, remove the material from the oven periodically, to separate the faster-drying leaf material (before it burns) from the slower drying buds. One way to do this is to place all the material on a wire screen over a tray. Every few minutes rub the material across the screen. Dried material falls onto the tray and is removed from the oven. Repeat until all the material has dried.

Oven curing works well when closely watched. Dried marijuana that is left in the oven will lose potency quickly. Any time the marijuana begins to char, most of the potency will already have been lost. This should not be a problem unless you are careless, or allow the temperature to go above 200 degrees.

Sun Drying

Some growers dry their crops right in the field. There are many methods of sun drying. In Oregon, some growers break the main stem about two feet from the ground. The leaves and buds dry gradually, since they are still partly attached to the plant. Other growers spread burlap and cover it with plants left to dry. Fan leaves are left on the plants to protect the drying buds from the sun. The grass is manicured after drying. Growers in Arizona shade drying plants with cheesecloth.

Sun-dried marijuana usually has a taste similar to that of oven-dried. Often the sun bleaches it slightly but also destroy some of the delicate bouquet. Prolonged exposure to the sun will decrease potency, although there is no noticeable loss if drying is done quickly.

Dry Ice

Many homegrowers have written to us that the dry-ice cure increases the potency of marijuana considerably, and we would be remiss not to mention it.

Dry ice is frozen carbon dioxide. When it melts (sublimates), it turns from a solid directly into a gas. This gas absorbs some moisture from the frozen marijuana and partially dries it.

There are many variations of the dry-ice method. Fresh or partially dried material is usually used, although some enthusiasts claim that the cure also works with dried material. The marijuana is placed in a coffee can or similar container with a lid, along with at least an equal volume of dry ice. Puncture the lid so that the gas can escape as it evaporates. Place the can in a freezer to prolong the evaporation process. When the dry ice is gone, the grass is dried, but still moist.

Some growers claim that simply freezing the grass increases potency. They often freeze fan leaves or other less-potent material for a couple of months before smoking it. This is said to work only with fresh (wet or dried) grass.

21.6 Fermentation

When vegetation dries, the individual cells which maintained life processes

die. But marijuana can still be conditioned by means of fermentation. Fermentation is the process in which microbes and plant enzymes break down complex chemicals into simpler ones, mainly starch and sugars into alcohol and simple acids. In the process chlorophyll is destroyed, giving the material a more ripened appearance. If the fermentation is stopped early, the marijuana has a sweeter taste because of the sugars which the ferment produced.

Fermentation occurs when the moisture content of the marijuana is raised above 15 percent and the temperature is above 60 degrees. The more tightly packed the material, that faster the ferment proceeds. The rate of ferment is controlled primarily by varying the moisture content, but each batch proceeds at its own rate because of differences between plants in nitrogen content. (Nitrogen is necessary to maintain fermenting bacteria.) The process is delicate; should the ferment proceed too rapidly, the marijuana may be converted to compost. Watch the fermentation closely. After the desired colour or flavour (from a dried sample) is reached, dry the grass quickly to stop the process.

During fermentation, flavourings can be added to give the marijuana a spicy aroma. Such spices as cinnamon, cloves, ginger, mace, sage, or vanilla are placed between the fermenting material. Orange, lemon, or lime peels are also used. About half an ounce of spice or four ounces of peel are used for each cubic foot of material to be fermented. The spices are wrapped in cloth sachets. The citrus peels are strung. They can be placed between the layers of marijuana.

There are two types of fermentations: self-generating and forced. They are best used with leaves or immature plants.

Self-Generating Fermentation

Self-generating fermentation proceeds rapidly only when there is enough material to make a heap at least one cubic yard large. When smaller quantities are used, too much of the heat generated by the bacteria is dissipated, so that the process is slow and is more properly considered aging.

Place the material in a large container or in a pile with a tarpaulin placed over it, and lightly spray it with a mister if it is dry. Let the pile heat up for a few days, and then break it down. If it is repacked, the marijuana will develop a dull matte appearance and lose its sugars. IF the process is allowed to proceed even further, the marijuana will disintegrate.

Forced Fermentation

Forced fermentation can be used with small quantities of material. It requires an enclose chamber in which heat and humidity can be regulated.

Pack the marijuana loosely in a kiln or other chamber, and raise the temperature to 135 degrees. Maintain humidity at 75 percent. Check the progress of the ferment periodically. Within a week the ferment should be completed. During this ferment there is a release of ammonia compounds, resulting in some foul odours, but upon completion of the ferment and

drying, the marijuana should smoke sweet and mellow.

21.7 Storage

THC is degraded by both heat and light. Table 26 shows results of an experiment conducted at the University of Mississippi, in which marijuana was stored under varying temperature conditions¹⁷¹. These results indicate that marijuana stored at room temperature (72) or below, and in darkness for up to two years will lose only an insignificant amount of its original potency; whereas marijuana stored in darkness at 97 or above will lose almost all its potency within two years.

In another experiment,¹⁶⁴ Fairbairn stored dried marijuana at different temperatures in both light and dark conditions. The samples in light were exposed to a north-facing windows (no direct sunlight). The results are shown in Table 27.

Fairbairn also performed an experiment to discover the effect of air on THC¹⁶⁴. Freshly prepared Cannabis resin was stored as a loose powder, a compressed powder, and an unbroken lump for one year at 68 degrees F (about room temperature). Samples were stored under two conditions: in light and air, and in darkness and air. The results are shown in Table 28.

Fairbairn experimented further with pure cannabinoids and extracts of marijuana dissolved in petroleum ether, chloroform, and ethanol (alcohol)¹⁶⁵. The results, in Tables 29 and 30, show that the THC and CBD in solution are much more unstable than when they are left in marijuana, especially if they are held by the plant in undamaged glands, where they are protected from exposure to air and, to some degree, light. Crude extracts seem more stable than highly refined cannabinoids, especially CBD, which is very unstable in refined solutions.

Extract makers and purchasers should limit the exposure of the solution to light and heat as well as to air. Oils and extracts should be kept refrigerated in opaque, sealed container. Notice that THC is almost completely degraded in a few weeks when it is held in solution and exposed to light. Red oil, hash oil, and honey oil must be stored in light-tight containers to preserve potency.

From the tables, you can see that light is the primary factor that causes decomposition of THC. The decomposition products are unknown, but are suspected to be polymers or resins. We also do not know whether the rate of decomposition would be faster in direct sunlight.

Air (oxygen) acts much more slowly to convert THC to CBN. Decomposition of THC to CBN is not significant unless temperatures are in the nineties or higher. However, such high temperatures can occur in grass that is packed before it is properly dried. The moisture that is left supports microbial activity, which heats the grass internally, as occurs during certain types of curing. Potency of cured grass is not lowered significantly when the cure is done properly and when the buds are left intact during the process.

The figures for powdered and compressed grass in Table 28 show that both light and air cause rapid decomposition when the resin is exposed through

breaking of the resin glands. Intact resin glands appear to function well in storing the cannabinoids. For this reason, it is important to handle fresh and dried grass carefully, in order not to crush the material and thus break the glands, especially in the buds, which have a cover of raised resin glands. Most well-prepared marijuana will have intact, well-preserved buds.

The best place to store marijuana is in a dark container in a refrigerator or freezer. Cannabis should be stored uncleaned, so that the glands containing the THC are not damaged, since damage causes their precious contents to be exposed to light and air. Marijuana should be cleaned only when it is about to be smoked.

Many growers place a fresh lemon, orange, or lime peel in with each lid of stored grass. The peel helps to retain moisture, which keeps the buds pliable, and also gives the grass a pleasant bouquet.

Most growers take well-earned pride in the quality of the marijuana that they grow. By supplying yourself with an herb which may play an important role in your life, you gain a feeling of self-sufficiency that can be infectious.

Since your homegrown is well-tended and fresh, it has a sweet flavourful taste, far superior to that of commercial grass. And there need be no fear of contamination from herbicides, pesticides, adulterants, or other foreign matter. By growing your own, you come to the pleasant realisation that you are free from the vagaries and paranoia of the marijuana market - not to mention how little a home garden costs. All of these feelings can add up to a very heady experience.

In a time of quiet contemplation, you might also reflect on the experiences that brought you this wondrous herb from a tiny seed. There is a tradition of mutual nurture and support between humanity and this plant that goes back 10,000 years.

You are now part of this continuing tradition.

As you probably realised while reading this book, some of the practical information came to us through letters from growers. We appreciate these letters and will continue to refer to them when we update and improve future editions of the Marijuana Grower's Guide. We would also like to hear ideas, criticisms, and feedback from our readers. Other research material and copies of professional research are also welcome.

Wishing you a Happy Harvest,
Mel Frank
Ed Rosenthal

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[1] [Image]

by Mel Frank and Ed Rosenthal
Typed by Ben Dawson
Revised 1992

NOTE:- Footnotes have been placed in double brackets (()). Numbers throughout refer to bibliography and are sometimes in brackets, sometimes they aren't. All dates are for northern hemisphere only. Comments on pictures are in curly brackets {}. Please distribute this widely so we can all smoke better marijuana. Legalise marijuana.

4-Oct-96

Copying this book was a megamission that took about 3 weeks in the September of 1993. Everything in the book has been copied - even the bibliography. The online version of this guide is available at:
<http://www.iinet.net.au/~ben/Guide> Ben Dawson
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Jan-98

Hyperlinks were added throughout the document for easy navigation. Also the text was formatted to be more readable. Alonso Acu-a.

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FOREWORD

Marijuana, or cannabis as it is known internationally, is a plant whose presence is almost universal in our world today. Conservative international reports estimate that there are now 300 million cannabis users. Recent reports indicate that 10 percent of the adult population in the United States are regular users, a figure which is probably similar for many countries in Europe. Its use is also widespread in Africa, Asia, many Arab nations, parts of South America and the Caribbean, as well as Australia and New Zealand. In 1978, more than 5.2 million kilograms (12 million pounds) of cannabis were seized by police worldwide. Authorities estimated that this did not exceed 10 percent of the total traffic.

What has been the response of officials around the world to the use of this plant by its citizens? Regrettably, the climate has been one of almost universal repression, hostility and open violence. Despite gains made in the United States and Europe throughout the 1970's, a new wave of ignorance regarding the use of this plant seems to be sweeping the world. Predictably, the United States has sought to export this "neo-Reefer Madness" to other countries. A United Nations sub-commission of drug enforcement officials in the Far East released a report some time ago extremely critical of the efforts of some countries to decriminalize (i.e. remove criminal penalties for possession of a small amount) cannabis. The sub-commission stated that any such reduction of penalties would vastly increase use, and strongly urged that all countries continue to keep strict laws on the books even for possession of cannabis¹. Others requested that publicity campaign be conducted in the media against cannabis, and that more funding be given to scientific work to prove that cannabis was harmful².

US officials, alarmed by reports of cannabis use among adolescents (which, although undesirably high, is in fact leveling off), and by political pressure from reactionary elements, have attempted to depict cannabis as the greatest threat since the atomic bomb. The results of this new hysteria have been great confusion among the public and a slowdown in the progress of cannabis law reform. The results have been predictable: in 1979, over 448,000 people were arrested in the USA for cannabis possession, 80 percent for simple possession. The estimated direct arrests cost to our increasingly debt-ridden government was over \$600 million. But no one has ever attempted to account for the total cost of the immense law enforcement efforts against cannabis: for the salaries of Drug Enforcement Administration agents and federal and state narcotics agents and support personnel, the cost of incarcerating the thousands of people sentenced to jail (estimated at 10 percent of the total arrests, or 48,000 people), the costs of the anti-cannabis media campaign, the secret grants from NSA/CIA for cannabis eradications, and the economic cost to society created by turning law-abiding citizens into criminals. When these factors are taken into consideration, the cost goes into the billions. By contrast, in the eleven

states which have enacted decriminalization since 1972, millions of dollars and hundreds of thousands of court, police and administrative work-hours have been saved.

What can the concerned cannabis consumer do to end this climate of hysteria and ignorance? First, we must stress that cannabis legalisation would entail adult use only, and that social and legal restrictions on the use of cannabis would curtail, not increase, use by adolescents. Second, we must educate the public about the genuine effects of cannabis and stress moderate responsible use. This is what we stress about the user of society's legal drugs - alcohol, nicotine and caffeine, and we should take the same approach toward cannabis. Third, the public should be educated about the limits of the law and the rights of citizens; we should not seek to regulate private behaviour through the use of the criminal sanction. Laws protecting public safety, such as driving while under the influence of any substance, would still be kept on the books.

However, as consumers we have an additional responsibility: we must begin to address the problems of supply and demand. It is essential that we take upon ourselves the task of proposing viable solutions to the current unworkable prohibition.

With this in mind, numerous cannabis reform organizations around the world have begun exploring models for the legalization of cannabis. Under the auspices of the International Cannabis Alliance for Reform (ICAR), an international organization of cannabis law-reform groups, many of these organizations met in Amsterdam, Holland in February, 1980, at the first International Cannabis Legalization Conference to discuss legalization plans and proposals. The many plans presented reflected the various backgrounds and interests of the countries they represented some called for a totally open-market system run by cooperatives, others employed elaborate organizational systems with varying degrees of governmental control, and still others called for total control by the private sector. Emphasis was placed on the need for all groups to develop legalization models suited to their own particular climate and country and that a single, monolithic legalization plan was neither feasible nor desirable.

However, virtually all the plans had one important element in common: every person would have the right to grow cannabis for his or her own personal use. This is the very minimum requirement upon which all legalisation models are based, for this would allow the consumer the chance to remove himself or herself from the black market, whether it be licit or illicit.

This is an essential aspect of cannabis reform: to convince consumers to diversify their sources of supply by growing their own cannabis. Growing cannabis enables one to reduce drastically the costs and at the same time establish a closer relationship with the plant itself. Its amazing adaptability, acquired through centuries of travel to all four corners of the earth, users that it can grow and thrive anywhere there is sunlight and water. By learning the relatively simple techniques involved in cannabis horticulture, the consumer can avoid the illicit market with all its attendant problems, and concentrate on growing the plant itself, on producing and consuming the product of one's own labor, a product which is pure and can be produced at a cost of pennies per ounce.

We must take this step, for just as the nations of the world are seeking energy, self-sufficiency, so now must we seek cannabis self-sufficiency.

The willingness of consumers greatly to diversify their sources has caused tremendous changes in the manner in which cannabis is grown and marketed. Plagued by ridiculously high prices, dangers in purchasing, wild fluctuations in quantity and quality, impurities, and continual police harassment, consumers all over the world are discovering that anyone can grow good cannabis just about anywhere.

In Central and South America, production has increased so rapidly in the last few years that large quantities are now being exported to Europe. Arab countries, traditionally dependent on Lebanon and Syria, are now reporting increasing domestic cultivation attempts. Many countries of Europe, especially the southern countries of Spain, Italy, Portugal and Greece, are reporting cultivation. India noted that both its legal (in the states of West Bengal, Orissa and Madhya Pradesh) and illegal (all other states) under a similar scheme. In the Near and Middle East, notably Nepal, Pakistan and Afghanistan, the people are continuing their traditional production of cannabis for local and export use.

Australia, a country whose huge size (roughly that of the US) and relatively sparse population make it virtually ideal for cultivation, reported widespread cultivation and seizures of over 70,000 kilos of cannabis, 2,500 kilos of hashish, and 850,000 plants uprooted in a two-year period between 1977 and 1978. Many people living on Pacific islands such as New Zealand, New Caledonia, Fiji, the Cook Islands and elsewhere have discovered that cannabis will grow very well in their environment; Jamaica and other islands in the Caribbean are also experiencing an increase in cultivation. Recent newspaper reports from that country indicate that as many as 1/2 million Jamaican farmers out of a total population of 2 million may be producing cannabis to satisfy domestic and export demand. The total gross income from the Jamaican cannabis business is estimated to exceed \$200 million a year³.

Virtually every country in South America reported at least some cannabis cultivations. In addition to increased production in Colombia, whose 1978 crop was estimated to be worth between \$1.5 and \$2 billion, other countries are experiencing an increase in cultivation. Over 50,000 acres of cannabis were discovered under cultivation in western Venezuela in 1978. In 1976 in Brazil, 271 kilos of cannabis were reported seized, but the next year increased to 91,207 kilos, and by 1978, authorities seized over 276,000 kilos. Cultivation was also reported in Argentina, Ecuador, Guyana, Surinam and Uruguay. Soviet officials go to inordinate lengths to deny that cannabis-use exists in their country though Russia is known to be a large cannabis producer, and not just for commercial purposes. (Soviet officials reported to the United Nations that they seized only 227 grams of cannabis in the entire country⁴ in 1978; the few offenders were immediately sent to psychiatric hospitals.) In several Eastern European countries the best hashish is known as "Tashkenti," named for the major city in south-central Russia. Tashkent is ethnically dominated by Turkic tribesmen and shares the Hindu Kush mountain range with Afghanistan.

The key to stability in the cannabis market is clearly domestic production,

which offers many economic and social advantages over continued importation.

Domestic varieties offer ease of access and supply, and help to diversify the overall market by offering new products which compete in quality and price with the imported varieties. In addition, they serve to stimulate the local concentrating bulk of the profits in the region in which they were produced. This is a noticeable reversal of the previous consumer-producer relationship, where most of the profits were realized by exporters and middlepersons who operated outside the source country. Expanded domestic production would decrease the influence of these middlepersons and greatly strengthen the overall market.

This book was written to make the consumer aware of how easy (and important) it is to cultivate cannabis. In a clear and simply style, Mel Frank and Ed Rosenthal describe everything you need to know about growing cannabis. By employing some of these simple methods you can greatly reduce your dependence on foreign products and at the same time gain a greater understanding of a plant whose relationship with humanity dates to prehistoric times.

Be fruitful, and multiply...

Bob Pisani Coordinator, International Cannabis Alliance for Reform
(ICAR) Philadelphia, PA

Preface

The purpose of this book is to show you how to grow enough marijuana to supply all your family's needs. It doesn't matter where you live, or even if you are growing your first plant, because all the information needed to become a master marijuana farmer in your own home, or in the field, is provided in these pages.

The world has seen an enormous increase in marijuana use in the past ten years. Consequently, many governments have sponsored research in order to understand the nature of the plant as well as its psychoactive compounds - substances that are being smoked or ingested by more than 400 million people all over the world. Before the recent interest, marijuanaphiles had only research papers (mostly on hemp varieties) to glean for information about the plants and their cultivation. Now there are thousands of papers dealing directly with the plants and their use as marijuana. This doesn't mean all is known about marijuana. In fact, much of what is discussed deals with unknown aspects of these ancient and mysterious plants. The mysteries, however, are beginning to unravel.

Our information resources include our personal experience with growing and the experience and knowledge shared with us by marijuana growers all across the country. We also rely on the professional research of many scientists (see the Bibliographic Notes). For the experienced growers, we've included the latest research on increasing potency, some ideas for improving yield and controlling flowering (time of harvest), and also procedures for breeding quality strains suited to a particular growing situation.

Some of the best grass in the world is grown right here in the United States (that is our very own stoned opinion of homegrown gratefully sampled from Hawaii to Maine). You can do it too - it's not magic, and it's not difficult to do. Highly potent plants can be grown indoors, as well as in gardens, fields, and the wilds. Indoor growers must create an environment, whereas outdoor gardeners work within the environment. Following these two approaches to cultivation, this book is divided into separate, parallel parts on indoor and outdoor sections, preceded by some background information on marijuana plants, and followed by general procedures for breeding, harvesting, etc., that are independent of the type of growing site.

Cultivation is not a complicated process, and we hope we don't make it appear difficult. But even if you're a novice when you first sow your seeds, your questions on the plants and their cultivation will become more complex as you gain experience and insight. We hope we have anticipated your questions with solid and clearly stated answers; we intend this book to serve as a guide long after your first reading and harvest.

There are probably as many ways to grow marijuana as there are marijuana farmers. We hope to impart an understanding of the plants and their cultivation, so that you can adapt the knowledge to fit your particular situation - where you live, the land or space available, and the time, energy, and funds at your disposal.

Modest indoor gardens are quite simple to set up and care for. All the materials you'll need are available at nurseries, garden shops, and hardware and lighting stores, or they may be found around the house or streets. The cost will depend on how large and elaborate you make the garden and on whether you buy or scavenge your materials. With a little ingenuity, the cost can be negligible.

It takes about an hour every three or four days to water and tend to a medium-sized indoor garden.

Outdoors, a small patch in your summer garden can supply all your smoking needs with little or no expense. Generally, marijuana requires less care than most other crops, because of its natural tenacity and ability to compete with indigenous weeds. Hardy Cannabis resists mild frost, extreme heat, deluge, and drought. In this country, few diseases attack marijuana; once the plants are growing, they develop their own natural protection against most insects.

In some areas of the country, such as parts of the Midwest and East, the plants may require no more attention than sowing the seeds in spring and harvesting the plants in autumn. But if you're like most growers, you'll find yourself spending more and more time in your garden, watching the tiny sprouts emerge, then following their development into large, lush, and finally resinous, flowering plants.

Nurturing and watching these beautiful plants as they respond can be a humanising experience. Marijuana farmers know their plants as vital living organisms. If you already are a plant grower, you may understand. If not,

read through this book, imagining the various decisions you, as grower, would be making to help your plants reach a full and potent maturity. Then make your plans and get started. There's just no reason to pay \$50 an ounce for superior smoke when it grows for free. Free, grass, free yourself.

This book is the result of the efforts of many people, each of whom contributed uniquely to its final form and content. First there are the many growers who opened their hearts and gardens to us. Our love and thanks to our friends in California (Calistoga, Calaveras, Humbolt, Orange counties, and the Bay Area), the Umpqua Valley, Oregon, Eastern Colorado, Central Florida, Eastern Massachusetts, Upstate New York, New York City, Atlanta, Hawaii, and Port Antonio, Jamaica. We would also like to thank everyone who wrote and shared their growing experiences with us.

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Chapter One
History and Taxonomy of Cannabis

1.2 CANNABIS AND ANCIENT HISTORY

The ancestors of Cannabis originated in Asia, possibly on the more gentle slopes of the Himalayas or the Altai Mountains to the north. The exact origin, obscured by Stone Age trails the cross the continent, is not known.

We don't know when Cannabis and humanity first met. Given the growth habit of the plant and the curiosity of humanity, such a meeting was inevitable. In the plant world, Cannabis is a coloniser. It establishes new territory when running water or seed-eating animals carry seed to cleared and fertile soil open to the sun. Fertile soil, clear of competing plants, is rare and short-lived in nature, and is commonly caused by catastrophe such as flood or earthslide. Natural dissemination is slow and the plants tend to grow in thick stands by dropping seed about the spread of their branches.

During the Neolithic era, some 10,000 years ago nomadic groups scavenged, hunted, fished, and gathered plants in an unending search for food. The search ended when they learned to plant the native grains (grasses) and developed agriculture. Agriculture requires a commitment to the land and

grants a steady food supply which enables people to form permanent settlements. Cannabis and Neolithic bands probably came in contact often as the plants invaded the fertile clearings - the campsites, roadsides, fields and garbage heaps - that occur wherever people live.

In 1926 the Russian botanist Vavilov summarised the observations of his comrade, Sinkaia, on the domestication of hemp by peasants of the Altai Mountains: "1. wild hemp; 2. spreading of hemp from wild centers of distribution into populated areas (formation of weedy hemp); 3. utilisation of weedy hemp by the population; 4. cultivation of hemp."²⁴

The plants which people learn to use help define aspects of their way of life, including perceptions of the world, health, and the directions their technologies and economies flow. The plants you are about to grow are descended from one of the ancient plants that made the transition to civilisation possible.

The earliest cultural evidence of Cannabis comes from the oldest known Neolithic culture in China, the Yang-shao, which appeared along the Yellow River valley about 6,500 years ago (*Cannabis is known to have been used in the Bylony culture of Central Europe (about 7,000 years ago).¹⁸⁴). The clothes the people wore, the nets they fished and hunted with, and the ropes they used in the earliest machines were all made of the long, strong, and durable fibre, hemp. This valuable fibre separates from the stem of Cannabis when the stem decays (rets).

In the early classics of the Chou dynasty, written over 3,000 years ago, mention is often made of "a prehistoric culture based on fishing and hunting, a culture without written language but which kept records by tying knots in ropes. Nets were used for fishing and hunting and the weaving of nets eventually developed into clothmaking."⁸ These references may well be to the Yang-shao people.

As their culture advanced, these prehistoric people replaced their animal skins with hemp cloth. At first, hemp cloth was worn only by the more prosperous, but when silk became available, hemp clothed the masses.

People in China relied on Cannabis for many more products than fibre. Cannabis seeds were one of the grains of early China along with river barley, millet, and soybeans. The seeds were ground into a meal, or roasted whole, or cooked in porridge. The ancient tombs of China had sacrificial vessels filled with hemp seed and other grains for the afterlife. From prehistoric times there is a continuous record of the importance of hemp seed for food until the first to second century BC when the seed had been replaced by more palatable cereal grains.⁷ (an interesting note from the Tung-kuan archives (28 AD) records that after a war-caused famine the people subsisted on "wild" Cannabis and soybean.⁸)

The effects of Cannabis' resinous leaves and flowers did not go unnoticed. The Oen-ts-ao Ching, the oldest pharmacopoeia known, states that the fruits (flowering tops) of hemp, "if taken in excess will produce hallucinations" (literally "seeing devils"). The ancient medical work also says, "If taken over a long term, it makes one communicate with spirits and lightens one's body."⁹ Marijuana, with a powerful effect on the psyche, must have been

considered a magical herb at a time when medical concepts were just being formed. The P[er]n-t[s]ao Ching, speaking for the legendary Emperor Sh[un] of about 2000 BC, prescribes marijuana preparations for "malaria, beriberi, constipation, rheumatic pains, absent-mindedness, and female disorders."¹⁵ Even the Cannabis root found its place in early medicine. Ground to form a paste, it was applied to relieve the pain of broken bones and surgery.

New uses were discovered for Cannabis as Chinese civilisation progressed and developed new technologies. The ancient Chinese learned to mill, heat, and then wedge-press Cannabis seeds to extract the valuable oil, a technique still used in the western world in the twentieth century. Pressed seeds yielded almost 20 percent oil by weight. Cannabis oil, much like linseed oil, could be used for cooking, to fuel lamps, for lubrication, and as the base in paint, varnish, and soap making. After oil extraction, the residue or "hemp cake" still contained about 10 percent oil and 30 percent protein, a nutritious feed for domesticated animals.

Another advancement came with the Chinese invention of paper. Hemp fibres recycled from old rags and fish nets made a paper so durable that some was recently found in graves in the Shense province that predates 100 BC (9). Hemp paper is known for its longevity and resistance to tearing, and is presently used for paper money (Canada) and for fine Bibles.

The ancient Chinese learned to use virtually every part of the Cannabis plant: the root for medicine; the stem for textiles, rope and paper making; the leaves and flowers for intoxication and medicine; and the seeds for food and oil. Some of the products fell into disuse only to be rediscovered by other people at other times.

While the Chinese were building their hemp culture, the cotton cultures of India and the linen (flax) cultures of the Mediterranean began to learn of Cannabis through expanding trade and from wandering tribes of Aryans, Mongols, and Scythians who had bordered China since Neolithic times.

The Aryans (Indo-Persians) brought Cannabis culture to India nearly 4,000 years ago. They worshipped the spirits of plants and animals, and marijuana played an active role in their rituals. In China, with the strong influence of philosophic and moralistic religions, use of marijuana all but disappeared. But in India, the Aryan religion grew through oral tradition, until it was recorded in the four Vedas, compiled between 1400 and 1000 BC. In that tradition, unlike the Chinese, marijuana was sacred, and the bhargas spirit was appealed to "for freedom of distress" and as a "reliever of anxiety" (from the Atharva Veda).¹ A gift from the gods, according to Indian mythology, the magical Cannabis "lowered fevers, fostered sleep, relieved dysentery, and cured sundry other ills; it also stimulated the appetite, prolonged life, quickened the mind, and improved the judgement."¹⁵

The Scythians brought Cannabis to Europe via a northern route where remnants of their campsites, from the Altai Mountains to Germany, date back 2,800 years. Seafaring Europe never smoked marijuana extensively, but hemp fibre became a major crop in the history of almost every European country. Pollen analysis dates the cultivation of Cannabis to 400 BC in Norway, although it is believed the plant was cultivated in the British Isles several centuries

earlier.² The Greeks and Romans used hemp for rope and sail but imported the fibre from Sicily and Gaul. And it has been said the "Caesar invaded Gaul in order to tie up the Roman Empire," an allusion to the Romans' need for hemp.

Marijuana, from its stronghold in India, moved westward through Persia, Assyria and Arabs by 500 AD. With the rising power of Islam, marijuana flourished in a popular form as hashish. In 1378, the Emir Soudon Sheikhoui tried to end the use of Indian hashish by destroying all such plants, and imprisoning all users (first removing their teeth for good measure). Yet in a few years marijuana consumption had increased.¹

Islam had a strong influence on the use of marijuana in Africa. However, its use is so ingrained in some ancient cultures of the Zambezi Valley that its appearance clearly predated Islam. Tribes from the Congo, East Africa, Lake Victoria, and South Africa smoke marijuana in ritual and leisure. The ancient Riamba cult is still practiced in the Congo. According to the Riamba beliefs, marijuana is a god, protector from physical and spiritual harm. Throughout Africa treaties and business transactions are sealed with a puff of smoke from a yard-long pipe.⁽¹⁵⁾

With increased travel and trade, Cannabis seed was brought to all parts of the known world by ships and caravans rigged with the fibre of its kind. And when the first settlers came to the Americas, they brought the seed with them.

1.3 CANNABIS AND AMERICAN HISTORY

Like their European forbears, Americans cultivated Cannabis primarily for hemp fibre. Hemp seed was planted in Chile in 1545,⁽⁶⁴⁾ Canada in 1606, Virginia in 1611, and in the Puritan settlements in Massachusetts in the 1630s⁽¹⁵⁾. Hemp-fibre production was especially important to the embryonic colonies for homespun cloth and for ship rigging. In 1637, the General Court at Hartford ordered that "every family within this plantation shall procure and plant this present year one spoonful of English hemp seed in some soyle."⁽¹²⁾

Hemp growing was encouraged by the British parliament to meet the need for fibre to rig the British fleets. Partly to dissuade the colonists from growing only tobacco, bounties were paid for hemp and manuals on hemp cultivation were distributed. In 1762, that state of Virginia rewarded hemp growers and "imposed penalties upon those that did not produce it."⁽²⁾

The hemp industry started in Kentucky in 1775 and in Missouri some 50 years later. By 1860, hemp production in Kentucky alone exceeded 40,000 tons and the industry was second only to cotton in the South. The Civil War disrupted production and the industry never recovered, despite several attempts by the United States Department of Agriculture to stimulate cultivation by importing Chinese and Italian hemp seed to Illinois, Nebraska, and California. Competition from imported jute and "hemp" (Musa textiles) kept domestic production under 10,000 tons per year. In the early 1900s, a last effort by the USDA failed to offset the economic difficulties of a labour shortage and the lack of development of modern machinery for the hemp industry ⁽⁶⁴⁾. However, it was legal force that would bring an end to US hemp production.

For thousands of years marijuana had been valued and respected for its medicinal and euphoric properties. The Encyclopaedia Britannica of 1894 estimated that 300 million people, mostly from Eastern countries, were regular marijuana users. Millions more in both the East and the West received prescription marijuana for such wide-ranging ills as hydrophobia and tetanus.

By the turn of the century, many doctors had dropped marijuana from the pharmacopoeias: drugs such as aspirin, though less safe (marijuana has never kill anyone), were more convenient, more predictable, and more specific to the condition being treated. Pill-popping would become an American institution.

Marijuana was not a legal issue in the United States until the turn of the twentieth century. Few Americans smoked marijuana, and those that did were mostly minority groups. According to author Michael Aldrich, (1) "The illegalisation of Cannabis came about because of who was using it" - Mexican labourers, southern blacks, and the newly subjugated Filipinos.

In states where there were large non-white populations, racist politicians created the myths that marijuana caused insanity, lust, violence and crime. One joint and you were addicted, and marijuana led the way to the use of equivalent drugs - cocaine, opium and heroin. These myths were promoted by ignorant politicians and journalists, who had neither experience nor knowledge of Cannabis, and grew into an anti-marijuana hysteria by the next generation.

For example, the first states to pass restriction on marijuana use were in the Southwest, where there were large populations of migrant workers from Mexico. One of the first states to act was California, which, "with its huge Chicano population and opium smoking Chinatowns, labelled marijuana 'poison' in 1907, prohibited its possession unless prescribed by a physician in 1915, and included it among hard narcotics, morphine and cocaine in 1929." (1)

In marijuana, the mainstream society found a defenceless scapegoat to cover the ills of poverty, racism, and cultural prejudice. San Franciscans "were frightened by the 'large influx of Hindoos ... demanding Cannabis indica' who were initiating 'the whites into their habit.'" (11) Editorialists heightened public fears with nightmarish headlines of the "marijuana menace" and "killer weed," and fear of Cannabis gradually spread through the West. By 1929, 16 western states had passed punitive restrictions governing marijuana use.

{Figure 5. (Sample -- Warning card to be placed in R. R. Trains, Buses, Street Cars, etc.)

Beware! Young and Old - People in All Walks of Life!

This {joint} may be handed you by the friendly stranger.

It contains the Killer Drug "Marihuana" -- a powerful narcotic in which lurks Murder! Insanity! Death!

WARNING!

Dope peddlers are shrewd! They may put some of this drug in the {teapot} or in the {cocktail} or in the tobacco cigarette.

WRITE FOR DETAILED INFORMATION, ENCLOSING 12 CENTS IN

POSTAGE -- MAILING COST

Address: THE INTER-STATE NARCOTIC ASSOCIATION
(Incorporated not for profit)
52W Jackson Blvd. Chicago, Illinois, U.S.A.

{'This may be handed you by the ...' is a mistake on the poster}}

Marijuana was not singled out by anti-drug campaigners. During this time, Congress not only banned "hard" narcotics, but also had prohibited alcohol and considered the prohibition of medical pain killers and even caffeine.

The Federal Bureau of Narcotics was established in 1930 with Harry Anslinger as its first commissioner. During the first few years of operation, the bureau minimized the marijuana problem, limited mostly to the Southwest and certain ghettos in the big cities of the East. However, the bureau was besieged with pleas from local police and sheriffs to help with marijuana problems. The FBN continued to resist this pressure, because Commissioner Anslinger had serious doubts as to whether federal law restricting marijuana use could be sustained as constitutional. Further, FBN reports indicate that the bureau did not believe that the marijuana problem was as great as its public reputation. Control of the drug would also prove extremely difficult, for as Anslinger pointed out, the plant grew "like dandelions." (11)

The joblessness and misery of the depression added impetus to the anti-marijuana campaign. This came about indirectly, by way of focusing public sentiment against migrant and minority workers who were blamed for taking "American" jobs. Much of this sentiment grew out of cultural and racial prejudice and was supported by groups such as Key Men of America and the American Coalition. The goal of these groups was to "Keep America American."

However, by 1935 almost every state had restricted marijuana use, and local police and influential politicians had managed to pressure the FBN to seek a federal marijuana law. The constitutional question could be circumvented by cleverly tying restrictions to a transfer tax, effectively giving the federal government legal control of marijuana.

With this new tack, the FBN prepared for congressional hearings on the Marijuana Tax Act so that passage of the bill would be assured. Anslinger and politicians seeking to gain from this highly emotional issue railroaded the Marijuana Tax Act through the 1937 Congress. Anslinger made sure that

the only
information
that they
(the
congressme
n) has was
what we
would give
them at the
hearings.

(11) No
users were
allowed to
testify in
pot's

defence, and doctors and scientists were ridiculed for raising contrary views (16). The new federal law made both raising and use of the plant illegal without the purchase of a hard-to-acquire federal stamp. The FBN immediately intensified the propoganda campaign against marijuana and for the next generation, the propoganda continued unchallenged.

The marijuana hysteria also ended any hopes for a recovery of the hemp industry. What had been needed was a machine that would solve the age-old problem of separating the fibre from the plant stem, an effort which required considerable skilled labour. The machine that could have revolutionised hemp production was introduced to the American public in the February 1938 edition of Popular Mechanics. But the Marijuana Tax Act has been passed four months earlier, and the official attitude toward all Cannabis is best illustrated by this quote from Harry J. Anslinger, commissioner of the Federal Bureau of Narcotics: "Now this (hemp) is the finest fibre known to man-kind, my God, if you ever have a shirt made of it, your grandchildren would never wear it out. You take Polish families. We'd go in and start to tear it up and the man came out with his shotgun yelling, 'These are my clothes for next winter!'" (2)

During the war years, after the Japanese had cut off America's supply of manila hemp, worried officials supplied hemp seed and growing information to Midwestern farmers. In Minnesota, Iowa, Illinois, and Wisconsin, hemp farmers showed their wartime spirit by producing over 63,000 tons of hemp fibre in 1943.

Unlike many of our ancient domesticated plants, Cannabis never lost its colonising tendencies or ability to survive without human help. Cannabis readily "escapes" cultivated fields and may flourish long after its cultivation is abandoned. However, Cannabis always keeps in contact by flourishing in our waste areas - our vacant fields and lots, along roads and drainage ditches, and in our rubbish and garbage heaps. Perhaps it awaits discovery by future generations. The cycle has been repeated many times.

States that once supported hemp industry are now dotted with stands of escaped weedy hemp. Weedy hemp grows across the country, except in the Southwest and parts of the Southeast. Distribution is centered heavily in the Midwest. Most of these plants are descended from Chinese and European hemp strains that were bred in Kentucky and the grown in Midwestern states during World War II. But some weed patches, such as in Kentucky and

Missouri, go back perhaps to revolutionary times.

The Anslinger crusades that continued through the sixties are a fine example of government propaganda and control of individual lives and beliefs. We still feel the ramifications in our present laws and in the fear-response to marijuana harboured by many people who grew up with Anslingian concepts. Poor Cannabis, portrayed as a dangerous narcotic that would bring purgatory upon anyone who took a toke - violence, addiction, lust, insanity - you name it, and marijuana caused it. All it ever did to us was get us stoned ... things slowed down a bit ... enough to stop and look around.

{Figure 6. A weedy hemp stand in Nebraska.}

Hopefully, we are living in the last years of the era of illegal marijuana and the persecution of this plant. Cannabis is truly wondrous, having served human needs for, perhaps, 10,000 years. It deserves renewed attention not only for its chemical properties, but also as an ecologically sensible alternative for synthetic fibres in general and especially wood-pulp paper. May Cannabis be vindicated.

1.4 Cannabis: Species or Varieties

The 10,000-year co-evolution of Cannabis and humanity has had a profound impact on both plant and humans. Cannabis has affected our cultural evolution; we have affected the plant's biological evolution.

From small populations of ancient progenitors, hundreds of varieties or strains of Cannabis have evolved. These variations can be traced to human acts, both planned and accidental.

Ancient farmers, knowing that like begets like, selected Cannabis for certain characteristics to better suit their needs. With the need for fibre, seeds from plants with longer stems and better fibres were cultivated. Gradually, their descendants became taller, straight-stemmed, and had a minimum of branches. Some farmers were interested in seed and oil. They developed large-seeded, bushy plants that could bear an abundance of seeds. Marijuana farmers interested in potency selected plants that flowered profusely with heavy resin and strong psychoactive properties.

The subsequent variations in Cannabis are striking. In Italy, where hemp fibre supports a major textile and paper industry, some fibre varieties grow 35 feet in a single season. Other Italian varieties may reach only five or six feet in height, but have slender, straight stems that yield a fibre of very fine quality. In Southeast Asia, some marijuana plants grow only four feet or less, yet these are densely foliated and heavy with resin. Other varieties of marijuana grow 15 to 20 feet in a season and yield over a pound of grass per plant.

Breeding plants is a conscious act. The plant's evolution, however, has also been affected by its introduction to lands and climates different from its original home. Whether plants are cultivated or weeds, they must adapt to their environment. Each new country and growing situation presented Cannabis with new circumstances and problems for survival. The plants have been so successful at adapting and harmonising with new environments that they are

now considered the most widely distributed of cultivated plants. (45)

In French, Cannabis is sometimes called "Le Chanvre tromper" or "tricky hemp," a name coined to describe its highly adaptable nature. The word adaptable actually has two meanings. The first refers to how a population of plants (the generic pool) adjusts to the local environment over a period of generations. (The population is, in practice, each batch of seeds you have, or each existing stand or field.) For instance, a garden with some plants that flower late in the season will not have time to seed in the north. The next year's crop will come only from any early seeding plants. Most of them will be like their parents and will set seed early. (See section 18.)

Adaptable is a term that also applies to the individual living plant (phenotype) and, in practical terms, means that Cannabis is tenacious and hardy -- a survivor among plants. It thrives under a variety of environmental conditions, whether at 10,000 feet in the Himalayas, the tropical valleys of Colombia, or the cool and rainy New England coast.

Through breeding and natural selection, Cannabis has evolved in many directions. Botanically and historically, the genus is so diverse that many growers are confused by the mythology, exotic names, and seeming contradictions that surround the plants. Many inconsistencies are explained by understanding how variable Cannabis is. There are hundreds of wild, weedy, and cultivated varieties. Cultivated varieties may be useful for only hemp, oil, or marijuana. "Strains," "varieties," "cultivars," "chemovars," or "ecotypes" differ widely in almost every apparent characteristic. Varieties range from two to 35 feet tall; branching patterns run from dense to quite loose, long (five or six feet) or short (a few inches). Various branching patterns form the plant into shapes ranging from cylindrical, to conical, to ovoid, to very sparse and gangly. The shape and colour of leaves and stems, seeds, and flowering clusters are all variable characteristics that differ among varieties. Life cycles may be as short as three months, or the plants may hang on to life for several years. Most importantly, different varieties provide great variations in the quality and quantity of resin they produce, and hence in their psychoactive properties and value as marijuana.

The taxonomy (ordering and naming) of Cannabis has never been adequately carried out. Early research placed the genus Cannabis within the Families of either the Moraceae (mulberry) or the Urticaceae (nettle). Now there is general agreement that the plant belongs in a separate family, the Cannabaceae, along with one other genus, Humulus, the hops plant. (See section on Grafting in section 18.)

A modern Scheme for the phylogeny of Cannabis would be:

- Subdivision Angiospermae (flowering plants)
- Class Dicotyledoneae (dicots)
- Order Urticales (nettle order)
- Family Cannabaceae (hemp family)
- Genus Cannabis (hemp plant)

Below the genus level, there is no general agreement on how many species should be recognised within Cannabis. The Cannabis lineage has not been

possible to trace after thousands of years of human intervention.

Most research refers to Cannabis as a single species - Cannabis sativa L. (The word Cannabis comes from ancient vernacular names for hemp, such as the Greek Kannabis; sativa means "cultivated" in Latin; L. stands for Linnaeus, the botanical author of the name.) But some botanists who are studying Cannabis believe there are more than one species within the genus.

Richard Schultes, for example, describes three separate species (see Box A) based on variations in characteristics believed not to be selected for by humans (natural variations) such as seed colour and abscission layer (scar tissue on the seed which indicates how it was attached to the stalk).

BOX A

Schultes' Key as it appears in Harvard Botanical Museum Leaflets (45)

Cannabis Sativa

1. Plants usually tall (five to 18 feet), laxly branched; akenes ((Akene (or Achene) is the botanical name for the fruit of Cannabis. In Cannabis, the fruit is essentially the seed.)) smooth, usually lacking marbled pattern on outer coat, firmly attached to stalk and without definite articulation.

Cannabis Indica

1A. Plant usually small (four feet or less), not laxly branched; akenes usually strongly marbled on outer coat, with a definite abscission layer, dropping off at maturity.
2. Plants very densely branched, more or less conical, usually four feet tall or less; abscission layer a simple articulation at base of akene.

Cannabis ruderalis ((Limited to parts of Asia.))

2A. Plants not branched or very sparsely so, usually one to two feet at maturity. Abscission layer forms a fleshy carbuncle-like growth at base of akene.

Ideally, the classification of living things follows a natural order, reflecting relationships as they occur in nature. Species are groups of organisms that are evolving as distinct units. Biologically, the evolutionary unit is the population, a population being a group of freely inbreeding organisms. Living things don't always fit neatly into scientific categories. And the meaning of species changes with our understanding of life and the evolutionary processes. Often, the definition of species will depend on the particular being studied.

A traditional way of defining separate species is that off-spring that result cannot reproduce successfully. As far as is known, all Cannabis plants can cross freely, resulting in fully fertile hybrids (107). But growth habit and actual gene exchange are important considerations in plant taxonomy. If different populations never come in contact, then there is no pressure for them to develop biological processes to prevent them mixing. Cannabis is pollinated by the wind. Although wind may carry pollen grains hundreds of miles, almost all pollen falls within a few feet of the parent

plant. The chance of a pollen grain fertilising a tiny female flower more than 100 yards away is extremely small (201). Hence, separate stands or fields of Cannabis (populations) are quite naturally isolated. For Cannabis, the fact that populations are isolated by distance is not sufficient grounds for labelling them separate species, nor is successful hybridisation reason enough to group all populations as one species.

The species question and Cannabis mythology are complicated by the plant's ability to rapidly change form and growth habits. These changes can be measured in years and decades, rather than centuries or millennia.

The fact that a pollen grain does occasionally fertilise a distant flowers leads to a process called introgression. Introgression means that new genes (new variations and possible variations) are incorporated into the population via the foreign pollen. This crossing between populations leads to an increase in variation within the population, but a decrease in the differences between the populations. Although introgression confuses the species question, it also adds to the plant's adaptable nature by providing a resource for adaptive variations. In other words, Cannabis has been around. The plants have a rich and varied history of experience, which is reflected in their variety and adaptive nature.

If breeding barriers do not exist, species are often delimited by natural differences in morphology (structure or appearance). The natural variations on which Schultes' key is based are actually affected by contact with farmers. For instance, seeds which drop freely from the plant are less likely to be collected and sown by the farmer, so that cultivated Cannabis may eventually develop a different type of abscission layer than when wild or weedy.

Seed colour and pattern are affected naturally by the need for camouflage. Under cultivation this natural selection pressure would not be the same. Many farmers select seeds by colour, believing the darkest are the best developed. In other words, there are serious problems with this limited approach to categorising species in Cannabis. This does not go unrecognised by Dr. Schultes, and the key represents a starting point. However, species should represent distinct groups within a genus, and populations with intermediate characteristics should be the exception. When you grow marijuana, you'll find that most varieties do not fit into any of these categories, but lie somewhere between. The majority of the marijuana from the Western Hemisphere would follow this description: plants tall (eight to 18 feet); well-branched; akenes usually strongly marbled; base of the seed sometimes slightly articulated.

Other characteristics, such as variations on wood anatomy (17) and leaf form (28), have been suggested for delimiting Cannabis species. However, wood anatomy, like stem anatomy, can be seriously affected by selection for hemp in particular, but also by selection for marijuana and seed. Wood anatomy also depends on the portion of the stem examined and on the arrangement of leaves (phyllotaxy), which, in turn, is influenced by light levels, photoperiod, and the physiological development of the plant.

Most Cannabis plants have compound leaves with seven to nine blades or leaflets per leaf. Occasionally, varieties are seen where all the leaves

have only one to three blades (monophyllous). Such plants sometimes arise from varieties with compound leaves. The factor is genetic, but carries little weight for the separation of species.

Human selection for particular traits can powerfully alter plants. Sex vegetables - cabbage, cauliflower, brussel sprouts, broccoli, kale, and kohlrabi - are all descended from a single wild species of mustard herb, *Brassica oleracea* (216). Human preference for particular parts of the plant led to their development. All six are still considered one species.

Any classification of species in *Cannabis*, based solely on morphological grounds, will prove difficult to justify with our present knowledge of the plant. At this time it seems that all *Cannabis* should be considered one species, *Cannabis sativa* L.

{Figure 7. Common marijuana leaf with seven blades (Colombian)}

{Figure 8. Four leaf types from Colombian marijuana varieties}

{Figure 9. Leaf blades from Figure 8.}

The debate on whether there is more than one species has been intense, for the issue has legal implications. Many laws specifically prohibit only *Cannabis sativa*. Presumably other species would not be prohibited. However, in the United States, this argument was recently dismissed when tested in a California court. The court upheld the argument that the law's intent is clear, although it may be questionable botanically: under law all *Cannabis* are regarded alike.

Luckily, the controversy over the number of species is of no more than academic interest to the marijuana grower. The most important characteristic to enthusiasts is the quality or potency of the grass they'll grow.

Potency is mostly a factor of heredity. The quality of the grass you grow depends on how good its parents were, so choose seeds from the grass you like best.

The environment has an impact, too, but it can only work on what is contained in the seed. A potent harvest depends on an environment which encourages the seed to develop to a full and potent maturity. The way to begin is to find the most potent grass you can; then you will have taken the first step.

CHAPTER 2

CANNABINOIDS: THE ACTIVE INGREDIENTS OF MARIJUANA

Cannabis is unique in many ways. Of all plants, it is the only genus known to produce chemical substances known as cannabinoids. The cannabinoids are the psychoactive ingredients of marijuana; they are what get you high. By 1974, 37 naturally occurring cannabinoids had been discovered 115,118. Most of the cannabinoids appear in very small amounts (less than .01 percent of total cannabinoids) and are not considered psychoactive, or else not important to the high. Many are simply homologues or analogues (similar structure or function) to the few major cannabinoids which are listed.

1. (-)- Δ^9 -trans-tetrahydrocannabinol ((There are several numbering systems used for cannabinoids. The system in this book is most common in American publications and is based on formal chemical rules for numbering pyran compounds. Another common system is used more by Europeans and is based on a monoterpene system which is more useful considering the biogenesis of the compound.)) This (Δ^9 THC) is the main psychotomimetic (mindbending) ingredient of marijuana. Estimates state that 70 to 100 percent (121) of the marijuana high results from the Δ^9 THC present. It occurs in almost all Cannabis in concentration that vary from traces to about 95 percent of all the cannabinoids in the sample. In very potent varieties, carefully prepared marijuana can have up to 12 percent Δ^9 THC by dry weight of the sample (seeds and stems removed from flowering buds). ("Buds" of commercial marijuana is the popular name given to masses of female flowers that form distinct clusters.)

Δ^8 THC - This substance is reported in low concentration, less than one percent of the Δ^9 THC present. Its activity is slightly less than that of Δ^9 THC. It may be an artefact of the extraction/analysis process. Here we refer to Δ^9 THC and Δ^8 THC as THC.

2. Cannabidiol - CBD also occurs in almost all varieties. Concentration range from nil (119,138), to about 95 percent of the total cannabinoids present. THC and CBD are the two most abundant naturally occurring cannabinoids. CBD is not psychotomimetic in the pure form (192), although it does have sedative, analgesic, and antibiotic properties. In order for CBD to affect the high, THC must be present in quantities ordinarily psychoactive. CBD can contribute to the high by interacting with THC to potentiate (enhance) or antagonise (interfere or lessen) certain qualities of the high. CBD appears to potentiate the depressant effects of THC and antagonise its excitatory effects (186). CBD also delays the onset of the high (183) but can make it last considerably longer (as much as twice as long). (The grass takes a while to come on but keeps coming on.) Opinions are conflicting as to whether it increases or decreases the intensity of the high, "intensity" and high" being difficult to define. Terms such as knock-out or sleepy, dreamlike, or melancholic are often used to describe the high from grass with sizeable proportions of CBD and THC. When only small amounts of THC are present with high proportions of CBD, the high is more of a buzz, and the mind feels dull and the body de-energised. {See Figure 11 to 16 for chemical structure in monochrome bitmap format.}

3. Cannabinol - CBN is not produced by the plant per se. It is the degradation (oxidative) product of THC. Fresh samples of marijuana contain very little CBN but curing, poor storage, or processing such as when making hashish, can cause much of the THC to be oxidised to CBN. Pure forms of CBN have at most 10 percent of the psychoactivity of THC (192). Like CBD, it is suspected of potentiating certain aspects of the high, although so far these

affects appear to be slight (183,185). CBN seems to potentiate THC's disorienting qualities. One may feel more dizzy or drugged or generally untogether but not necessarily higher. In fact, with a high proportion of CBN, the high may start well but feels as if it never quite reaches its peak, and when coming down one feels tired or sleepy. High CBN in homegrown grass is not desirable since it represents a loss of 90 percent of the psychoactivity of its precursor THC.

4. Tetrahydrocannabivarin - THCV is the propyl homologue of THC. In the aromatic ring the usual five-carbon pentyl is replaced by a short three-carbon propyl chain. The propyl cannabinoids have so far been found in some varieties originating from Southeast and Central Asia and parts of Africa. What are considered some very potent marijuana varieties contain propyl cannabinoids. In one study, THCV made up to 48.23 percent (Afghanistan strain) and 53.69 percent (South Africa) of the cannabinoids found (136). We've seen no reports on its activity in humans. From animal studies it appears to be much faster in onset and quicker to dissipate than THC (181). It may be the constituent of one- or two-toke grass, but its activity appears to be somewhat less than that of THC.

The propyl cannabinoids are a series corresponding to the usual pentyl cannabinoids. The counterpart of CBD is CBDV; and of CBN, CBV. There are no reports on their activity and for now we can only speculate that they are similar to CBD and CBN. Unless noted otherwise, in this book THC refers collectively to delta-9 THC, delta-8 THC, and THCV.

5. Cannabichromene - CBC is another major cannabinoid, although it is found in smaller concentrations than CBD and THC. It was previously believed that it was a minor constituent, but more exacting analysis showed that the compound often reported as CBD may actually be CBC (119,137). However, relative to THC and CBD, its concentration in the plants is low, probably not exceeding 20 percent of total cannabinoids. CBC is believed not to be psychotomimetic in humans (121); however, its presence in plants is purportedly very potent has led to the suspicion that it may be interacting with THC to enhance the high (137). Cannabicyclol (CBL) is a degradative product like CBN and CBV (123). During extraction, light converts CBC to CBL. There are no reports on its activity in humans, and it is found in small amounts, if at all, in fresh plant material.

2.2 Cannabinoids and the High

The marijuana high is a complex experience. It involves a wide range of psychological, physical, and emotional responses. The high is a subjective experience based in the individual - one's personality, mood, disposition, and experience with the drug. Given the person, the intensity of the high depends primarily on the amount of THC present in the marijuana. Delta-9 THC

is the main ingredient of marijuana and must be present in sufficient quantities for a good marijuana high. People who smoke grass that has very little cannabinoids other than delta-9 THC usually report that the high is very intense. Most people will get high from a joint having delta-9 THC of .5 percent concentration to material. Grass having a THC concentration of three percent would be considered excellent quality by anyone's standards. In this book, for brevity, we use potency to mean the sum effects of the cannabinoids and the overall high induced.

Marijuana (plant material) is sometimes rated more potent than the content of delta-9 THC alone would suggest. It also elicits qualitatively different highs. The reasons for this have not been sorted out. Few clinical studies with known combinations of several cannabinoids have been undertaken with human subjects. This field is still in its infancy. So far, different highs and possibly higher potency seem to be due to the interaction of delta-9 THC and other cannabinoids (THCV, CBD, CBN, and possibly CBC). Except for THCV, in the pure form, these other cannabinoids do not have much psychoactivity.

Another possibility for higher potency is that homologues of delta-9 THC with longer side chains at C-3 (and higher activity) might be found in certain marijuana varieties. Compounds with longer side chains have been made in laboratories and their activity is sometimes much higher, with estimates over 500 times that of natural delta-9 THC (55,113,191). Compounds besides THCV with shorter chains (methyl (139) and butyl (118)) in this position have been found in small amounts in some marijuana samples, indicating that variations do exist. However, this is not a very likely explanation. More likely, THCV is more prevalent in marijuana than supposed and probably had additive or synergistic effects with delta-9 THC.

The possibility that there are non-cannabinoids that are psychoactive or interacting with the cannabinoids has not been investigated in detail. Non-cannabinoids with biological activity have been isolated from the plants, but only in very small quantities (181). None are known to be psychotomimetic. However, they may contribute to the overall experience in non-mental ways, such as the stimulation of the appetite.

Different blends of cannabinoids account for high of different qualities. The intensity of the high depends primarily on the amount of delta-9 THC present and on the method of ingestion. A complex drug such as marijuana affects the mind and body in many ways. Sorting out what accounts for what response can become quite complex. The methodology to isolate and test the different cannabinoids now exists. The National Institute of Mental Health (NIMH) is funding research on the pharmacology of marijuana. However, such research is paltry, considering that over 30 million people in the United States use the crude drug. Much more research is needed before definite understanding of the cannabinoids and the high is attained.

When the legal restrictions are removed, marijuana will probably be sold by particular blends of cannabinoids and standard amounts of delta-9 THC. Synthetic marijuana will probably be made with homologues of delta-9 THC that have much higher activity than the natural form. For now, without access to a lab, you must be satisfied with your own smoking evaluation (for research purposes only), ultimately the most important criterion any way.

2.3 Resin and Resin Glands

Many people consider potency and resin concentration synonymous. People hear of plants oozing or gushing with copious resin, and the image is of resin flowing in the plant like the latex of a rubber tree or the sap of a maple tree. But these visions are just pipe dreams.

It is quite possible to have a resinous plant with little potency or a plant with little apparent resin which is very potent. Potency depends primarily on the concentration of THC in the plant material. Many more substances besides the cannabinoids make up the crude resin of Cannabis. Preparations such as ghanja or hashish are roughly about one-third by weight non-psychoactive water-soluble substances and cellular debris. Another third is non-psychoactive resins such as phenoloic and terpenoid polymers, glycerides, and triterpenes. Only one-fourth to one-third is the cannabinoids. In many Cannabis plants, THC may be only a very small percentage of the total cannabinoids. ((These figures are very approximate. Actual percentages depend on sample material, processing, and extraction procedures. See Table 8 and 9 for percentages of THC in hashish.)) The remainder (5 to 10 percent) of the resin will be essential oils, sterols, fatty acids, and various hydrocarbons common to plants.

Table 8 - Seized Hashish (a)

COUNTRY IN WHICH SEIZED	Range of Percentage of	
	THC	CBD
Greece	1 - 15.8	1.4 - 11.1
Nepal	1.5 - 10.9	8.8 - 15.1
Afghanistan	1.7 - 15	1.8 - 10.3
Pakistan	2.3 - 8.7	6.8(b)

a Figures compiled from many sources.
 b Only one figure reported

Table 9 - Relative Percentages of Major Cannabinoids from Hashish and Resin Preparations.

COUNTRY	Average Percentages of		
	THC	CBD	CBN
Afghanistan	52	36	12
Burma	15.7	16.3	68
Jamaica	77.5	9.1	13.4
Lebanon	32.2	62.5	5.3
Morocco	55	34.2	10.8
Nigeria	53.7	9.3	37
Pakistan	35.7	48.3	16.1
South Africa	75.6	8.4	16

a Each row sums to 100%
 _TABLE 9

The cannabinoids basically do not flow in the plant, nor are they the plant's sap. About 80 to 90 percent of the cannabinoids are synthesised and stored in microscopic resin glands that appear on the outer surfaces of all plant parts except the root and seed. the arrangement and number

(concentration) of resin glands vary somewhat with the particular strain examined. Marijuana varieties generally have more resin glands, and they are larger than resin glands on non-drug varieties.

Although resin glands are structurally diverse, they are of three basic types. The bulbous type is the smallest (15-30 μm ((μm is the symbol for a micrometer (or micron), equal to 1/1,000,000 of a meter, or approximately 1/25,000 of an inch.)) or about .0006 to .0012 inches). From one to four cells make up the "foot" and "stalk," and one to four cells make up the head of the gland (25). Head cells secrete a resin - presumably cannabinoids - oils, and related compounds which accumulate between the head cells and the outer membrane (cuticle). When the gland matures, a nipple-like outpocket may form on the membrane from the pressure of the accumulating resin. The bulbous glands are found scattered about the surfaces of the above-ground plant parts.

The second type of gland is much larger and more numerous than the bulbous glands. They are called "capitate," which means having a globular-shaped head. On immature plants, the heads lie flush or appear not to have a stalk and are called "capitate sessile." They actually have a stalk that is one cell high, although it may not be visible beneath the globular head. The head is composed of usually eight, but up to 16 cells, that form a convex rosette. These cells secrete a cannabinoid-rich resin which accumulates between the rosette and its outer membrane. This gives it a spherical shape, and the gland measures from 25 to 100 μm across. In fresh plant material about 80 to 90 percent of their contents will be cannabinoids, the rest primarily essential oils (146).

During flowering the capitate glands that appear on the newly formed plant parts take on a third form. Some of the glands are raised to a height of 150 to 500 μm when their stalks elongate, possibly due to their greater activity. The stalk is composed mostly of adjacent epidermal tissue. These capitate-stalked glands appear during flowering and form their densest cover on the female flower bracts. They are also highly concentrated on the small leaves that accompany the flowers of fine marijuana varieties. Highest concentration is along the veins of the lower leaf surface, although the glands may also be found on the upper leaf surface on some varieties. The male flowers have stalked glands on the sepals, but they are smaller and less concentrated than on the female bracts. Male flowers form a row of very large capitate glands along the opposite sides of anthers.

Capitate-stalked resin glands are the only ones visible without a microscope. To the naked eye, this covering of glands on the female flower bracts looks like talcum or dew sprinkled on a fuzzy surface. With a strong hand lens, the heads and stalks are distinct. Resin glands also can be seen on the anthers of the male flowers and on the undersides of the small leaves that intersperse the flower clusters.

{Figure 17. Upper surface of a small leaf, showing stalked glands.}

{Figure 18. Resin glands on a stem lie close to the surface beneath the cystolith hairs. Hairs always point in direction of growing shoots.}

Resin glands are not visible until flowers form. The more obvious covering of white hairs seen on stems, petioles, and leaves are not resin glands.

They are cystolith hairs of carbonate and silicate which are common to many plants. These sharp-pointed hairs afford the plant some protection from insects and make it less palatable to larger, plant-eating animals.

In India, to make the finest quality hashish (nup), dried plants are thrashed over screens. Gland heads, stalks and trichomes collect in a white to golden powder which is then compressed into hashish (for hashmaking search section 21 for "hash").

Resin rarely accumulates in the copious quantities people would lead you to believe. Actually, the plants form a cover of resin glands rather than a coating of resin. Usually this is no more apparent than for the female flowers to glisten with pin-points of light and for the leaves and stems to feel a bit sticky when you run your fingers over them.

On some fine marijuana strains, resin may become obvious by the end of flowering and seed set. Resins occasionally secrete through pores in the membrane of gland heads. Usually secretion occurs many weeks after the stalked glands appear. The glands seem to empty their contents, leaving hollow spaces (vacuoles) in the stalk and head cells. After secretion, the glands cease to function and begin to degenerate. Gland heads, stalks, and trichomes become clumped together, and the whole flowering surface becomes a sticky mass. For reasons we'll go into later, this is not necessarily desirable. (see sections 20,21.)

Small quantities of cannabinoids are present in the internal tissues of the plant. The bulk is found in small single cells (non-articulated laticifers) that elongate to form small, individual resin canals. The resin canals ramify the developing shoots, and penetrate the plant's conducting tissue (phloem). Minute clumps of resin found in the phloem are probably deposited by these resin canals. Other plant cells contain insignificant amounts of cannabinoids and probably a good 90 percent of the cannabinoids are localised in the resin glands.

Cannabinoid synthesis seems to occur primarily in the head and apex of the stalk cells of the resin glands (26). Laticifers and possibly other plant cells probably contribute by synthesising the simpler molecules that will eventually make up the cannabinoids. Biosynthesis (the way the plant makes the molecules) of the cannabinoids is believed to follow a scheme originally outlined by A.R. Todd in his paper "Hashish," published in 1946 (see Figure 19). In the 1960s the pathway was worked out by Raphael Mechoulam, and confirmed in 1975 by Dr. Shimomura and his associates.

{Figure 19. Possible biosynthesis of cannabinoids.}

Notice that all the cannabinoids are their acid forms with a (COOH) carboxyl group at C-2 in the aromatic ring. This group may also appear at C-4 and the compounds are called, for example, THC acid "A" and THC acid "B", respectively. The position of the carboxyl group does not affect the potency, but, in fact, in their acid forms the cannabinoids are not psychoactive. In fresh plant material, cannabinoids are almost entirely in their acid forms. The normal procedure of curing and smoking the grass (heat) removes the carboxyl group, forming the gas CO₂ and the psychoactive neutral cannabinoids. Removing the CO₂ is important only if you plan to eat

the marijuana. It is then necessary to apply heat (baking in brownies, for example) for the cannabinoids to become psychoactive. Ten minutes of baking marijuana at 200F is enough to convert the THC acids to neutral THC.

The formation of CBG acid, from which all the other cannabinoids are formed, is initially made from much simpler compounds containing terpene units. The example here is olivetolic acid condensing with a terpene moiety called geranyl pyrophosphate. It is not known whether these are the actual or only precursors to CBG in the living plant.

Terpenes and related substances are quite light and some of them can be extracted by steam distillation to yield the "essential oil" of the plant (from essence - giving the flavour, aroma, character). Over 30 of these related oily substances have been identified from Cannabis (143). On exposure to light and air, some of the polymerise, forming resins and tars.

The cannabinoids are odourless; most of the sweet, distinctive, pleasant minty fragrance and taste of fresh marijuana comes from only five substances which make up only 5 to 10 percent of the essential oils: the mono- and sesqui-terpenes alpha- and beta-pinene, limonene, myrcene, and beta-phalandrene (144). These oily substances are volatile and enter the air quickly, dissipating with time. Subsequently, the marijuana loses much of its sweetness and minty bouquet.

The essential oils constitute about .1 to .3 percent of the dry weight of a fresh marijuana sample, or on the order of 10 percent of the weight of the cannabinoids. Essential oils are found within the heads of the resin glands and make up about 10 to 20 percent of their contents in fresh material (146). They have also been detected in the resin canals (laticifers) (31).

Different samples of Cannabis have essential oils of different composition. This is not surprising given the variability of the plant. Since substances found in the essential oils are, or are related to, substances that are the precursors of the cannabinoids, there is some chance that a relationship exists between a particular bouquet and cannabinoids content. No such relationship is yet known, but it has only been studied superficially. When connoisseurs sample the bouquet of a grass sample, they are basically determining whether it is fresh. Fresh grass mean fresh cannabinoids and less of these are likely to have been degraded to non-psychoactive products.

2.4 Production of Cannabinoids by Cannabis

Why Cannabis produces cannabinoids and resins is a question probably every grower has wondered about. Supposedly, if you know, you could stimulate an environmental factor to increase cannabinoids production. Unfortunately, it does not follow that increasing a particular selective pressure will affect a plant's (phenotype) cannabinoids production. However, over a period of generations, it is possible that environmental manipulations can increase the overall cannabinoids concentrations in a population of plants. But even this procedure would work slowly compared to direct breeding by the farmer.

From the microstructure of the resin glands and the complexity of the resin, it is apparent that Cannabis invests considerable energy in making and storing the cannabinoids. Obviously, the cannabinoids are not a simple

by-product or excretory product. No doubt the cannabinoids and resins serve the plant in many ways, but probably they have more to do with biotic factors (other living things) rather than abiotic factors (non-living environment such as sunlight, moisture, etc.).

The cannabinoids, resins, and related substances make up a complex and biologically highly active group of chemicals, a virtual chemical arsenal from which the plant draws its means for dealing with other organisms. This would apply especially to herbivores, pathogens, and competing plants. In the case of humans, the cannabinoids are an attractant. Some possible advantages to the plant are listed below, but no direct studies have been done on this question. Indeed, it is surprising that botanists have shown so little interest in this question; they have even gone out of their way to state their lack of interest.

Possible Advantages of Cannabinoid Production

1. Obviously the cannabinoids are psychoactive and physiologically active in many animals. This may dissuade plant-eating animals from eating the plant, especially the reproductive parts. Many birds enjoy Cannabis seeds. But in nature, birds will not bother young seeds, probably because they are encased in the cannabinoids-rich bracts. In wild or weedy plants, when the seed is mature it "shells out" and falls to the ground. Birds will eat the naked seeds. However, matured seeds are quite hard. Many will not be cracked and eventually will be dropped elsewhere, helping the plant to propagate. Bees and other insects are attracted to the pollen. The cannabinoids and resins may deter insects from feeding on pollen and developing seeds. Resin glands reach their largest size on the anthers (which hold pollen) and bracts (which contain the seed). {See plates 6, 7, 10 and 11.}
2. Terpenoid and phenolic resins are known to inhibit germination of some seeds. Cannabis resins may help Cannabis seedlings compete with other seedlings by inhibiting their germination.
3. Many of the cannabinoids (CBD, CBG, CBC and their acids) are highly active antibiotics against a wide range of bacteria (almost all are gram +) (36,130,184). Crude resin extracts have been shown to be nematocidal (36). (However, fungicidal activity is low.)

Most of the explanations you've probably heard for resin production from both lore and scientists have to do with physical factors such as sunlight, heat, and dryness. Presumably the resin coats the plant, protecting it from drying out under physical extremes. These explanations make little sense in light of the resins' chemistry.

The physical qualities of the glands and resins probably aid the plant in some ways. The sticky nature of resin may help pollen grains to adhere to the flowering mass and stigmas, or simply make the plant parts less palatable. And gland heads do absorb and reflect considerable sunlight, and so possibly protect the developing seed. For instance, gland heads are at first colourless (i.e., they absorb ultraviolet light). This screening of ultraviolet light, a known mutagen, may lower possible deleterious mutations. But physical properties seem to be secondary to the resins' chemical properties as functional compounds to the plant.

2.5 Cannabis Chemotypes

All Cannabis plants produce some cannabinoids. Each strain produces characteristic amounts of particular cannabinoids. Strains differ in the total amounts they contain. Usually they average about three percent cannabinoids to dry weight, but concentrations range from about one to 12 percent cannabinoids in a cleaned (seeds and stems removed), dried bud. Strains also differ in which cannabinoids they produce. Based on which cannabinoids, Cannabis strains can be divided into five broad chemical groups. ((Chemical classification based on work by Small et al (51))) The general trend is for plants to have either THC or CBD as the main cannabinoid.

Type I

Strains are high in THC and low in CBD. This type represents some of the finest marijuana strains. They usually originate from tropical zones below 30 degrees latitude, which in the north runs through Houston and New Orleans to Morocco, North India, and Shanghai, and in the south through Rio de Janeiro, South Africa, and Australia. Most of the high-quality marijuana from Mexico, Jamaica, and Colombia and some in this country is this type; most of you will grow this type. As with all five chemical types, type I comes in different sizes and shapes. Most common are plants about 10 to 12 feet tall (outdoors), quite bushy, with branches that grow outward to form the plant into a cone (Christmas tree shape). Other tall varieties (to 18 feet) have branches that grow upward (poplar-tree shaped - some Mexican, Southeast and Central Asian varieties). A less common short variety (up to eight feet) develops several main stems and the plants appear to sprawl (Mexico, India).

Type II

This is an intermediate group, with high CBD and moderate to high THC. They usually originate from countries bordering 30 degrees latitude, such as Morocco, Afghanistan and Pakistan. In this country, this type of grass usually comes from Afghani and Colombian varieties. Type II plants are quite variable in the intensity and quality of the high they produce, depending on the relative amounts of THC and CBD in the variety. Probably because of their high CBD and overall resin content, these plants are often used to prepare hashish and other concentrated forms of marijuana. The most common varieties grow to about eight to 12 feet and assume a poplar-tree shape with long branches that grow upward from the stem base and much shorter branches toward the top. They usually come from Turkey, Greece, and Central or Southeast Asia and occasionally from Colombia and Mexico. Some varieties are shorter, about four to eight feet at maturity, and very bushy with a luxuriant covering of leaves. These usually originate from Nepal, northern India, and other parts of Central Asia as well as North Africa. Other varieties appear remarkably like short (five to seven feet) hemp plants, with straight,

slender stems and small, weakly developed branches (Vietnam). A common short variety, less than four feet tall (Lebanon, N. Africa), forms a continuous dense cluster of buds along its short stem. They appear remarkably like the upper half of more common marijuana plants.

{Figure 20. Left: This Pakistani variety ("indica") reaches a height of five feet (large leaves removed). Right: Flowering top two months later.}

Type III

Plants are high in CBD and low in THC. These are often cultivated for hemp fibre or oil seed. Usually they originate from countries north of 30 degrees latitude. As marijuana they yield a low-potency grass and are considered non-drug varieties. If you choose your seeds from potent grass, it will not be this type. An example of these plants are Midwestern weedy hems which are often collected and sold for low-grade domestic grass. The high CBD content can make you feel drowsy with a mild headache long before you feel high. These plants are very diverse morphologically even when categorised by cultivated types. Hemp plants are usually tall (eight to 20 feet) with an emphasis on stem development and minimal branching. Starting from the base, long, even internodes (stem portion from one set of leaves to the next pair) and opposite phyllotaxy (see 3.2) cover a good portion of the stem. Some varieties form long, sparse branches only on the upper portion of the stem (many Midwest weeds). Other varieties (Kentucky hemp) are the familiar Christmas-tree shape.

Seed varieties are usually short (two to eight feet) and very bushy. Branches on some are short, grow outward and are all of approximately the same length, giving the plant a cylindrical shape. Some of the shorter (two to three feet) seed varieties have undeveloped branches, and almost all of the seeds collect in a massive cluster along the top portion of the stalk. Seed plants are often the most unusual-appearing of Cannabis plants, and you won't find them in the United States.

As expected, the figures for average THC in Midwestern weeds are quite low. This is consistent with their reputation for low potency. But the range of THC goes up to 2.37 percent in the Illinois study. This is comparable with some of the higher-quality imported marijuana and is consistent with some people's claims that Midwestern weeds provided them with great highs.

Type IV

Varieties that produce propyl cannabinoids in significant amounts (over five percent of total cannabinoids) form a fourth group from both type I and II plants. Testing for the propyl cannabinoids has been limited and most reports do not include them. They have been found in plants from South Africa, Nigeria, Afghanistan, India, Pakistan, and Nepal with THCV as high as 53.69 percent of total cannabinoids (136). They usually have moderate to high levels of

both THC and CBD and hence have a complex cannabinoid chemistry. Type IV plants represent some of the world's more exotic marijuana varieties.

A fifth type, based on the production of CBGM, which is not psychoactive, is found in northeastern Asia, including Japan, Korea and China. This type is not relevant to us and will not be mentioned again.

There are many different techniques for sampling, extraction, and estimation of cannabinoids in plant material. To minimise differences among research groups, the above data (except for Midwestern weedy hems) are taken from studies at the University of Mississippi at Oxford (66,119,136).

Unfortunately, some of the best Colombian, Mexican and Thai varieties are not included in the data. Many of these have not been tested until recently, and the figures are not yet published. Under the system for testing at the University of Mississippi, the highest THC variety reached six to eight percent THC in a bud. These seeds originated from Mexico.

{See Table 01 to 10.}

These five chemical types are not distinct entities; that is, each type contains several quite different-appearing varieties. Actually, varieties of different types may look more similar than varieties from the same type. But the ability to produce characteristic amounts of particular cannabinoids is genetically based. This means the each type contains certain genes and gene combinations in common, and in biological terms, the plants are called chemical genotypes.

These types may be from virtually any country simply because of the plant's past and ongoing history of movement. the first three can be found in most countries where Cannabis is heavily cultivated, although marijuana plants (types I, II, IV) usually originate from lower latitudes nearer the equator. This may be simply explained in terms of cultural practices. Marijuana traditionally has been cultivated in southerly cultures such as India, Southeast and Central Asia, Africa; and in the West in Mexico, Colombia, Jamaica, and Central American countries. On the other hand, useful characteristics must exist before cultures can put them to use after selection. And the characteristic (drug or fibre) must maintain itself within the local environment (see 18.4).

Non-drug types (type III) usually originate at higher latitudes with shorter growing seasons. A definite gradation exists for non-drug to drug types, starting in temperate zones and moving toward the equator. The same gradation may be found for the appearance of propyl cannabinoids toward the equator. This doesn't mean that the quality of the grass you grow depends on whether you live in the north or south, but that over a period of years and decades, a group of plants may drift toward either the drug or the non-drug type (either rich in THC or rich in CBD).

The majority of the marijuana sold in the United States has less than one percent THC; and the bulk of this comes from Mexican and domestic sources. The highest percentages of THC in marijuana that we've seen are: Colombian (9.7), Mexican (13.2), Hawaiian (7.8), and Thai sticks (20.2; however, this

is believed to be adulterated with hash oil). The percentages of THC reported vary greatly, because they depend on the particular method of sampling and estimation used.

Five samples of Colombian Golds, bought in New York City and San Francisco for from \$30 to \$50 (1976) an ounce, averaged 2.59 percent THC and 1.27 percent CBN. The CBN represents an average of about one-third of the THC originally present in the fresh plant by the time it reaches American streets. This is one advantage that homegrowers have, since their marijuana is fresh. In fresh plant material, less than 10 percent of the THC will have been converted to CBN, as long as the material is properly harvested, cured, and stored.

By the time hashish reaches the American market, THC content is usually at the low end of the ranges given here, usually between 1.5 and 4 percent THC. The darker outer layer of hashish is caused by deterioration. The inner part will contain the highest concentration of THC.

The average range for hash oil and red oil is 12 to 25 percent when it is fresh. It is not uncommon for illicit hash oil to have more than 60 percent THC. However, light, as well as air, very rapidly decomposes THC in the oil form (see the section on "Storage" in section 21). You can't tell whether the oil will be wondrous or worthless unless you smoke it.

The preparations listed in Tables 9 and 10 are relatively fresh compared to hashish on the American market. Total cannabinoids make up roughly 25 to 35 percent by weight of hashish and resin preparations. Note that the data in these tables are relative concentrations.

Table 10 -Relative Percentages of Major Cannabinoids in Hashish from Nepal
Percentage(a) of THC HASHISH THC CBD CBN THCV CBDV CBV LOST(b) Sample 1 11.5
35.9 22.1 5.7 12.5 12.3 66 Sample 2 3.4 41.1 24.8 3 11.9 15.8 88 Sample 3
5.5 41.2 30.3 2.3 9.1 11.6 85 a Each row in these columns sums to 100% b
Percentage of original THC lost as CBN

The very high figures for CBN in hashish indicate that much of the THC is converted to CBN because of processing and aging. During hashmaking many of the gland heads are broken and the THC is exposed to light and air. The figures in these tables are typical of what to expect for relative concentrations of THC in hashish on the American market. Actual concentrations are roughly one-fourth to one-third of these figures.

Obviously, THC percentages for hashish and tinctures are not that high compared to fine marijuana. Hashish in the United States seldom lives up to its reputation. The best buy in terms of the amount of THC for the money is hash oil when it is high quality and fresh. More often a fine homegrown sinsemilla or sometimes a lightly seeded Colombian is the best investment. (Of course, the best value is always what you grow yourself.)

3.2 Choosing Seeds

Popular Market names of different grades of grass, such as Colombian commercial and Mexican regular, are familiar to growers, but each grade actually may encompass many different varieties. For example, there are Colombian Golds that are similar in most respects, but some varieties grow no taller than six feet. The more common types grow 12 to 15 feet under the same conditions. Some Oaxacan Cannabis forms several strong upright branches by maturity, and at a glance may seem to have several stems, yet more often, Oaxacan is conical-shaped and grows about 12 feet.

Most of the fine marijuana sold in this country comes from type I plants with THC as the predominant cannabinoid. Type II plants are less common. You might recognise type II plants by the high. The grass takes longer before its effects are felt, but the high lasts much longer than with other marijuana. Type IV plants are the least common; this marijuana seldom reaches the general American market. This type will get you high after only a few tokes. Type III plants are considered non-drug varieties because they are predominantly CBD with little THC. The effects of CBD are not felt unless it is accompanied by a sizeable concentration of THC, such as in type II plants. However, a lot of marijuana from these plants is sold in the United States. Some Mexican and Jamaican regular and much of the low-grade domestic is harvested from type III plants.

You may not be able to tell what type plant you're smoking, but you can tell what you like. Seeds from high-quality marijuana will grow into high-quality marijuana plants. If you like the grass you're smoking, you'll like the grass you grow.

The name of your grass has little to do with potency and may have originated in the mind of some enterprising dealer. Always choose your seeds from what you consider to be the best grass. Don't be swayed by exotic names. If you are not familiar with grass of connoisseur quality, ask someone whose experience you respect for seeds. Smokers tend to save seeds from exceptional grass even if they never plan to plant them.

The origin of your grass even if you knew it for certain, has little to do with whether it will be dynamite or worthless smoke. In both India(45) and Brazil, hemp is grown which is worthless for marijuana. Likewise, extremely potent marijuana plants grow which are useless for hemp fibre. These plants are sometimes found growing in adjacent fields. Most of the fine-quality marijuana varieties develop in those countries nearer to the equator. How much this had to do with environmental conditions or cultural practices is unknown. In either case, marijuana traffic has been so heavy that fine varieties now grow all over the world. For example, in the United States thousands of people now grow varieties from Mexico. These fine varieties originated in Asia and Africa, and many were brought to Mexican farmers by American dealers during the 1960s. As more farmers grew these new varieties, the quality of Mexican grass imported to the United States improved. Already people are speaking of varieties such as Maui Wowie and Kona Gold.

The colour of the grass does not determine its potency. Marijuana plants are almost always green, the upper surface of the leaves a dark, luxuriant green, and the undersurface a lighter, paler green. Some varieties develop

reds and purples along stems and leaf petioles. Occasionally, even the leaves turn red/purple during the last stages of growth (plate 6). Grasses termed "Red" more often get their colour from the stigmas of the female flowers, which can turn from white to a rust or red colour, giving the marijuana buds a distinct reddish tinge. The golds and browns of commercial grasses are determined by the condition of the plant when it was harvested - whether it was healthy (green) or dying (autumn colours). How the plants are harvested, cured, and stored also has a serious effect on colour. Commercial grasses from Colombia, Mexico, and Jamaica are often poorly cured and packed. Too much moisture is left in the grass, encouraging microbial decomposition; with warm temperatures, whatever green was left disappears, leaving the more familiar browns and golds. By the time they reach the United States, commercial grasses lose about five to 20 percent of their weight in water loss and often smell mouldy or musty.

Colour also depends on origin - varieties adapted to tropical or high-altitude areas have less chlorophyll and more accessory pigments, giving the plant their autumn colours (accessory pigments protect the plant from excessive sunlight). Varieties adapted to northern climates, where sunlight is less intense, have more chlorophyll and less accessory pigments. The dying leaves often turn light yellow, grey, or rust. Variations in pigment concentrations are also influenced by local light particularly the soil conditions under which the plants are grown.

The taste of the smoke - its flavour, aroma, and harshness - also depends more on when the marijuana was harvested and how it was handled after it was grown than on the variety or environmental influences.

You can detect subtle differences in the overall bouquet between freshly picked varieties. The environment probably influences bouquet too, but with most commercial grass the harvesting/storing procedures for outweigh these other, more subtle factors. A musty, harsh-smoking Colombian marijuana can give the mildest, sweetest, homegrown smoke when properly prepared. Don't be influenced by the marijuana's superficial characteristics. Choose seeds from the most potent grass.

Grasses of comparable potency can yield plants of different potencies. This is because fine sinsemilla (homegrown, Hawaiians, Thai weeds, and some Mexicans) are carefully tended and harvested at about peak potency. They are also cured and packed well; so they are fresh when they are distributed in the American market. When you smoke them you are experiencing the at about its peak potency. The seeds you plant from this grass will produce plants, at best, of about equal potency. Sometimes they are slightly less simply because of differences in growing conditions. Colombian grasses are not usually harvested at their peak potency. A significant amount (20 percent and up) of the active cannabinoids (THC,CBD) are converted to much less active cannabinoids (CBN,CBS) or inactive ingredients (polymers-tars, resins, oils, etc.). This is also true of many Mexican and Jamaican grasses that are heavily seeded and poorly handled. Homegrown from this grass can produce plants of higher potency than the original, simply because the homegrown is fresh, and is harvested and cured well so that the THC content is at its peak.

When choosing seeds you might consider the following Broad Generalisations.

Mexican, Jamaican (if you can find goof Jamaican anymore), and homegrowns, including Hawaiians, often develop quickly and have a better chance of fully maturing in the shorter growing seasons over most of the north and central states. Colombian, African, and Southeast Asian varieties, such as Vietnam and Thai sticks (from Thailand and Japan), more often need a longer season to fully develop/ Under natural conditions they seldom flower in the short growing season that covers the northern United States.

For indoor growers, the growing season is all year; so it doesn't matter if plants need longer to develop. Mexican and Jamaican plants usually reach full potency in about six months. Colombian and Southeast Asian varieties may need eight or nine months until they reach their maximum THC or general resin content under indoor conditions.

The grass you choose should have a good stock of mature seeds. Thai weed and fine homegrowns (sinsemillas, which are by definition female flowers buds without seeds) may have no seeds at all but more often have a few viable seeds. Most Colombian and Mexican grasses contain between one and two thousand seeds per ounce bag or lid of grass. This may sound like an exaggerated figure, but it's not. Look at the photos in Figure 21 showing the yield from some Michoacan buds. The yield is 40 percent grass (1.22 grams, about three joints), 50 percent seeds (1.56 grams or 120 seeds), and 10 percent stems (0.3 grams).

Relative to smoking material, seeds are heavy. Colombian grasses average about 50 percent seeds by weight. A film canister holds about 1,200 Colombian seeds. {Figure 21, Seeded buds often contain more weight in seeds than grass}

Depending on the variety, healthy mature seeds (which are botanically achene nuts) vary in size between 1/12 and 1/4 inches in length. From any variety, choose seeds that are plump and well-formed with well-developed colour. Seed colours range from a buff through a dark brown, and from light grey to almost black colours. Often seeds are mottled with brown or black spots, bars, or lines on a lighter field {plate 11}. Green or whitish seeds are usually immature and will germinate feebly if at all. Fresh seeds have a waxy glimmer and a hard, intact shell. Shiny, very dark brown or black seeds often mean the contents are fermented and the embryo is dead. Fermented seeds crush easily with finger pressure and are hollow or dust inside. Seeds that are bruised or crushed are also not viable. This happens to some seeds when grass is compressed or bricked.

Fresh, fully matured Cannabis seeds have a high rate of germination; 90 percent or better is typical. It is sometimes helpful to have an idea of how many seeds to expect to germinate. You can tell simply by placing a sample number between wet paper towels which are kept moist. Most of the seeds that germinate do so within a few days of each other. After a week or two, count how many of the original seeds germinated. This gives you a rough idea of what to expect from the seeds when planted.

The viability of seeds gradually declines with time; left in the ground, only 40 percent may germinate next season. Seeds are an ideal pray for many fungi, which are responsible for most of their deterioration. In a warm (70F or over) and humid atmosphere, fungi rapidly destroy seeds. If kept cool and

dry in an airtight container, seeds stored in this way and left in the buds also maintain high viability for over two years.

3.3 CANNABIS LIFE CYCLE

Marijuana plants may belong to any one of a number of varieties which follow somewhat different growth patterns. The following outline describes the more common form of growth. Differences between varieties can be thought of as variations on this standard theme.

Cannabis is an annual plant. A single season completes a generation, leaving all hope for the future to the seeds. The normal life cycle follows the general pattern described below.

Germination

With winter past, the moisture and warmth of spring stir activity in the embryo. Water is absorbed and the embryo's tissues swell and grow, splitting the seed along its suture. The radical or embryonic root appears first. Once clear of the seed, the root directs growth downward in response to gravity. Meanwhile, the seed is being lifted upward by growing cells which form the seedling's stem. Now anchored by the roots, and receiving water and nutrients, the embryonic leaves (cotyledons) unfold. They are a pair of small, somewhat oval, simple leaves, now green with chlorophyll to absorb the life-giving light. Germination is complete. The embryo has been reborn and is now a seedling living on the food it produces through photosynthesis. The process of germination is usually completed in three to 10 days.

Seedling

The second pair of leaves begins the seedling stage. They are set opposite each other and usually have a single blade. They differ from the embryonic leaves by their larger size, spearhead shape, and serrated margins. With the next pair of leaves that appears, usually each leaf has three blades and is larger still. A basic pattern has been set. Each new set of leaves will be larger, with a higher number of blades per leaf until, depending on variety, they reach their maximum number, often nine or 11. The seedling stage is completed within four to six weeks.

Vegetative Growth

This is the period of maximum growth. The plant can grow no faster than the rate that its leaves can produce energy for new growth. Each day more leaf tissue is created, increasing the overall capacity for growth. With excellent growing conditions, Cannabis has been known to grow six inches a day, although the rate is more commonly one to two inches. The number of blades on each leaf begins to decline during the middle of the vegetative stage. Then the arrangement of the leaves on the stem (phyllotaxy) changes from the usual opposite to alternate. The internodes (stem space from one pair of leaves to the next, which had been increasing in length) begin to decrease, and the growth appears to be thicker. Branches which appeared in the axils of each set of leaves grow and shape the plant to its characteristic form. The vegetative stage is usually completed in the third to fifth months of growth.

Preflowering

This is a quiescent period of one to two weeks during which growth slows considerably. The plant is beginning a new program of growth as encoded in its genes. The old system is turned off and the new program begins with the appearance of the first flowers.

Flowering

Cannabis is dioecious: each plant produces either male or female flowers, and is considered either a male or female plant. Male plants usually start to flower about one month before the female; however, there is sufficient overlap to ensure pollination. First the upper internodes elongate; in a few days the male flowers appear. The male flowers are quite small, about 1/4 inch, and are pale green, yellow, or red/purple. They develop in dense, drooping clusters (cymes) capable of releasing clouds of pollen dust. Once pollen falls, males lose vigour and soon die.

The female flower consists of two small (1/4 to 1/2 inch long), fuzzy white stigmas raised in a V sign and attached at the base to an ovule which is contained in a tiny green pod. The pod is formed from modified leaves (bracts and bracteoles) which envelop the developing seed. The female flowers develop tightly together to form dense clusters (racemes) or buds, cones, or colas (in this book, buds). The bloom continues until pollen reaches the flowers, fertilising them and beginning the formation of seeds. Flowering usually lasts about one or two months, but may continue longer when the plants are not pollinated and there is no killing frost.

Seed Set

A fertilised female flower develops a single seed wrapped in the bracts. In thick clusters, they form the seed-filled buds that make up most fine imported marijuana. After pollination, mature, viable seeds take from 10 days to five weeks to develop. When seeds are desired, the plant is harvested when enough seeds have reached full colour. For a fully-seeded plant this often takes place when the plant has stopped growth and is, in fact, dying. During flowering and seed set, various colours may appear. All the plant's energy goes to reproduction and the continuance of its kind. Minerals and nutrients flow from the leaves to the seeds, and the chlorophylls that give the plant its green colour disintegrate. The golds, browns, and reds which appear are from accessory pigments that formerly had been masked by chlorophyll.

Figure 30 THC potency through various growth stages in the male and female plant

About Plants Generally

Plants use a fundamentally different "life strategy" from animals. Animals are more or less self-contained units that grow and develop to predetermined forms. They use movement and choice of behaviour to deal with the changing environments. Plants are organised more as open systems - the simple physical characteristics of the environment, such as sunlight, water, and

temperature, directly control their growth, form, and life cycles. Once the seed sprouts, the plant is rooted in place and time. Since growth is regulated by the environment, development is on accordance with the plant's immediate surroundings. When a balance is struck, the strategy is a success and life flourishes.

Behaviour of a plant is not a matter of choice; it is a fixed response. On a visible level the response more often than not is growth, either a new form of growth, or specialised growth. By directly responding, plant in effect know, for example, when to sprout, flower, or drop leaves to prepare for winter.

Everyone has seen how a plant turns toward light or can bend upward if its stem is bent down. The plant turns by growing cells of different length on opposite sides of the stem. This effect turns or right the plant. The stimulus in the first case is light, in the second gravity, but essentially the plant responds by specialised growth. It is the same with almost all facets of a plant's live - growth is modified and controlled by the immediate environment. The influence of light, wind, rainfall, etc., interacts with the plant (its genetic make-up or genotype) to produce the individual plant (phenotype).

The life cycle of Cannabis is usually complete in four to nine months. The actual time depends on variety, but it is regulated by local growing conditions, specifically the photoperiod (length of day vs night). Cannabis is a long-night (or short-day) plant. When exposed to a period of two weeks of long nights - that is, 13 or more hours of continuous darkness each night

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allows the grower to control the life cycle of the plant and adapt it to local growing conditions or unique situations. Since you can control flowering, you control maturation and, hence, the age of the plants at harvest.

3.4 PHOTOPERIOD AND FLOWERING

For the marijuana grower the most important plant/environment interaction to understand is the influence of the photoperiod. The photoperiod is the daily number of hours of day (light) vs. night (dark). In nature, long nights signal the plant that winter is coming and that it is time to flowers and produce seeds. As long as the day-length is long, the plants continue vegetative growth. If female flowers do appear, there will only be a few. These flowers will not form the characteristic large clusters or buds. If the days are too short, the plants flowers too soon, and remain small and underdeveloped.

The plant "senses" the longer nights by a direct interaction with light. A flowering hormone is present during all stages of growth. This hormone is sensitive to light and is rendered inactive by even low levels of light. When the dark periods are long enough, the hormones increase to a critical level that triggers the reproductive cycle. Vegetative growth ends and flowering begins.

The natural photoperiod changes with the passing of seasons. In the Northern Hemisphere, the length of daylight is longest on June 21. Day-length

gradually decreases until it reaches its shortest duration on December 22. The duration of daylight then begins to increase until the cycle is completed the following June 21. Because the Earth is tilted on its axis to the sun, day-length also depends on position (or latitude) on Earth. As one moves closer to the equator, changes in the photoperiod are less drastic over the course of a year. At the equator (0 degrees altitude) day length lasts about 12.5 hours on June 21 and 11.5 hours on December 22. In Maine (about 45 degrees north), day-length varies between about 16 and nine hours. Near the Arctic Circle on June 21 there is no night. On December 22 the whole day is dark. The longer day-length toward the north prevents marijuana from flowering until later in the season. Over most of the northern half of the country, flowering is often so late that development cannot be completed before the onset of cold weather and heavy frosts.

The actual length of day largely depends on local conditions, such as cloud cover, altitude, and terrain. On a flat Midwest plain, the effective length of day is about 30 minutes longer than sunrise to sunset. In practical terms, it is little help to calculate the photoperiod, but it is important to realise how it affects the plants and how you can use it to your advantage.

Cannabis generally needs about two weeks of successive long nights before the first flowers appear. The photoperiod necessary for flowering will vary slightly with (1) the variety, (2) the age of the plant, (3) its sex, and (4) growing conditions.

1. Cannabis varieties originating from more northerly climates (short growing seasons) react to as little as nine hours of night. Most of these are hemp and seed varieties that are acclimated to short growing seasons, such as the weedy hems of Minnesota or southern Canada. Varieties from more southerly latitudes need longer nights with 11 to 13 hours of darkness. Since most marijuana plants are acclimated to southerly latitudes, they need the longer nights to flower. To be on the safe side, if you give Cannabis plant dark periods of 13 or more hours, each night for two weeks, this should be enough to trigger flowering.
2. The older a plant (the more physiologically developed), the quicker it responds to long nights. Plants five or six months old sometimes form visible flowers after only four long nights. Young marijuana plants (a month or so of age) can take up to four weeks to respond to long nights of 16 hours.
3. Both male and female Cannabis are long-night plants. Both will flower when given about two weeks of long nights. The male plant, however, will often flower fully under very long days (18 hours) and short nights (six hours). Males often flowers at about the same time they would if they were growing in their original environment. For most marijuana plants this occurs during the third to fifth month.
4. Growing conditions affect flowering in many ways (see Chapter 12). Cool temperatures (about 50F) slow down the flowering response. Cool temperatures or generally poor growing conditions affect flowering indirectly. Flower development is slower, and more time is needed to reach full bloom. Under adverse conditions, female buds will not develop to full size.

Applications of Photoperiod

The photoperiod is used to manipulate the plants in two basic ways:

1. By giving long dark periods, you can force plants to flower.
2. By preventing long nights, using artificial light to interrupt the dark period, you can force the plants to continue vegetative growth.

Outdoors

Most marijuana plants cultivated in the United States begin to flower by late August to early October and the plants are harvested from October to November. For farmers in the South, parts of the Midwest, and West Coast, this presents no problem and no special techniques are needed for normal flowering.

In much of the North and high-altitude areas, many varieties will not have time to complete flowering before fall frosts. To force the plants to flower earlier, give them longer night periods. If the plants are in containers, you can simply move them into a darkened area each evening. Plants growing in the ground can be covered with an opaque tarpaulin, black sheet plastic, or double or triple-layers black plastic trash bags. Take advantage of any natural shading because direct sunlight is difficult to screen completely. For instance, if the plants are naturally shaded in the morning hours, cover the plants each evening or night. The next morning you uncover the plants at about eight to nine o'clock. Continue the treatment each day until all the plants are showing flowers. This usually takes two weeks at most, is the plants are well developed (about four months old). For this reason, where the season starts late, it is best to start the plants indoors or in cold frames and transplant outdoors when the weather is mild. This in effect lengthens the local growing season and gives the plants another month or two to develop. By the end of August the plants are physiologically ready to flower; they sometimes do with no manipulation of the photoperiod. More often female plants show a few flowers, but the day-length prevents rapid development to large clusters. The plants seem in limbo - caught between vegetative growth and flowering. The natural day-length at this time of year will not be long enough to reverse the process, so you can discontinue the treatment when you see that the new growth is predominantly flowers.

In areas where frosts are likely to occur by early October, long-night treatments may be the only way you can harvest good-sized flower clusters. These clusters, or buds, are the most potent plant parts and make up the desired harvest. Forcing the plants to flowers early also means development while the weather is warm and the sun is shining strongly. The flower buds will form much faster, larger and reach their peak potency. A good time to start the treatments is early to middle August. This allows the plants at least four weeks of flowering while the weather is mild.

Another reason you may want to do this is to synchronise the life cycle of the plants with the indigenous vegetation. In the northeast and central states, the growing season ends quite early and much of the local vegetation dies back and changes colour. Any marijuana plants stick out like green thumbs, and the crop may get ripped off or busted. Plants treated with long

nights during late July will be ready to harvest in September.

Outdoors, growers should always plant several varieties, because some may naturally flower early, even in the northern-most parts of the country. These early-maturing varieties usually come from Mexican, Central Asian, and homegrown sources. By planting several varieties, many of you will be able to find or develop an early-maturing variety after a season or two. This, of course, is an important point, because it eliminates the need for long-night treatments.

Preventing Flowers

Manipulation of the photoperiod can also prevent the plants from flowering until a desired time. For example, in Hawaii the weather is mild enough to grow winter crops. The normal summer crop is harvested anytime from September to mid-November. The winter crop is generally planted from October to December. Because the winter days are so short, the plants flower almost immediately, usually within two months. The plants are harvested in their third or fourth month and yield about 1/4 the yield of summer plants. A large Hawaiian female can yield a pound of buds. Most of the plant's overall size is reached while it is vegetatively growing. By interrupting the night period with light, you can keep these plants vegetatively growing for another month, yielding plants of about twice the size.

The amount of light needed to prevent flowering is quite small (about .03 foot candles⁹⁵ - on a clear night the full moon is about .01 foot candles). However, each plant must be illuminated fully, with the light shining over the whole plant. This might be accomplished with either electric light or a strong flashlight. The easiest way is to string incandescent bulbs, keeping them on a timer. The lights need be turned on for only a flash at any time during the night period, from about 9:00 pm to about 3:00 am. The interrupting the long night period to less than nine hours. Start these night treatments each night or two, until you want the plants to flower.

Indoors

Natural Light

Indoors, the growing season lasts all year. The night period is much easier to control. Sometimes people grow plants in their windows for more than a year without any female flowers ever forming. This is because household lamps are turned on sometime at night, illuminating the plants. Under natural light exclusively, indoor plants flower at about the same time they would outdoors (sometime a bit sooner because it is warmer indoors or the plants may be shaded). When plants are well developed and you want them to flower, make sure that no household lamps or nearby street lamps are shining on them. During late fall and winter, the natural day-length is short enough for the plants to flower naturally, if you simply keep off any lights at night that are in the same room as the plants. If you must use light, use the lowest wattage possible, such as a six-watt bulb. (The hormone is also least sensitive to blue light.) Shield the light away from the plants. Or shield the plants from any household light with aluminium foil curtains. Once the flowers are forming clusters, you can discontinue the dark treatments, especially if it is more convenient. However, if it is too soon

(when you see only a few random flowers), household lights can reverse the process.

By using natural light, you can grow indoor crops all year. The winter light is weak and the days are short, so it is best to use artificial lights to supplement daylight, as well as to extend the photoperiod. The extra light will increase the growth rate of the plants and hence size and yield. You should allow winter crops to flower during late January or February, using the natural photoperiod to trigger flowering. If you wait until spring, the natural light period will be too long and may prevent flowering.

Artificial Lights

Under artificial light the photoperiod is, of course, any length you wish. The most popular way to grow with artificial lights is the harvest system. Start the plants under long light periods of from 16 to 18 hours daily. After the plants have reached a good size, usually between three and six months, shorten the light cycle to about 12 hours to force flowering.

To decide exactly when to force the plants to flower, let their growth be the determinant. If male plants are showing their flowers, then the females are physiologically ready to flower. Most of the plant's overall height is achieved during vegetative growth. Some varieties, of course, are smaller and grow more slowly than others. Wait until the plants are nearing the limits of the height of the garden or are at least five feet tall. This is large enough to support good flower development and return a good yield. If you turn down the light cycle when the plants are young and small, you'll harvest much less grass because the plants simply can't sustain a large number of flowers.

Some leaf growers prefer a continuous growth system, emphasising leaf growth and a continuous supply of grass. The light cycle is set for 18 to 24 hours a day. This prevents flowering and the plants continue their rapid vegetative growth. Growing shoots and leaves are harvested as used, and plants are removed whenever they lose their vigour and growth has noticeably slowed. New plants are started in their place. In this way, there will be plants at different growth stages, some of which will be in their rapid vegetative growth stage and will be quite potent. Male plants and some females eventually will form flowers, but the females will not form large clusters. People often use this system when the lights are permanently fixed. Small plants are raised up to the lights on tables or boxes. This garden never shuts down and yields a continuous supply of grass.

3.5 INHERENT VARIATIONS IN POTENCY

The potency of a particular marijuana sample will vary because of many factors other than the variety. Many of these have to do with the natural development of the plants and their resin glands. Environmental factors do affect potency but there are large differences in any variety. These inherent factors must be explained before we can talk of factors outside the plant that affect relative potency. Strictly environmental effects are discussed in Chapter 19.

Variations in Potency Within Varieties

There are noticeable differences in THC concentrations between plants of the same variety. Differences are large enough so that you can tell (by smoking) that certain plants are better. This is no news to homegrowers, who often find a particular plant to be outstanding. Five-fold differences in THC concentration have also shown up in research. However, when you consider a whole group of plants of the same variety, they're relatively similar in cannabinoid concentrations. Type II plants are the most variable, with individual plants much higher than others in certain cannabinoids.

Variations by Plant Part

The concentration of cannabinoids depends on the plant part, or more specifically, the concentration and development of resin glands to plant part. The female flower bracts have the highest concentration of resin glands and are usually the most potent plant parts. Seeds and roots have no resin glands. These show no more than traces of cannabinoids. Smoke seeds will give you a headache before you can get high. If you got high on seeds, then there were probably enough bracts adhering to the seeds to get you high. {Figure 29 The highest concentration of stalked resin glands forms a cover on the female flower bracts Resin glands beneath cystolith hairs on a leaf petiole}

Here are the potencies, in descending order, of the various plant parts:

1. Female flowering clusters. In practice you don't separate hundreds of tiny bracts to make a joint. The whole flowering mass (seeds removed), along with small accompanying leaves, forms the material.
2. Male flower clusters. These vary more in relative potency depending on the strain (see "Potency by Sex," below).
3. Growing shoots. Before the plants flower, the vegetative shoots (tips) of the main stem and branches are the most potent plant parts.
4. Leaves (a) that accompany flowers (small);
(b) along branches (medium);
(c) along main stem (large).
Generally, the smaller the leaf is, the more potent it can be.
5. Petioles (leaf stalks). Same order as leaves.
6. Stems. Same order as leaves. The smaller the stem (twig), the higher the possible concentration of cannabinoids. Stems over 1/16" in diameter contain only traces of cannabinoids and are not worth smoking. The small stems that bear the flowers can be quite potent.
7. Seeds and Roots. Contain only traces (less than .01 percent) and are not worth smoking or extracting.

This order is fairly consistent. The exceptions can be the small leaves that accompany male flowers, which are sometimes more potent than the flowers themselves. The growing shoots are sometimes more potent than the mature female flowers.

Samples of pollen show varying amounts of cannabinoids. Resin glands are found inside the anthers, alongside the developing pollen grains, and form two rows on opposite sides of each anther. Pollen grains are smaller than the heads of large resin glands ({see Plate 7}), and range from 21 to 69

micrometres in diameter²¹. A small amount of resin contaminates the pollen when glands rupture, but most of the THC in pollen samples comes from gland heads that fall with pollen when the flowers are shaken to collect it. One study, using pollen for the sample, found concentrations of up to 0.96 percent THC, more than enough to get you high⁷⁹.

Potency by Position on Plant

The potency of marijuana on any plant increases toward the top of the plant, the topmost bud being the most potent. The bottommost leaves on the main stem are the least potent of the useable material. Along branches there is a less steep THC gradient increasing to the growing tip.

The ratios in Table 11 are representative of high-quality marijuana varieties. Plant no. 2 is an exception, with four percent THC in its lower leaves, a figure comparable to high-quality Colombian and Mexican buds in commercial grass.

Table 11 - Relationship of THC Content to Leaf Position (68)

Percentage of THC by weight of Leaf from Position on plant	No. 1 (SP-5)	NO.2 (SP-5)	NO.3 (UNC-335)
Plant			
Top	6.1	6.9	4.8
Middle	3	5.5	3.1
Bottom	0.8	4	1.5
Ratio (gradient)	8:4:1	1.7:1.4:1	3:2:1

Notice the large difference in the gradients of Plants no. 1 and 2, which are from the same variety (SP-5). Like almost all characteristics of these plants, considerable variation occurs even among sibling. Our experience is that generally the better the quality of the variety, the steeper the gradient: in other words, the bigger the difference between top and bottom leaves. For example, the plants given here are high-quality type I varieties. Plant no. 1 is more typical, with its steep gradient, than no.2, where the gradient is much less pronounced. Lower-quality varieties generally do not have as steep a gradient and the ratios would look more like that of Plant no. 2.

Potency by Sex

Although marijuana lore claimed the female to be the more potent, scientists disclaimed this. But there is some truth to both sides. In fine marijuana varieties, male and female leaves average about the same in cannabinoid concentrations. Either a male or a female individual may have the highest concentration in any particular case. The largest variation is in comparing the flowers. Male flowers may be comparable to the females, or they may not even get you high. It seems that the higher the quality of the grass, the better the male flowers will be. In fine type I plants, male flowering clusters usually approach the potency of the female. In low-quality type III varieties females are usually more potent (20 to 30 percent) than the males.

Type II plants are the most variable, with large differences among individual plants. But the trend is for the females to average about 20 percent high in potency of leaves and flowers.

Table 12 - Relative Potencies of Male and Female Plants (66)

COUNTRY OF ORIGIN	SEX (a)	Percentage by Weight (b) of		TYPE PLANT
		THC	CBD (C)	
Mexico	M	3.7	0.86	I
	F	3.7	0.35	
India	M	4.3	0.12	I
	F	1.78	0.19	
Thailand	M	3.2	0.08	I
	F	3.2	0.42	
India	M	0.81	2.1	II
	F	1.3	0.89	
Pakistan	M	1.37	1.24	II
	F	0.71	1.5	
Turkey	M	0.84	2.11	II
	F	0.92	1.33	
India	M	0.15	2.2	III
	F	0.12	1.2	
Poland	M	0.04	0.97	III
	F	0.06	1.1	

a) M, male (staminate); F, female (pistillate). (b) Of flowering mass with accompanying leaves. (c) Includes CBC. _

Potency by Age

In general, the longer the life cycle of the plant, the more the concentration of cannabinoids increases, as long as the plant stays health and vigorous. Actually, it is the development of the plant, rather than chronological age, that determines this difference in potency. A plant that is more developed or more mature is generally more potent.

Because you decide when to plant and/or can control the photoperiod, you also control when the plants flowers and, hence, the overall age at maturity. A six-month-old plant will generally be better than a four-month-old plant, both of which are flowering. Plants eight months old will usually be more potent than six-month-old plants. Most indoor growers plan their gardens to be about five to eight months old at harvest. Healthy plants can be extended to about 10 months. Plants older than 10 months often develop abnormally. There is usually a decline in vigour and a loss in potency. But some growers have decorative plants several years old.

Outdoor growers more often simply allow the plants to develop according to the local growing conditions which will govern their development and flowering time. Where the growing season is short, some growers start the plants indoors and transplant when the local growing season begins. This gives the plants a longer growing season.

One reason female plants are considered more potent is because of age. Males often flower in four to five months and die, while the females may continue to a ripe old age of eight or nine months, especially when they are not pollinated.

Potency by Growth Stage

Although the general trend is for the cannabinoid concentration to increase with age, this is not a matter of the simple addition or accumulation of cannabinoids. The concentration of cannabinoids changes with the general metabolic rate of the plant, and can be related to the plant's growth pattern or life cycle. Figure 30 shows a hypothetical curve following the concentration of THC from the upper leaves and growing tips of a male and female plant.

Notice that THC increases immediately with germination and establishment of the seedling, and continues to rise until the plant enters its vegetative stage. At this point, the plant is well-formed, with a sturdy stem, and no longer looks fragile. As the plant's rate of growth increases, there is a corresponding rise in THC that continues throughout the vegetative stage until a plateau is reached. Before the plateau is reached the arrangement of leaves on the stem (phyllotaxy) changes from opposite to alternate. The plateau is maintained until the plant's rapid growth all but stops and the plant has entered preflowering. By this time, the branches have formed the plant to its characteristic shape. Preflowering lasts about one to two weeks, during which THC concentration falls until the appearance of the first flowers.

For the male plant, preflowering ends with renewed growth. This lengthens the uppermost internodes and the first male flower buds appear. THC immediately increases with the development of the male flower clusters, and reaches its peak when most of the flowers are fully formed and a few are beginning to release pollen. After pollen release, the male normally loses vigour and THC content slowly declining until the plant is cured and stored.

Female plants reach their maximum THC when the plants are in full bloom. Full bloom is when the plant has filled out with well-formed flower clusters, but flowers are still slowly forming. Most of the stigmas will still be white and healthy.

Flowering lasts anywhere from two to 10 weeks, depending on whether the plants are pollinated or not, as well as on variety and the environment. (See Chapter 20 for details.) THC content declines as the formation of new flowers slows and the majority of the stigmas begin to brown. The only changes you may see in the plants are the maturation of the seeds and the loss of green colour in the leaves and flowers. In some cases the plant's apparent resin (its look and feel) increases during the last few weeks of life while the THC concentration is still declining.

You may feel that you should only pick marijuana when the plants are in full bloom, but this is not the case. Think of the garden as a continuous supply of grass. You can never be sure of the fate of your plants. The biggest problem with outdoor growing is that there is a good chance that the plants will be ripped off before you plan to harvest. It is much better to harvest grass during the course of a season, assuring yourself a return for your efforts. For example, during the third month of growth, you could cut back the growing tips, which should be quite potent, often more potent than Figure 30 suggests. This doesn't mean there will be less to harvest at season's end. In fact, the plant will be forced to develop its branches,

possible yielding a larger plant.

Common sense tells you that it is always best to test one sample before you harvest. By taking one tip, curing and smoking, you'll know whether it's worthwhile to harvest more at that time or to wait longer. When a tip is about equal to its parents' potency, then definitely harvest more growing tips. This peak high often occurs during the middle to late rapid, vegetative-growth stage.

The reader should keep in mind that Figure 30 serves only as an example. Chronological age is not as important as the physiological age of the plant. In this graph, the life of the plants is about six months. But the life cycle depends on the particular variety and the growing conditions, which strongly influence the rate of development. (For details on how to use the graph, see Chapter 20.) The important facts that the reader should get from the graph are that the potency of the grass can decrease as well as increase during the plant's life cycle. Actual studies of the cyclic variations in potency over the course of a season have shown much more complicated rhythms, with many more peaks and valleys than here 71,74,80,86,92. Most varieties will more or less follow a growth pattern as described. Changes in the plant's development, such as phyllotaxy and growth rate, are cues to changes in THC concentration. Secondly, the growing tips of the main stem and branches can be very potent. Growers do not have to wait until flowers form to harvest top-quality smoke.

3.6 Cultivation: Indoors or Outdoors?

The basic elements of the environment (light, water, air, and soil) provide plants with their fundamental needs. These environmental factors affect the growth rates of plants, as well as their life cycles. If one factor is deficient, growth rate and vigour will wane regardless of the other three. For instance, with low light, the growth will be limited no matter how fertile and moist the soil is. In the same sense, if soil minerals are scarce, the growth rate will be limited no matter how you increase the light.

Photosynthesis

Cannabis, like all green plants, manufactures its food through the process photosynthesis. Unlike animals, which depend on pre-formed food for survival, plants can use energy from light to form food (carbohydrates) from simple inorganic molecules absorbed from the air and soil.

Plants absorb light energy through pigments that are concentrated in the leaf cells. These pigments are also found in most of the aboveground parts of the plant. The most abundant pigment is chlorophyll, which gives the plants their green colour. The energy absorbed is stored in chemical compounds such as ATP and NADPH₂. ((ATP, adenosine-triphosphate; NADPH₂, nicotinamide-adenine-dinucleotide-phosphate.)) These are storage/transfer compounds that function to transfer energy and matter in the living system. ATP transfers energy that fuels the reactions for the making of carbohydrates as well as most other metabolic functions. NADPH₂ transfers electrons, usually as hydrogen, for the synthesis of carbohydrates as well as other compounds.

The raw material for the synthesis of carbohydrates $(\text{CH}_2\text{O})_n$ comes from carbon dioxide (CO_2) and water (H_2O). Carbon dioxide is absorbed primarily from the air, but can also be absorbed from the soil and secondarily from the air.

Photosynthesis is summarised as follow:

light energy ----- ATP + NADPH₂

$\text{CO}_2 + \text{H}_2\text{O}$ ----- $(\text{CH}_2\text{O})_n + \text{O}_2$

For more complex bio-molecules such as amino acids and proteins, the plant absorbs minerals (including nitrogen, phosphorus, and sulfur) from the soil. Carbohydrates provide food energy for the plant using processes similar to those that occur in humans. They also form the basic building blocks for plant tissues. For example, the sugar glucose $(\text{CH}_2\text{O})_6$ is strung and bonded to form long chains of cellulose, the most abundant organic compound on earth. About 80 percent of the structure of the plant's cells is made from cellulose.

The plant is a living thing existing in a holistic world; a myriad of factors affect its life. However, good cultivation techniques require attention to only four basic growth factors. With this accomplished, the plants will do the rest.

As grower, your strategy is to bring out the plant's natural qualities. The cannabinoids are natural to the plants. Seeds from potent marijuana grow into potent marijuana plants when they are nurtured to a full and healthy maturity.

Since most marijuana plants are adapted to tropical or semitropical climates, it is up to the grower to make the transition to local growing conditions harmonious. This requires sensible gardening techniques and, in some cases, manipulation of the photoperiod. There is no magic button to push or secret fertiliser to use. The secret of potency lies within the embryo. The environment can and does affect potency, as it does most aspects of the plant's life. However, environmental factors are secondary to the plant's heritage (genetic potential).

Indoors vs. Outdoors

At this point the book divides into separate indoor and outdoor cultivation sections, and you may wonder whether it is better to grow the plant indoors or outdoors. Each alternative has advantages and disadvantages. It is usually better to grow the plants outdoors if possible, because the plants can grow much larger and faster than indoors. Indoors presents space and light limitations. It is possible to grow a 15-foot bush indoors, but this is unrealistic in most homes. There simply isn't enough room or light for such a large plant. Outdoor gardens return a much higher yield for the effort and expense. Most indoor gardeners buy soil and may have to buy electric lights. So there is an initial investment of anywhere from \$10 on up.

On the other hand, outdoor plants are more likely to be seen. Many gardens get ripped off, and busts are a constant threat. Indoor gardens are much

less likely to be discovered. Gardening indoors allows the grower closer contact with the plants. The plants can be grown all year long; it is an easy matter to control their growth cycles and flowering. Probably the biggest attraction of indoor gardens is that they are beautiful to watch and easy to set up anywhere.

One popular compromise is to construct a simple greenhouse. Use plastic to either enclose part of a porch or to cover a frame built against the house.

The potency of the plants doesn't depend on whether they are grown indoors or outdoors. As long as you grow healthy plants that reach maturity and complete their life cycle, the grass can be as good as any you've ever smoked.

PART 2: INDOOR GARDENING

Chapter Four INTRODUCTION

Marijuana adapts well to indoor conditions. You can grow it in sunny rooms or with artificial light. The factor limiting the rate of growth indoors is often the amount of light, since it is less a problem to supply the plants with plenty of water, nutrients, and air.

Natural light is free. If feasible to use, natural light eliminates the most expensive components for indoor gardeners: artificial lights and the electricity they use. Window light is the easiest way to grow plants for decorative purposes or for a small crop. On the other hand, a greenhouse, sunporch, or particularly sunny room can support larger plants than most artificial light systems. A sunny porch or roof area enclosed in sheet plastic to form a greenhouse is a simple, inexpensive way to grow pounds of grass.

Cannabis grows into a fully formed bush when it receives a minimum of five hours of sunlight a day. But you can grow good-sized plants of excellent quality with as little as two hours of daily sunlight provided windows are unobstructed by buildings or trees and allow full daylight. Windows facing south usually get the most light, followed by windows facing east and west (north-facing windows seldom get any sun). Use the location with the longest period of sunlight. The corner of a room or alcoves with windows facing in two or three directions are often very bright. Skylights are another good source of bright, unobstructed light.

Some growers supplement natural light with artificial light from incandescent or fluorescent fixtures. This is essential during the winter, when sunlight is weaker than the summer, and in spaces where the plants get little direct sunlight. Artificial lights can also be used to lengthen the natural photoperiod in order to grow plants all year.

The best time to plant using natural light is in late March or April, when the sun's intensity and the number of hours of daylight are increasing. Cleaning windows dramatically increases the amount of light, especially in cities where grime collects quickly. Paint walls adjacent to windows a flat white or cover them and the floor with aluminium foil to reflect light to

the plants. Place young plants on shelves, blocks, or tables to bring them up to the light. Position the plants as close to the windows as possible. Insulate germinating plants from freezing winter drafts by stapling clear sheets of polyethylene film to the window frame.

The main problem with marijuana in windows is that it may be seen by unfriendly people. This won't be a problem at first, but when the plants grow larger, they are easily recognised. You could cover the windows with mesh curtains, rice paper, polyethylene plastic or other translucent materials to obscure the plants. A strip covering the lower part of the window may be enough to conceal the plants from outsiders.

Most of you will want the garden completely hidden. Some gardeners opt for closets, basements, attics - even under loft beds. They cover the windows if the garden is visible and grow the plants entirely with artificial light.

The amount of light you provide is what determine the garden's size - the amount of soil, number and eventual size of the plants, and the overall yield. Since light is the factor on which you base the planning of your garden, let's begin with artificial light.

{A picture of a self-contained mini-horizontal (150 or 175 watt HID) is perfect for a personal small garden.}

Chapter Five ARTIFICIAL LIGHT[

5.2 Fixtures

Florescent light is the most effective and efficient source of artificial light readily available to the home grower. Florescent lamps are the long tubes typical of institutional lighting. They require a fixture which contains the lamp sockets and a ballast (transformer) which works on ordinary house current.

Tubes and their fixtures come in length from four inches to 12 feet. The most common and suitable are four- and eight-foot lengths. Smaller tubes emit too little light for vigorous growth; longer tubes are unwieldy and hard to find. The growing area must be large enough to accommodate one or more of these fixtures through a height of at least six feet as the plants grow. Fixtures may hold from one to six tubes and may include a reflector, used for directing more light to the plants. Some fixtures are built with holes in the reflectors in order for heat to escape. They are helpful in areas where heat builds up quickly. You can make reflectors with household materials for fixtures not equipped with reflectors. Try to get fixtures that have tubes spaced apart rather than close together. See 5.5 for further suggestions.

The tubes and their appropriate fixtures are available at several different wattage or outputs. Standard or regular output tubes use about 10 watts for each foot of their length - a four-foot tube has about 40 watts and an eight-foot tube about 80 watts.

High Output (HO) tubes use about 50 percent more watts per length than regular output tubes and emit about 40 percent more light. An eight-foot (HO) runs on 112 to 118 watts. Very High Output (VHO) or Super High Output (SHO) tubes emit about two-and-a-half times the light and use nearly three times the electricity (212 to 218 watts per eight-foot tube).

The amount of light you supply and the length of the tube determine the size of the garden. Marijuana will grow with as little as 10 watts per square foot of growing area, but the more light you give the plants, the faster and larger they will grow. We recommend at least 20 watts per square foot. The minimum-size garden contains a four-foot fixture with two 40-watt tubes, which use a total of 80 watts. Dividing total watts by 20 (watts per square foot) gives 80w divided by 20w/sq. ft.=four sq.ft. (an area one by four feet). A four-tube (80 watts each) eight-foot fixture would give: 320w divided by 20w/sq. ft. = 16 sq. ft. or an area the length of the tube and about two feet wide.

VHO and HO tubes in practice don't illuminate as wide an area when the plants are young, because the light source is one or two tubes rather than a bank. Once the plants are growing well and the light system is raised higher, they will illuminate a wider area. Figure about 25 w/(ft*ft) for HO and 35 w/(ft*ft (or foot squared)) for VHO to determine garden size. A two-tube, eight-foot VHO fixture will light an area the length of the tube and one-and-a-half feet wide.

The more light you give the plants, the faster they will grow. Near 50w/sq. ft. a point of diminishing returns is reached, and the yield of the garden is then limited by the space the plants have to grow. For maximum use of electricity and space, about 40w/sq. ft. is the highest advisable. Under this much light the growth rate is incredible. More than one grower has said they can hear the plants growing - the leaves rustle as growth changes their position. In our experience, standard-output tubes can work as well as or better than VHO's if four or more eight-foot tubes are used in the garden.

The yield of the garden is difficult to compute because of all the variable that determine growth rate. A conservative estimate for a well-run garden is one ounce of grass (pure smoking material) per square foot of garden every six months.

In commercial grass, the seeds and stems actually make up more of the bulk weight than the useable marijuana.

The grass will be of several grades depending on when and what plant part you harvest. The rough breakdown might be 1/3 equal to Mexican regular, 1/3 considered real good smoke, and the rest prime quality. With good technique, the overall yield and the yield of prime quality can be increased several fold.

5.3 Sources

When sunlight is refracted by raindrops, the light is separated according to wavelengths with the characteristic colours forming a rainbow. Similarly, the white light of electric lights consists of all the colours of the

visible spectrum. Electric lights differ in the amount of light they generate in each of the colour bands. This gives them their characteristic colour tone or degree of whiteness.

Plants appear green because they absorb more light near the ends of the visible spectrum (red and blue) and reflect and transmit more light in the middle of the spectrum (green and yellow). The light energy absorbed is used to fuel photosynthesis. Almost any electric light will produce some growth, but for normal development the plants require a combination of red and blue light.

Sunlight has such a high intensity that it can saturate the plants in the blue and red bands, though most of the sun's energy is in the middle of the spectrum. Artificial lights operate at lower intensities; so the best lights for plant growth emit much of their light in the blue and red bands.

Fluorescent Tubes

Several lighting manufacturers make tubes (gro-tubes) that produce much of their light in the critical red and blue bands. (Plant-gro (GE), Gro-Lux (Sylvania), Agro-Lite (Westinghouse), and gro-lum (Norelco) are examples, and they look purple or pink. Vita-lite and Optima (Duro-test) produce a white light with a natural spectrum very similar to daylight. Duro-test tubes are more expensive than other tubes but they last twice as long. {See spectrum for "The action spectra of chlorosynthesis and photosynthesis compared to that of human vision. Adapted from IES Lighting Handbook237"}

Theoretically, these tubes should work better for growing plants than standard lighting tubes. However, some standard or regular fluorescent tubes used for lighting actually work better for growing plants than more expensive natural-spectrum tubes and gro-tubes specifically manufactured for plant growth. The reason is that regular fluorescent produce more light (lumens), and overall lumen output is more important for growth rate than a specific light spectrum. To compensate for their spectrums, use them in combinations of one "blue" fluorescent to each one or two "red" fluorescent (Box B).

Manufacturers use standardised names such as Daylight and Softwhite to designate a tube that has a certain degree of whiteness. Each name corresponds to a tube that emits light in a particular combination of colour bands. For example, Cool White emits more blue light than other colours and appears blue-white. By combining tubes that emit more blue light with tubes that emit more red light, the tubes complement each other and produce a more natural spectrum for healthy plant growth. More "red light" than "blue light" sources are needed to foster healthy growth, so use two red tubes to each blue tube.

The best combinations are either Warm White or Soft White (red) tubes used with either Cool White or Daylight (blue) tubes. These four tube types are common, much cheaper, and when used in combination, will give you a better return than any of the more expensive gro-tubes or natural-spectrum tubes. Any hardware store carries these common lighting tubes, and the cost may be less than a dollar each.

Do not use tubes with "deluxe" in their designation. They have a more natural spectrum but emit considerably less light. Preferably, buy "Cool White" since it emits 50 percent more light than "Cool White Deluxe."

Incandescents and Flood Lights

The common screw-in incandescent bulb produces light mainly in the longer wavelengths: far-red, red, orange, and yellow. Higher-wattage bulbs produce a broader spectrum of light than lower-wattage bulbs. Incandescents can be used alone to grow marijuana, but the plants will grow slowly and look scraggly and yellow. Incandescents combined with fluorescent work well, but fluorescent are a better source of red light. Fluorescent tubes generate slightly less heat per watt. With incandescents, heat is concentrated in the small bulb area, rather than the length of the tube, and can burn the plants. In addition, incandescents have less than one-third the efficiency of fluorescent in terms of electricity used. If you decide to use incandescents in combination with fluorescent, use two times the wattage of incandescents to blue source fluorescent, that is, two 40-watt Daylight tubes to about three 60-watt incandescents, evenly spacing the red and blue sources.

The common floodlight has a spectrum similar to but somewhat broader than incandescents. Because they cast their light in one direction and operate at higher intensities, these lights work better than incandescents, both as a single source and to supplement natural or fluorescent light. {Figure 33. Supplement natural light with floodlights. Use foil curtains for reflectors.}

The best application for floodlights and incandescents is to supplement natural and fluorescent light, especially when the plants get larger and during flowering. Incandescents and floodlights require no special fixtures, although reflectors increase the amount of light the plants receive. These lights are easy to hang or place around the sides of any light system, and their strong red band promotes more growth and good flower development. Some of their energy is in the far-red band. Most purple gro-tubes and white fluorescent are deficient in this band, and addition of a few incandescents make them more effective. Agro-lite and W/S Gro-Lux emit adequate far-red light and need no addition of incandescents.

Several companies make screw-in spotlights specifically for plant growth. Two brand names are Duro-Test and Gro n'Sho. Although they are an improvement over incandescents as a single source, these lights don't perform nearly as well as fluorescent. A 150-watt bulb would grow one plant perhaps four feet tall. Two eight-foot fluorescent tubes (160 watts) will easily grow eight six-foot plants. For supplemental lighting, the incandescents and floodlight work as well and are cheaper.

HID Lamps. Metal Halide (MH) and Sodium-Vapour Lamps (HPS)

HID's (High-Intensity-Discharge) are the lamps of choice for serious indoor gardeners. HID lamps commonly illuminate streets, parking lots, and sports stadiums, and they emit very intense light and produce more light, more efficiently than fluorescent. All HID's require specific ballasts and fixtures to operate, so purchase complete systems (fixture, ballast,

reflector) along with the lamp. High Times and Sinsemilla Tips magazines (p. 332) feature numerous ads by retailers of horticultural HID systems. Contact the advertisers, and they'll send you brochures with enough information to make an informed choice.

Ordinary metal-halides (MH's and HP's) may emit dangerous UV and particle radiation if the bulb envelope breaks, cracks, or develops a small hole. Broken MH bulbs may continue to operate apparently normally, and exposure may cause serious eye or skin injury. Make sure to purchase MH bulbs designed with a safety feature (such as GE Sat-T-Gard or Sylvania Safeline) that causes the bulb to burn out immediately if the outer envelope ruptures. OR purchase fixtures that shield the bulb in protective tempered glass.

HID's come in many sizes, but generally, use only 400 and 1,000 watt sized lamps. The largest size (1,500 watts) is not recommended because of its relatively short bulb life. Sizes less than 400 watts do not return as much marijuana considering set-up costs and ease of operation. The only exceptions are certain "self-contained" mini-units of 150 and 175 watts (see 4.1). These mini-self-contained units have a horizontal fixture and built-in ballast, which is easy to set up. The horizontal fixture directs up to 45 percent more light to the plants than conventional, vertically positioned lamps with reflectors. The intense light encourages excellent growth and bud formation with modest electrical consumption. They are the best overall light system for small, personal gardens such as closet set-ups.

Position 400 watt HID lamps 18 to 30 inches above plant tops, and 1,000 watt lamps 30 to 42 inches above the tops. During flowering, flowers may "run" rather than form in compact buds if lamps are positioned too close to the plant tops, particularly when using HPS's.

Heat is the main problem with HID's, and the room must be well-ventilated. Use exhaust fans to draw heat out of the room. The fan doesn't need to be large, just active enough to create a strong, ventilating draft.

Light Balancers

Sophisticated gardeners use light balancers which employ a small motor to move reflectors and HID lamps held on tracks or mechanical arms slowly across a garden in either a linear or circular pattern {(see p. 88 Figure 38b)}. Light balancers save considerable power and bulb costs because they dramatically increase the effectively illuminated garden size, while using less than 24 watts per balancer. With the lights moving on a balancer, all of the garden becomes equally illuminated for modest running costs. Instead of adding another 1,000 watt HID, a light balancer increases the garden size without measurably increasing power consumption, an important consideration when electricity consumption or costs are of concern.

With multi-bulb HID gardens, use one MH to each HPS lamp on a light balancer, and hang the lamps about one foot closer to the plant tops than usual. MH's favour blue light, and HPS's produce more orange-red light. By combining the two, the spectrum is more balanced, and you'll get a better return of well-formed buds.

Low Cost HID Systems

By far, the most efficient and effective set-up for a modest artificial light garden is to use fluorescent lamps set on a long photoperiod for germination, growing seedlings or to raise clones; use another room,, or part of the room separated by a light-tight curtain or barrier, for flowering with (HPS) lamps in horizontal reflectors kept on a short photoperiod to induce and promote flowering.

For example, separate and average sized room into two growing areas by hanging an opaque curtain to block light between the two sections. In the smaller area, grow seedling or clones (see 18.5) for two to six weeks under fluorescent set on a constant light. In the larger section, keep HPS lamp(s) on a 12-hour light cycle for flowering. Move larger seedlings under the HPS lamp(s) for about 9 to 15 weeks to initiate and complete flowering. Meanwhile, start more seedling under fluorescent. It's easy to maintain both sections of the room be constantly replenishing either area with new plants. This setup is very productive for a modest investment in both costs and labour - no time or costly light and electricity is wasted on empty space, and you'll find yourself continuously harvesting mature buds.

{A no frills setup with an HID. Notice that the ballast is insulated from the floor with pieces of wood; the fixture is supported by rope and not the electric cord; plastic protects the floor; there is a timer, a reflector, and fan.}

{Figure 34 and 35 for light-output from two and four 40 watt white fluorescent and comparing effectiveness in footcandles.}

Using this setup, the initial long photoperiod and small area necessary for seedlings or clones is illuminated cheaply by fluorescent. Seedlings grow, and cuttings root, better under fluorescent than HPS's. The larger, more costly flowering section is kept under a short photoperiod of 12 hours of daily light and the strong red light is necessary for good flowering.

For example, the whole operation could draw less then 650 watts: 160 watts by four, four-foot fluorescent set on constant light to start the seedlings; one 400 watt HPS set on 12 hours daily light for flowering; two timers and a venting fan for automating the lights and controlling heat. It's possible to harvest four to six, fully mature crops each year, or continuously harvest. (See Mel Frank's new Marijuana Grower's Insider Guide by RED EYE PRESS for much more information on efficient, low cost, indoor systems and greenhouse gardening.)

5.4 Setting up the Garden

Under artificial light, marijuana grows from three to sic feet in three months, so the height of the light must be easy to adjust. Fixtures can be hung from the ceiling, shelves, walls, or from a simple frame constructed for the purpose. If you are hanging the lights from the walls or ceiling, screw hooks directly into a stud. Studs are located in every room corner and are spaced 16, 18 or 24 inches apart. Light can be supported from lathing using wingbolts, but plaster is too weak to hold a fixture unless a wooden strip held by several wingbolts is attached to the walls or ceiling first to distribute the pressure. Then hang the fixture from a hook in the strip. Closets have hooks and shelves or clothes rungs that are usually sturdy

enough to support the fixture. People have gardens under loft beds.

Chains are the easiest means of raising and lowering fixtures. Two chains can be suspended from a solid support from above, and attached to an "S" hook at each end of the fixture. Raise the fixture by inching the hooks to higher links on the chain. Or tie rope to the fixture, pass through an eye hook or pulley in the ceiling or frame, and tie-off at a hook or boat cleat anchored in the wall or frame.

You can also hang the lights permanently and lower plants on a shelf or plywood. The shelf could be suspended or lowered by supporting the shelf with progressively smaller block. This arrangement is often used in "growing factories" where plants are rotated to larger gardens and grow for only a few weeks in each space. One garden may have fluorescent for starting plants and another garden for maturing plants under HID's. With HID's and skylights, lowering the plants may be your best option. Use lightweight soil components or hydroponics rather than heavier soil, and the operation is easier.

If you plan to use six or more fluorescent, remove end sockets and ballasts from fixtures. Mount end sockets and tubes on a frame of one-by-twos or plywood. Space sockets so tubes cover the garden evenly (see Figure 37 and 38). This arrangement illuminates the garden more evenly and drastically reduces the suspended weight since ballasts make up most of a fixture's weight. Keep ballasts off floors and away from water. Mount the ballasts on a nearby wall or on a wooden box. Wet ballasts could actually explode, and at best, are electrically dangerous when wet.

Always buy fixtures with reflectors. For HID's, companies make their own reflectors, but the best reflectors are for horizontally positioned lights no matter which company. Horizontal reflectors focus much more useable light than either parabolic or cone reflectors. HPS's can work in any position, but MH lamps are made to work in either a horizontal or vertical position, and you must buy bulbs that correspond with the fixtures.

For fluorescents, you can make an overhead reflector from the cardboard cartons in which tubes and fixtures are packaged. Cut off the end flaps and form the cardboard into a "U". Face inner side with aluminium foil or paint them white. Leave enough space so the foil or cardboard does not contact end sockets. Staple or tape the reflector behind the tubes to the fixture or from to reflect light toward the plants.

Surround all garden with reflective surfaces, but not so tightly that air can't freely circulate. Even in window gardens, reflective sheets set adjacent to the plants make a marked difference in growth. When artificial lights are high, reflectors from the floor on up keep lower branches actively growing. Mylar, with its mirror-finish, is popular for facing walls. A flat white paint (super or decorator white) reflects better than glossy white or aluminium foil. Flat white has about three percent more reflecting capacity than aluminium foil, and reflects light more uniformly. The difference is slight, so use whatever means is most convenient. Paint walls that border the garden a flat white or cover them with aluminium, mylar, or white plasterboard. {Figure 36. Reflectors can be made from sturdy paper faced with aluminium foil. Make them with staples, tape, or tacks.

Figure 37.}

Natural-light gardens also benefit from reflectors. Make them out of cardboard painted white or faced with aluminium foil. Once the plants are past the seedling stage, surround them with reflectors; otherwise only one side of the plants will be fully illuminated.

Covering the floor with a plastic dropcloth (about \$1 at any hardware store) will protect your floor and your neighbour's ceiling from possible water damage.

Marijuana grows well in a dry atmosphere, but heated or air-conditioned homes are sometimes too dry during germination and early growth. Enclosing the garden in reflectors will contain some of the moisture and insure a healthy humidity. White sheet plastic is available to enclose open gardens. Do not completely enclose the garden. Leave some open spaces at the bottom, top and ends of the garden to allow air to circulate. Air circulation will become more important as the plants grow larger.

Don't rely on training your pets to stay out of the garden. The garden will attract them, and they can easily destroy young plants by chewing on leaves and stems. Soil is more natural to their instincts than the sidewalk or kitty litter. Protect the garden from pets and toddlers; surround it with white plastic or chicken wire. Large plants are more sturdy and animals can do them little harm. The jungle ambience and an occasional leaf are irresistible to most cats, and they'll spend hours in the garden.

5.5 Electricity

For most growers, the amount of electricity used is of little concern. A four-tube, regular-output, eight-foot fixture draws about 320 watts per hour or about the same as a colour TV. The cost increase to your electric bill will be about two to six dollars a month, depending on local rates.

Farmers who devote entire basements or attics to their gardens are sometime restricted by the amount of current they can draw. Older homes or apartments may have only one 15-ampere circuit but more often have two, for 30 amperes total. Newer homes have either 60 or 100 amperes available through four to six circuits. One 15-ampere circuit can safely accommodate three, two-tube VHO fixtures or six tubes for 1,290 watts, or 16 regular-output, eight-foot tubes for about 1,280 watts total. This allows for a 20 percent safety margin of circuit capacity, which is necessary considering heat loss, starting voltages, etc.

In kitchen and basements the circuits may be rated higher, at either 20 or 30 amperes. You can find out the amperage of the circuit by looking at the fuse rating on the face of the fuse. Determine what room or rooms each circuit is feeding by removing the fuse and seeing which outlets are not working. The wattage capacity of any circuit is found by multiplying volts times amps. Standard United States voltage is 110 to 120 volts.

Fluorescent light fixtures are sometimes sold unwired or without a line cord, and the job is left to you. Follow the diagram on the ballast which shows the wires marked by their colour. Simply attach the wires to the

sockets as diagrammed. New sockets have small holes which automatically make contact when the bare end of the wire is pushed into them. Older fixtures have sockets with conventional screw terminals.

Indoor gardens may have aluminium foil, chains, reflectors, and wet floors, all of which are good electrical conductors. Coupled with hanging lights, these conditions could lead to dangerous electrical shocks. Never touch a reflector, fixture, or ballast while watering or standing on a damp floor. Eliminate the chance of serious shocks altogether by turning off the lights whenever you work in the garden. An HID ballast on a damp floor is very dangerous. Raise HID ballasts on wood blocks off the floor.

Reduce the risk of dangerous shocks by using fixtures grounded to the power source. A fixture with a three-pronged plug connected to a three-wire outlet is grounded in a properly wired house. You can also ground a fixture by connecting a #12 or #14 gauge wire to any bare metal screw (not an electric terminal) on the fixture housing to the screw that holds the cover plate on the electrical outlet your using.

{With two prong outlets, connect an adaptor plug with a terminal (top left) or third wire (top right) from the plug to the screw that holds the cover plate. This converts two-wire outlets to three wire grounded systems when a three-wire electric cord is used, an important electrical safeguard which grounds the light system.}

Chapter Six SOIL AND CONTAINERS FOR IT

6.2 Pots and Other Containers

In its natural state, marijuana may grow an extensive root system - a fibrous network of fine, lateral roots that branch off a main, carrot-shaped tap root. In dry areas, the tap root can grow more than six feet deep in its search for water. In moist areas with fertile soil (such as in potting mixtures), the lateral roots are able to supply water and nutritive needs and the tap root remains small, often only three or four inches long on a seven-foot-tall mature plant.

The purpose of the growing medium is to provide adequate water and nutrients in addition to anchoring the roots, which hold the plant upright. By watering and fertilising as needed, you could grow a six-foot plant in a four-inch ((Pots are measured by diameter across the top.)) pot or in a three-foot layer of soil over your whole garden; but neither of these extreme procedures is very practical.

Most growers use containers that will hold between two and five gallons of soil. These are a good compromise in terms of weight, space, cost, and labour. They can be moved easily and hold an adequate reservoir of water and nutrients to support a large mature plant.

Some growers use a single large box or several long troughs that hold a six-to 12-inch layer of soil. These have the advantage of minimal restriction of roots and less frequent waterings, but they require more soil and make rotating or moving the plants impractical.

Determine the right size pot to use in your garden by the amount of light per square foot. For a moderately lighted garden (15 to 25 watts per square foot and most window gardens), use one- to three-gallon containers. For gardens with more light energy - over 25 watts per square foot or one-half day or more of sunlight - use three- to eight-gallon containers. The smallest pot we recommend for a full-grown plant is eight inches or one gallon. This is also a good size for starting plants to be transplanted after two months.

Practically any container that can withstand repeated waterings and has a top at least as wide as its base will do. Each pot must have several holes in the bottom to assure drainage. Growers use flower pots, institutional-sized cans and plastic buckets, baskets and small trash cans, milk crates and wooden boxes.

Plastic trash bags are sometimes used when other large containers can't be found. They must be handled carefully, since shifting the soil damages the fragile lateral roots. They are also more difficult to work with when transplanting. However, a roll of trash bags is an available and inexpensive substitute for other large containers. Plastic bags should be double or triple bagged. Small holes should be punched in the bottom to drain excess water. Use masking tape to patch any unwanted tears. The capacity of the bag should be no more than twice as many gallons as the amount of soil used. For example, with four gallons of soil, the bag should be of a five-gallon, but not more than eight-gallon size. Otherwise, it will not form a cylinder, and the bag will remain a shapeless mass.

Use as many pots as can fit in the lighted area to make the most efficient use of space. Many growers prefer to start the plants in smaller pots, transplanting into larger pots when the plants are larger. There are definite advantages to this method in terms of the yield in the garden, given its space and light energy. Seedlings and small plants take up much less space than they will at maturity, so they can be placed closer together. As the plants grow and begin to crowd each other, remove the less vigorous (to smoke, of course) and transplant the rest into larger pots. Start plants which will be transplanted later in four- to eight-inch flower pots, or one-quart to one-gallon tin cans or milk containers. Peat pots or planting pots are made of compressed plant fibre for the purpose of starting young plants. They are available at garden shops and come in several sizes. Use at least a four-inch pot so that the roots are not restricted in early growth. Peat pots are supposed to break down in the soil, but marijuana's delicate lateral roots may not be able to penetrate unless you score or break away the sides while transplanting. Wax paper cup (six to eight ounces), filled with a soil mixture, work as well as peat pots and are cheaper.

BOX C

Finding Large Containers

Use your ingenuity in finding large containers. Large clay flower pots do not work any better than the large metal and plastic containers discarded by restaurants and food stores. Various milk containers are good starting pots. Many garden shops sell used pots for a few cents each. Wholesalers sell

plastic pots by the carton at a discount. Large plastic pots and pails can sometimes be picked up inexpensively at flea markets or variety stores. Any vessel that holds an adequate amount of soil and does not disintegrate from repeated waterings is a satisfactory container.

6.3 Properties of Soil

The soil or growing medium serves as a source and reservoir for water, air, and nutrients, and to anchor the roots. Since marijuana grows extremely fast, it has higher water and nutritive needs than most plants grown indoors. The success of your garden depends on supplying the plant with a medium that meets its needs without creating toxic conditions in the process.

There is no such thing as the perfect soil for Cannabis. Each variety can grow within a range of soil conditions. For healthy, full, growth, marijuana prefers a medium with good drainage, high in available nutrients, and near a neutral pH (7.0). These conditions result from a complex set of physical, chemical and biological factors. We will refer to them simply as: (1) texture; (2) nutrients; (3) pH.

Most indoor growers prepare the growing medium using commercial potting mixes. These mixes are usually sterilised or pasteurised and have good general soil properties. Since they seldom list the contents, nutrients, or pH, do some simple test of your basic soil whether you buy or dig for it. Then you can adjust the soil to meet the basic requirements of the plant.

Texture

The texture of the medium determines its water-holding and draining properties. Marijuana must have a well-drained medium for healthy growth. Soils that hold too much water or hold it unevenly can drown the roots, leading to poor growth or death of the plant. In a well-drained soil the roots are in contact with air as well as water. Soils that have too much clay, or are overly rich in compost or other organic matter, tend to hold too much water and not enough air. This condition worsens in time. This is especially true of the soil in pots.

You can determine the texture of your soil from its appearance and feel. Dry soil should never cake or form crusts. Dry or slightly moist soil that feels light-weight, airy, or spongy when squeezed, and has a lot of fibrous material, will hold a lot of water. Mix it with materials which decrease its water-holding capacity, such as sand, perlite, or even kitty litter.

Wet soil should remain spongy or loose and never sticky. A wetted ball of soil should crumble or separate easily when poked.

Soil that feels heavy and looks dense with fine particulate matter, or is sandy or gritty, will benefit by being loosened and lightened with fibrous materials such as vermiculite, Jiffy Mix, or sometimes sphagnum moss.

Soil Conditioners to Improve Texture

Perlite (expanded sand or volcanic glass) is a practically weightless horticultural substitute for sand. Sand and perlite contribute no nutrients of their own and are near neutral in pH. They hold water, air, and nutrients from the medium on their irregular surfaces and are particularly good at aerating the soil.

Vermiculite (a micaceous material) and sphagnum moss contribute small amounts of their own nutrients and are near neutral in pH. They hold water, air, and nutrients in their fibre and improve the texture of sandy or fast-draining soils. Jiffy Mix, Ortho Mix, or similar mixes are made of ground vermiculite and sphagnum moss, and are fortified with a small amount of all the necessary nutrients. They are available at neutral pH, are good soil conditioners, and are also useful for germinating seeds.

Sphagnum and Peat Moss (certain fibrous plant matter) are sometimes used by growers to improve water holding and texture. Both work well in small amounts (10 to 15 percent of soil mixture). In excess, they tend to make the medium too acidic after a few months of watering. Use vermiculite or Jiffy Mix in preference to sphagnum or peat moss.

Nutrients

Nutrients are essential minerals necessary for plant growth. The major nutrients are nitrogen (N), phosphorus (P), and potassium (K), which correspond to the three numbers, in that order, that appear on fertiliser and manure packages, and that give the percentage of each nutrient in the mix (see section 9).

Marijuana prefers a medium that is high in nitrogen, and mid-range in phosphorus and potassium. Generally, the darker the soil, the more available nutrients it contains. Commercial soils usually contain a good balance of all nutrients and will support healthy growth for a month or two, even in smaller (one gallon) containers. Many growers prefer to enrich their soil by adding sterilised manures, composts, or humus. All of these provide a good balance of the three major nutrients. They also retain water in their fibre. In excess they cause drainage problems, make the medium too acidic, and attract insects and other pests. A good mixture is one part compost or manure to five to eight parts of soil medium. In large pots (four or five gallons), these mixtures might provide all the nutrients the plant will ever need. {Table 13.}

The many prepared organic and chemical fertilisers that can be mixed with the soil vary considerably in available nutrients and concentrations. Used in small amounts, they do not appreciably effect the soil texture. Many prepared fertilisers are deficient in one or more of the major nutrients (see Table 14). Mix them together so there is some of each nutrient, or use them with manures, which are complete (contain some of all three major nutrients). When adding fertilisers, remember that organic materials break down at different rates. It is better to use combinations which complement each other, such as poultry manure and cow manure, than to use either fertiliser alone. (See Table 22 in section 13 for a complete list of organic fertilisers.

Table 14 - Prepared Organic Fertilisers

Type of fertiliser	Percentage by weight of			Availability to Plant
	N	P2O5	K2O	
Blood meal	13	0	0	Rapid/medium
Bone meal	0.5	15	0	Medium/slow
Blood/bone meal	6	7	0	Medium/slow
Cottonseed meal	6	2	1	Slow/medium
Fish meal	8	2	0	Slow/medium
Hoof and bone meal	10	2	0	Slow
Rock phosphate	6	24	0	Slow
Wood ash	0	1.5	3-7	Rapid
Greensand	0	0	2-8	Medium/slow

Chemical fertilisers are made in about every conceivable combination and concentration. Pick one that is complete and where the first number (N) is at least equal if not higher than both P and K. For example, rose foods may be 12-12-12 or 20-20-20, and work very well for marijuana. Others are: Vigoro 18-4-5 and Ortho 12-6-6. The higher the number, the more concentrated the mix is, and consequently, the more nutrients are available.

Don't use fertilisers which come in pellets or capsules, or that are labelled "timed" or "slow release." They do not work as well indoors as do standard organic and chemical fertilisers. Chemical fertilisers seldom list the amount to mix per pot. You can get some idea by the instructions for application per square foot. Use that amount of each one-half cubic foot of soil mixture.

Many growers add no nutrients at this time but rely on watering with soluble fertilisers when they water. These fertilisers and their application are discussed in section 9.

pH

The pH is a convenient measure of the acidity or alkalinity of the soil medium. It is another way of expressing whether the soil is bitter (alkaline) or sour (acid). The pH is measured on a scale of 0 to 14, with 7.0 assigned neutral; below 7.0 is acid and above is alkaline.

You can think of the pH as a measure of the overall chemical charge of the medium. It affects whether nutrients dissolve to forms available to the plant or to forms the plant can't absorb, remaining locked in the soil medium.

Marijuana responds best to a neutral (7.0 pH) medium, although in a fertile, well-drained soil, it will grow well in a range of 6.0 to 8.5. The simplest way to check the pH is with a soil-test kit from a garden shop or nursery. Test kits are chemicals or treated papers - for example, litmus papers or Nitrazine tape - that change colour when mixed with a wet soil sample. The colour is then matched to a colour chart listing the corresponding pH. Nitrazine tape is available, inexpensively, in drug stores. Some meters measure pH, but these are expensive. Agricultural agents, agricultural schools, and local offices of Cooperative Extension will test a soil sample for pH and nutrient content. Occasionally, a garden-shop person will check

pH for you or will know the pH of the soils they sell.

Highly alkaline soils are characteristically poor soils that form cakes, crusts, and hardpan. Soil manufacturers don't use them, nor should they be dug for indoor gardens. Alkaline soils are treated with sulphur compounds (e.g., iron sulphate) to lower the pH.

We have never seen commercial soils that were too alkaline for healthy growth, but they are sometimes too acidic. The pH of acid soil is raised by adding lime (calcium-containing) compounds. Liming compounds come in many forms and grades. Some are hydrated lime, limestone, marl, or oyster shells, graded by their particle size or fineness. Use the finest grade available, since it will have more of a neutralising potential than a coarse grade. You need to use less and are more interested in immediate results than long-term soil improvement. For indoor gardens, use hydrated lime (available in any hardware store) or wood ashes to raise the pH. Hydrated lime is rated over 90 percent for its neutralising potential. Wood ashes will neutralise soil acids roughly one-half as well as hydrated lime. However, they also contain some nutrients (potassium, phosphorus, magnesium, and micronutrients) and are handy and free.

There is no exact formula we can give you for raising the pH. The pH does not have to be exact; it's an approximation. At low pH it takes less lime to raise the pH one point than it does when the pH is near neutral. Sandy soils need less lime to raise the pH one point than soils high in clay or organic matter. In general, add three cups of hydrated lime or six cups of fine wood ash to every bag (50 pounds or a cubic foot) of soil to raise the pH one point. For soils that test slightly acid (about 6.5), add two cups of lime or four cups of wood ash.

Soil that tested below 6.0 should be retested in about two weeks, after thoroughly mixing and wetting the soil. Repeat the application until the pH is in an acceptable range. Check the pH of plain water to see if it is influencing the tests. Distilled water is neutral, but tap water sometimes has minerals that can change the pH. Hard water is alkaline. Sulphurous water and highly chlorinated water are acidic.

If you have already added lime to a soil that now tests from 6.5 to 7.0, don't add more lime trying to reach exactly 7.0. Too much lime will interfere with nutrient uptake, notably of potassium, phosphorus, and magnesium.

General Soil Characteristics

The texture, pH, and available nutrients of the soil are all related. The most important single factor is texture (good drainage). When soil drains poorly, it creates anaerobic (without air) pockets in the soil. Bacteria or microbes that live without air will begin to multiply and displace beneficial microbes that need air to survive. The anaerobic microbes break down organic matter to a finer consistency, and release CO₂ and organic acids to the medium. Drainage worsens, the acids lower the pH, and nutrients, even though present, become unavailable to the plant.

The result can be a four-month-old marijuana plant that is only three inches

tall, especially if you use high concentrations of manures and composts, peat and sphagnum moss. If your soil lists manures or composts as additives, add no more than 10 percent of these on your own.

Drainage problems sometimes develop after several months of healthy growth. It is a good idea to add about 20 percent sand or perlite to even a well-drained soil. You can never add too much of these; they can only improve drainage. They dilute the nutritive value of the soil, but you can always water with soluble fertilisers.

Mixtures using many components in combination seem to work particularly well. This may be because, at a micro-level each component presents a slightly different set of physical, chemical and biological factors. What the plant can't take up at one point may be readily available at another.

6.4 Preparing Commercial Soils and Mixes

Garden soils (or loams) and potting mixes are actually two different groups of products, although they are frequently mislabelled. Some companies sell soil in large bags and a potting mixture in smaller bags, while labelling them the same. Soils and potting mixtures are usually manufactured locally, since transportation costs are prohibitive; so they differ in each area.

Texture and Nutrients

Soils and loams are usually topsoil blended with humus or compost for use as a top dressing in gardens, for planting large outdoor containers, or for the soil part of a potting mixture. They may have a tendency to compact under indoor conditions and will benefit from the addition of perlite or vermiculite. Soils and loams usually contain a good supply of nutrients and may support a full-grown plant in a large container. Commercial soils that are heavy generally work better than lightweight soils. Heavy soils usually contain topsoil, in which marijuana grows very well. Lightness indicates more fibrous content.

For example of possible soil mixtures, see Box D. pre?

BOX D Examples of Soil Mixtures* 1. 5 parts soil 2. 8 parts soil 2 parts perlite 3 parts sand 1 part cow manure 1/4 part 10-10-10 chemical fertiliser 3. 5 parts soil 4. 4 parts soil 2 parts perlite 1 part sand 2 parts humus 1 part vermiculite 1/2 part cottonseed meal 2 parts humus 1/2 part poultry manure 5. 3 parts soil 6. 6 parts soil 1 part perlite 2 parts perlite 1 part sand 2 parts vermiculite 2 parts Jiffy Mix 1/2 part poultry manure 1/2 part blood/bone meal 1/2 part cow manure 1/2 part wood ash 1 part wood ash
*Almost all fertilisers are acidic, and need to be neutralised by lime. For the above mixtures, or any similar ones, mix in one cup of lime for each five pounds of manure, cottonseed meal, or chemical fertiliser in order to adjust the pH.

Potting mixes are intended to support an average-size house plant in a relatively small pot. They are sometimes manufactured entirely from wood and bark fibre, composts, and soil conditioners. These mixes are made to hold a lot of water and slowly release nutrients over a period of time, which is what most house plants require. For marijuana, these mixes seldom contain

enough nutrients to support healthy growth for more than a couple of months. (Their N is usually low, P adequate, and K usually very high.) They work best when sand or perlite is added to improve drainage, and fertilisers are added to offset their low nutrient content.

The pH

Most commercial mixes and soils are between 6.0 and 7.0 in pH, a healthy range for marijuana. If you buy your soil, it will not be too alkaline for healthy growth, but it might be too acidic. You can minimise the chances of getting an acid soil by avoiding soils with "peat" or "sphagnum" in their names. Avoid soils that are prescribed for acid-loving plants such as African violets or azaleas, or for use in terrariums. With common sense, you can buy a soil, add two cups of lime to each large bag, and not have to worry about the pH. However, the surest procedure is to test the pH yourself.

Probably the best way to find the right soil for your garden is to ask long-term growers. They can relate their past experiences with various mixes and blends. Most long-term growers with whom we have talked have tried many of the mixes available in their areas. A reliable, enlightened nursery person or plant-shop operator may also be able to give you some advice.

6.5 Buying Soil Components

All the materials discussed here are available at farm and garden stores or nurseries. Many suburban supermarkets sell large bags of soil and humus. Always buy your materials in the largest units possible to reduce the cost.

Large bags of soil and humus come in either 50-pound bags or one- to four-cubic-foot bags. A 50-pound bag fills about six gallons. There are eight gallons to a cubic foot. Perlite is sold in four-cubic-foot bags (thirty-two gallons). Jiffy Mix and vermiculite are sold in four-cubic-foot bags and in 16 pound bags (about 18 gallons). Sand, perlite and vermiculite come in coarse, medium, and fine grades. All grades work well, but if you have a choice, choose coarse. Sand (not beach sand) is an excellent soil conditioner. The only disadvantage is its heavy weight. Buy sand from lumber yards or hardware stores where it is sold for cement work. It will cost from 1/50 to one-half the cost of garden or horticultural sand. Sand from piles at construction sites works very well.

Calculating the Amount of Soil

The maximum amount of soil mixture for any garden can be found by multiplying the capacity of the largest pot you plan to use by the number of pots that you can fit in the garden. In many cases, the actual amount of the mixture used will be somewhat less. Two illustrations follow.

1. A small garden with a two-tube, eight-foot fixture (160W). Using 20 watts per square foot for fast growth gives 160W divided by 20W/sq.ft. = eight sq.ft. The largest pot needed for this system is three gallons, but two gallons would work. You can fit about 10 three gallon pots in eight square feet; so $3 * 10 = 30$ gallons of soil mixture are needed (see Box E).

BOX E

Examples Showing How Much Soil Material to Buy to Fill a Known Number of Unit-Volume Containers

Example 1. For a garden eight square feet in size,
Buy Component Which amounts to

3 50-lb (6 gal. ea.) bags of soil 18 gallons
1 cubic foot of perlite 8 gallons
30 lbs of humus 3 gallons
10 lbs of chicken manure 2 gallons
TOTAL 31 gallons

Example 2. For a garden 24 square feet in size,
Buy Component Which amounts to

4 1-cu. ft. bags of soil 32 gallons
2 1-cu. ft. bags of perlite 16 gallons
1 1-cu. ft. bag of vermiculite 8 gallons
20 pounds of cow manure 3 gallons
 cottonseed meal 2 gallons
 wood ash 2 gallons
TOTAL 63 gallons

2. A large garden with two two-tube, eight-foot VHO fixtures (four times 215 watts or 860 total watts) illuminating a garden three by eight feet, or 24 square feet.

860 watts divided by 24 sq. ft. = about 36W/sq. ft.

The largest pot size for this system is about five gallons. About 16 five-gallon containers can fit in 24 square feet; so 16 * 5 = 80 gal. of mixture are needed. But you could start many more plants in smaller containers and transplant when they are root-bound. You do not use more soil by starting in smaller pots, since all soil is reused. In many cases, you actually use much less soil.

In this system you could start and fit about 40 plants in one-gallon pots in 24 square feet. When the plants begin to crowd each other, some are harvested, making room for the others, which are transplanted to larger pots. In practice, a high-energy system such as this one (36W/sq. ft.) will grow large plants whose size is limited mainly by the space available. Twelve large female plants are about the most you would want in the system during flowering and for final harvest. Sixty gallons of mixture is all that is needed for the seedlings and the mature crop. This is one-fourth less than the original estimate of 80 gallons, and you actually will harvest a lot more grass (see Box E).

Mixing and Potting

Mix your soil in a large basin, barrel, or bathtub. Individual pots are filled with mixtures by using a smaller container to measure out by part or volume.

Perlite, sand, and dry soil can give off clouds of dust. When mixing large amounts of these, wear a breathing mask or handkerchief over your nose and mouth.

To pot any of the mixtures, first cover any large drainage holes with a square of window screen or newspaper to prevent the mixture from running out. Place a layer of sand, perlite, or gravel about one inch deep to insure drainage. Fill the pots with soil mixture to within three-fourths of an inch from the top of the pot. If your mixture contains manures or composts, cover the last inch or two in each pot with the mixture minus the manure and compost. This will prevent flies, gnats, moulds, and other pests from being attracted to the garden. Press spongy soils firmly (not tightly) to allow for more soil in each pot; otherwise, after a period of watering, the soil will settle and the pot will no longer be full.

Some growers add a few brads or nails to each pot to supply the plant with iron, one of the necessary nutrients. Water the pots and allow them to stand for a day or two before planting. As the soil becomes evenly moist, beneficial bacteria begin to grow and nutrients start to dissolve. {Figure 40.}

6.6 Digging Soil

Most growers prefer to buy their soil, while some prefer to dig it. Marijuana cannot tolerate heavy clays, mucks, or soils that dry to crusts. Choose a soil from a healthy garden or field, or from an area that supports a lush growth of annual weeds.

Fields that support a good crop of alfalfa, corn or other grains will support a good crop of marijuana. Fields with beets, carrots, and sugar cane indicate a well-drained soil, with near neutral pH. Red clover, sweet clover, and bluegrass have soil requirements similar to those of marijuana. Garden soils are usually fertile and well-drained, but often need lime to counteract soil acidity.

Take the topsoil layer that starts about two inches below the surface debris. Good soil will look dark, feel moist, and smell clean and earthy. Use all of the topsoil layer that maintains its dark colour and is interlaced with roots. Your hands should be able to easily penetrate the underlying topsoil if the soil is in good condition. When the soil changes colour, or roots no longer appear, then you are past the fertile topsoil layer. Abundant worms, millipedes, and other small lifeforms are a good indication that the soil is healthy. A rich layer of topsoil collects by walls, fences, and hedges where leaves and debris collect and decay to a rich humus. Sift the soil to remove stones and root clods. Also, shake out the root clods, which are rich in nutrients.

Soil that is dug should be tested the same way as already prescribed. It should be adjusted with at least 30 percent sand or perlite (vermiculite for very sandy soils), since potting will affect the drainage of even well-drained soils. Never use manures or composts that are not completely degraded to a clean-smelling humus.

Soil that is dug must be sterilised to kill weed seeds, insect eggs, and

harmful moulds and fungi. Some chemical treatments (e.g. formaldehyde) are mixed with water and poured over the soil to sterilise it. Soil can be sterilised in a pressure cooker at 15 pounds pressure for 15 minutes, or by baking wet soil in a large pot at 200 degrees for 30 to 40 minutes. Be advised that baking soil will release some formidable odours.

6.7 Growing Methods

As we said before, there are probably as many growing methods as there are marijuana growers. These methods are personal preferences or adaptations to fit particular situations; one method is not necessarily better than any other. However, the value of a garden is often based on the amount of high-quality grass it yields. Since indoor gardens are limited in size, you want the plants to quickly fill the garden with lush growth in order to use the garden efficiently. Otherwise, for the first couple of months, the lights are shining on empty space.

Secondly, the possession of small quantities of marijuana will probably be decriminalised nationally within the next few years. Decriminalisation for personal possession will open the way for decriminalisation for cultivation for personal possession. But small quantities are more difficult to define for cultivation than for simple possession, which is done by weight. Several possible ways to limit the amount for cultivation have been raised: by the number of plants, by the area cultivated, or by the number of plants at a particular stage of development. The outcome may determine whether you try to grow the largest plants possible or the most plants possible in a given area.

There are several ways to increase your garden's yield.

1. Pinch or cut back the growing shoots when the plants are young. This forces each plant to develop several strong growing shoots and generally yield large robust plants.
2. Plant a number of plant in each pot.
3. Start many plants in small pots and transplant the best plants to larger pots when the plants crowd each other.
4. Use different light systems to grow plants at different growth stages.

Here are some examples of how to carry out each of these four methods.

1. Fill the growing area with large containers (about five gallons each). Start several plants in each pot but thin the seedlings over a period of six weeks to two months, until one plant is left in each pot. During the fourth or fifth week of growth, pinch back the plants to about equal heights. Cut the growing shoot at about the fourth internode. Each plant will develop a sturdy stem which will support four to eight growing stems and will quickly fill any empty space in the garden. The whole garden is the treated like a hedge. After another month or two, you cut back the growing shoots again to have plants of equal heights. Remove the male plants as soon as they begin to release pollen (or before any male flowers open for sinsemilla). This will leave more space and light for the females to develop. By the time females flower, they've been cut

back two or three times or more, and form a dense growth of growing shoots that fill the garden with a cubic layer of flowers. Some growers maintain the plants for up to a year before the final harvest.

{Figure 41. Plant clipped at fourth internode.}

2. This method also requires large pots. Instead of thinning the seedlings to leave one per pot, leave at least three. After a few months of growth, remove any plants that lag far behind or any plants that show male flowers. The value of this method is that the odds are at least seven to one that any pot will have at least one female plant.

Most of the plants you'll grow will fill out with branches by four months at the latest. Often the branches develop young seedlings. The plants may begin to look like small Christmas trees by the second to third months of growth.

Generally, you don't want to have more than three or four plants in a five-gallon container, because growth will be limited by competition for light and space.

{Figure 42. Basement growing factory in Atlanta.}

Some varieties never do fill out. The branches remain small, only two to three inches long, and yield very little grass. We've seen plants like this grown from grass from Vietnam, Thailand, Afghanistan, and Africa. These plants are also quite short, being four to six feet tall fully grown. With varieties like this, it is better not to pinch tops, and to start about six plants per square foot of garden space. At harvest, the garden will be crowded with top stems that are laden with flower clusters.

Of course, you don't know what varieties will look like until you've seen them grow. For most varieties, each plant will need at least one square foot of space at maturity. It is much less common to find varieties that naturally grow small or especially thin, and, therefore, are those of which you would want to plant more than a few per large pot.

3. Another popular way to grow is to start plants in a large number of small pots. As the plants crowd each other, some are removed and the rest transplanted to larger pots.

4. To get the most for your investment requires conservation of light and soil. When the plants are young, a large number fit into a small place. Some growers take advantage of this fact by having several light systems, each with plants at different growth stages. The plants are rotated into larger gardens and pots. This method conserves space, materials, and electricity, and yields a harvest every two months. Using this method, "growing factories" turn out a steady supply of potent grass. {Table 15.}

Chapter Seven

MAINTAINING THE CORRECT ENVIRONMENT

7.2 Requirements for Germination

Before the seed fell, almost all of its water was sapped to prepare the seed for winter. With only the tiny drop that it holds, the embryo lives a life so slow as to be outside of time as we know it. Cannabis seeds need only water to germinate or sprout. The seeds germinate without light and at temperatures low enough to form ice. Higher temperatures hasten germination. Fresh, homegrown Oaxacan seeds germinated in three days at 70F and in eight days at 33F. Temperatures 70 to 90F are best for germination.

Fresh, mature seeds have a high rate of germination (about 90 to 100 percent) and sprout quickly. Usually sprouts appear three to seven days after planting. Older seeds (over a year, depending on storage) have a lower rate of germination and respond slower. They may take up to three weeks to sprout. To get an idea of what to expect from the seeds follow the procedure in 3.1.

Seeds that do sprout will grow normally, no matter how old they are or how long they take to sprout. From any batch of seeds, most of the ones that sprout will do so within two or three days of each other. A few will continue to come up as many as six months later, but the garden should consist of plants that are basically the same age and size. This makes the garden easier to care for.

Choosing Seeds

Different varieties grow at different rates and attain different sizes and shapes. Under artificial lights, gardens plants from one batch of grass require the least attention, because the plants sprout and grow uniformly and can all be tended at the same time. When several varieties are grown together, some plants are taller than others; you must adjust the height of the plants to keep the marijuana equally illuminated. You may also have to water and fertilise the plants on an individual basis. Some growers start at different varieties under separate light systems. On the other hand, planting several varieties offers you a comparison in potency and yield, and a source for hybrids if you want to develop seed. The next time you plant you'll know which seeds gave the best results and what growing methods will work best for you. {Figure 43. Within each seed lies an embryo.}

There is no strict correlation between the form and height of the plants and seed size, colour, or pattern. However, some large-seeded varieties grow too tall, with long spaces between leaves. Under artificial lights they yield more stems than leaves. If you have a choice between two equally potent grasses, and one has particularly large seeds (3/16 to 1/4 inch), choose the smaller-seeded variety.

Sowing

The easiest way to start the plants is to sow the seeds directly into the

soil. First, wet the soil with a moderate amount of water, enough to wet the soil with a moderate amount of water, enough to get the soil evenly moist without water running out the bottom. This takes about one-half quart of water for one-gallon containers, and about one quart for three-gallon containers. Plant the seeds a quarter- to half-inch deep. The germination rate is lower when they are planted deeper; and if seeds are planted less than one-quarter inch deep, the sprouts may have difficulty anchoring their roots. Plant about six seeds per pot to assure some sprouts in each pot. Gently press each seed into the soil. Cover the seeds with soil and sprinkle lightly with water. Each day, sprinkle or spray the surface with enough water to thoroughly wet the top half-inch of soil, since the seed must be kept moist for germination.

For most people, germinating the seed is easy. Problems with germination come from either too much or too little water. If you saturate the pots with water, and especially if you continue to saturate the pots after the seeds have sprouted, the seedlings may develop stem rot or root problems. When stem rot develops, the base turns brown, and the seedlings fall over, ending the garden. This can also happen if you keep seedlings in germination boxes or terrariums where the humidity is very high. When the humidity is low, the soil surface dries out quickly and the seeds won't germinate. Sprouts that may come up shrivel and dry at the base of the stem and die.

The key to germination is to keep the soil surface moist after first having moistened the whole pot; then, after the first sprouts have been up for a few days, let the surface of the soil dry between waterings. Don't spray the surface any more. Water with medium amounts of water when the soil in the top couple of inches feels dry. For small pots, water seedlings about twice a week. For larger pots, once each week or two may be enough.

Some growers prefer to plant only seeds they know will sprout, especially when planting seeds which have a low viability. Start the seeds in wet towels or a glass of water. Add one teaspoon of liquid bleach (a three-percent solution) to each cup of water. This will prevent fungus from attacking the seeds, which happens when they are soaked for more than three days. Check the seeds each day. Plant when the radical or roots begins to come out from the pointed end of the seed. Cannabis seed is quite small and has only enough stored food for the embryo to anchor its root and raise its cotyledons. The more developed the root is when planted, the less energy it has to anchor itself in the soil. The sprout may die or growth be delayed until the root is established (transplant shock). In Figure 44, the seeds in a circle are all ready to plant. The centre seed will not survive transplanting. {Figure 44. Seeds in a circle are ready to plant. Centre sprout will not survive planting

{**Centre sprout too large**}

Some growers prefer to start the plants in a germination box. This extra hassle is not necessary. Transplanting seedlings from one medium to another often causes transplant shock. It is best to plant the seeds directly into the soil.

If you use Soilless mixtures, your seedlings should be started in paper cups, peat pots, or other small pots filled with a soil mixture (see

Transplanting in Chapter 8 {8.3}). This procedure is also helpful if you have the difficulty starting the plants in large containers. Expandable peat pellets also work very well.

The position of the seed in the soil has a slight effect on germination. The root directs its growth in response to gravity, as shown in Figure 45. However, germination is a little faster when the seeds are planted with the pointed end up. The difference is small, and it's not really necessary to position the seeds in the soil.

If a dry atmosphere presents problems, you can create the moist atmosphere of a germination box and still plant directly in the pot. Cover the seeds with transparent plastic cups or glasses, or cover the pot with plastic kitchen wrap. This creates a greenhouse effect and keeps the soil surface moist without watering. Remove all the covers as soon as you see the first sprouts begin to appear; the sprouts will die if the cover is left on.

{Figure 45. The root directs its growth toward gravity. Seeds are germinated between glass and cotton, and held vertically. Four seeds to left have pointed and up. Two middle seeds are horizontal. Six seeds on right have pointed end down.} {Figure 46. During germination soil can be kept moist by using plastic covers to create a greenhouse effect.}

7.3 Light Cycle and Distance of Lights from Plants

The seed doesn't need light to germinate. The sprout does need light as soon as it breaks through the soil. Most growers turn the light on when they sow the seeds, though, to warm the soil and encourage germination. Lights may also dry the surface of the soil, especially in large pots or with VHO fixtures. If this is a problem during germination, leave the lights off until you see the first sprout breaking through the soil; or hang the lights about 18 inches above the soil, and lower them to six inches as soon as the sprouts appear.

It is important for normal development that the plants receive a regulated day/night cycle. We emphatically recommend that you use an automatic electric timer (about \$8). A timer makes gardening much easier, since you don't have to turn the lights on or off each day. The plants won't suffer from irregular hours or your weekend vacations. Set the timer so that the plants get about 16 to 18 hours of light a day, and leave it on this setting until the plants are well grown (three to six months) and you decide to trigger flowering.

During the seedling and vegetative stages of growth, the plants may be subjected to light during their night period. During flowering, however, the night period must be completely dark.

The plants grow more slowly with less than 16 hours of artificial light a day, and they may flower prematurely. Some growers leave the lights on up to 24 hours. A cycle longer than 18 hours, may increase the growth rate, especially if the plants are not saturated with light. A longer cycle is helpful in small gardens, such as under standard four-foot fixtures.

No matter what the light source, place the lights as close to the tops as possible without burning the plants. Pay no attention to the manufacturer's

instructions for the distance of the plants from the lights; these instructions don't apply to a high-energy plant such as Cannabis. With standard-wattage tubes, keep the lights from two to six inches above the plant tops. With VHO tubes, allow four to eight inches. Maintain the lights at these distances throughout the life of the garden. In most cases you will have to raise the lights once or twice a week as the plants grow.

Standard fluorescents don't get hot enough to burn the plants unless they are in direct contact with leaves for several hours. VHO tubes will burn leaves before they touch them. But you do want to keep the lights as close to the plants as possible. This encourages stocky, robust growth. Incandescents and floodlights get very hot; place them at a greater distance from the plants. Test the distance by feeling for heat with your hands. Place the bulb at the distance where you begin to feel its heat. For a 75-watt incandescent lamp, this is about eight inches.

7.4 Water

Water, the fluid of life, makes up more than 80 percent of the weight of the living plant. Within the cells, life processes take place in a water solution. Water also dissolves nutrients in the soil, and this solution is absorbed by the roots. About 99 percent of the water absorbed passes from the roots into the conduits (xylem) of the stem, where it is distributed to the leaves via the xylem of the leaf veins. Transpiration is the evaporation of water from the leaves. The flow of water from the soil, through the plant to the air, is called the transpiration stream. Less than one percent of the water absorbed is broken down to provide electrons (usually in the form of hydrogen) which, along with carbon dioxide, are used to form carbohydrates during photosynthesis. The rest of the water is transpired to the air.

Watering

Water provides hydrogen for plant growth, and also carries nutrients throughout the plant in the transpiration stream. However, it is not true that the more water given a plant, the faster it will grow. Certainly, if a plant is consistently under-watered, its growth rate slows. However, lack of water does not limit photosynthesis until the soil in the pot is dry and the plant is wilting.

The amount of water, and how often to water, varies with the size of the plants and pots, soil composition, and the temperature, humidity, and circulation of the air, to name a few variables. But watering is pretty much a matter of common sense.

During germination, keep the soil surface moist. But once the seedling are established, let the top layer of soil dry out before watering again. This will eliminate any chance of stem rot. Water around the stems rather than on them. Seedlings are likely to fall over if watered roughly; use a hand sprinkler.

In general, when the soil about two inches deep feels dry, water so that the soil is evenly moist but not so much that water runs out the drainage holes and carries away the soil's nutrients. After a few trials, you will know approximately how much water the pots can hold. Marijuana cannot tolerate a

soggy or saturated soil. Plants grown in constantly wet soil are slower-growing, usually less potent, and prone to attack from stem rot.

Over-watering as a common problem; it develops from consistently watering too often. When the plants are small, they transpire much less water. Seedlings in large pots need to be watered much less often than when the plants are large or are in small pots. A large pot that was saturated during germination may hold enough water for the first three weeks of growth. On the other hand, a six-foot plant in a six-inch pot may have to be watered every day. Always water enough to moisten all the soil. Don't just wet the surface layer.

Under-watering is less of a problem, since it is easily recognised. When the soil becomes too dry, the plant wilts. Plant cells are kept rigid by the pressure of their cell contents, which are mostly water. With the water gone, they collapse. First the bottom leaves droop, and the condition quickly works its way up the plant until the top lops over. If this happens, water immediately. Recovery is so fast, you can follow the movement of water up the stem as it fills and brings turgor to the leaves. A plant may survive a wilted condition of several days, but at the very least some leaves will drop.

Don't keep the pots constantly wet, and don't wait until the plant wilts. Let the soil go through a wet and dry cycle, which will aerate the soil and aid nutrient uptake. Most growers find that they need to water about once or twice a week.

When some soils get particularly dry, the water is not absorbed and runs down the sides and out the bottom of the pot. This may be a problem the first time you water the soil, or if you allow the soil to get very dry. To remedy, add a couple of drops of liquid detergent to a gallon of water. Detergent acts as a wetting agent and the water is absorbed more readily. First water each pot with about one cup of the solution. Allow the pots to stand for 15 minutes, then finish watering with the usual amount of pure water.

Use tepid water; it soaks into the soil more easily and will not shock the roots. Try to water during the plant's morning hours. Water from the top of the pot. If you do want to water from the bottom with trays (not recommended), place a layer of pebbles or gravel in the trays to insure drainage. Don't leave the pots sitting in water until the pot is heavily saturated. The water displaces the soil's oxygen, and the plants grow poorly.

Tap water in some areas highly chlorinated, which does not seem to harm Cannabis; and many fine crops are raised with water straight from the tap. But chlorine could possibly affect the plants indirectly, by killing some beneficial micro-organisms in the soil. Chlorine also makes the water slightly acidic. However, neither effect is likely to be serious. Some growers have asked whether they should use pet-shop preparations that are sold to remove chlorine from water in fish tanks. These preparations generally add sodium, which removes the chlorine by forming sodium chloride (table salt). This solution does not harm the plants, although repeated use may make the soil too saline. Probably the best procedure is to simply allow

the water to sit in an open container for a few days. The chlorine is introduced to water as the gas Cl_2 , which dissipates to the air. The water temperature also reaches a comfortable level for the plants.

Hard (alkaline) water contains a number of minerals (e.g., Ca^{++} , Mg^{++} , K^+) which are essentially nutrients to the plants. Water softeners remove these minerals by replacing them with sodium, which forms slightly salty water. It is much better to water with hard water, because artificially softened water may prove harmful after some time. Occasionally, water may be acidic (sulphurous). Counteract this by mixing one teaspoon of hydrated lime per quart water and watering with the solution once a month.

Water and Potency

We've seen no studies that have evaluated potency in relation to water. A few studies have mentioned the fact that plants that received less water were slightly more potent. Water stress has been practiced by several marijuana-growing cultures. In parts of India, watering is kept to a minimum during flowering.

To limit watering, water with the usual amounts but as infrequently as possible. To encourage good growth, yet keep watering to a minimum, wait until the plants are a few months old before you curtail watering. Give the plants their normal water and note the number of days before they begin to wilt. As the plants get larger, the water needs increase, but this generally stabilises by the time of flowering.

7.5 Air

The properties of the air seldom present any problems for indoor gardeners. The plants grow well under the ordinary conditions that are found in most homes and can withstand extremes that are rarely found indoors. The plants can survive, in fact thrive, in an atmosphere many house plants can't tolerate. For plant growth, the most important properties of the air are temperature, humidity, and composition.

Temperature and Growth Rate

Temperature control should be no problem. The plants can withstand temperatures from freezing to over 100F. Plant growth is closely related to temperature. Marijuana varieties are, in general adapted to warm if not hot climates. Different varieties will reach their maximum rate of photosynthesis at different temperatures. For almost all marijuana varieties, the rate of photosynthesis will increase sharply with increases in temperatures up to about 70F. Some strains reach their peak rate of growth at about 75F. Others, especially from areas near the equator, such as Colombia, may not reach their peak rate until the temperature is about 90F. However, for all varieties, increases in the growth rate will be slight with increased temperatures over 75F. The average temperature for maximum is about 75 to 80F. In other words, normal household temperatures are fine for growing marijuana and no special temperature control is necessary for most gardens.

Don't set up the garden right next to, or in contact with, a heat source

such as a radiator or furnace. If the garden is nearby, the plants should do quite well. The plants are most susceptible to cool temperatures during germination and the first few weeks of growth. In basement gardens, the floor temperature is often lower than the air. It is a good idea to raise the pots off the floor with pallets or boxes. The seeds will germinate quicker, and the plants will get off to a faster start.

If heating is necessary, propane catalytic heaters work well, are safe and clean, and increase the carbon-dioxide content of the air. Electric and natural gas heaters also work well. Do not use kerosene or gasoline heaters. They do not burn cleanly, and the pollutants they produce may harm the plants. Any heater that burns a fuel must be clean and in good working order. Otherwise, it may release carbon monoxide, which is more dangerous to you than to the plants.

Temperature and Potency

Since marijuana varieties are most often grown in semi-tropical and tropical areas, the idea that high temperatures are necessary for potent marijuana is firmly entrenched in marijuana lore. This myth, like many others, is slowly disappearing as marijuana farmers and researchers accumulate more experience and knowledge. There are only a few published papers on the effects of temperature on potency. The best study we've seen ¹⁹ grew four different varieties in a controlled environment under artificial lights on a 15-hour day-length. Two temperature regimes were used: a "warm" regime, with temperatures of about 73F during the day and 61F at night (about average for most homes); and a "hot" regime, set at 90F daytime and 73F at night. In all four varieties, the concentration of THC and of total cannabinoids was higher under the "warm" regime. For instance, a Nepalese strain was 3.4 times higher in concentration of total cannabinoids, and 4.4 times higher in THC, when grown under the "warm" regime than the same strain grown under the hot regime. Although we agree with the findings in principle, these figures are higher than our experience tells us.

Interpretation of the data does show one point clearly. In all four varieties, the amount of THC lost as CBN was higher under the "hot" regime (see Table 16 - currently excluded from this guide), even though the concentration of THC was higher under the "warm" regime.

Another research group in France has looked at the relationship of potency to temperature. The most recent paper ⁷⁹ compared four temperature regimes, given in descending order of potencies found: 75F day, 75F night (highest potency); 72F day, 54F night; 81F day, 81F night; and 90F day, 54F night (lowest concentration of THC). In each, the day period was 16 hours and the night period eight hours.

Interestingly, this same research group in an earlier paper ²⁰ reported that the concentration of THC was higher for male plants grown at 90-72F than for those grown at 72-54F. For the female plants, the differences in THC concentration were small. The variety used was a propyl variety (type IV) containing about half as much THCV as THC. For both the male and female plants, the concentration of THCV were high under the 90-72F regime.

The simplest interpretation of all these results is that mild temperatures

seem to be optimum for potency. Temperatures over 90F or below 60F seem to decrease the concentration of THC and total cannabinoids. Also, at higher temperatures, much more THC will be lost as CBN. And last, propyl varieties may produce less THCV under a cool regime. Bear in mind that none of these papers accounted for all of the many variables that could have affected the findings. For instance, the concentration of THC was 18 times higher at 75-75F than at 90-54F. We've never seen differences of this magnitude, and sampling error undoubtedly influenced the findings.

In terms of growth rate and potency, daily temperatures of about 75F, give or take a few degrees, are roughly optimum. Normal household temperatures are in the low 70's during daytime and the low 60's at night. The heat from a light system will raise the garden's temperature a few degrees. In most gardens temperatures will be near 75F during the day. Night-time temperatures drop about 10 to 15 degrees. When night-time temperatures drop into the 50's or below, set the light cycle to turn on during the early morning, when the temperature will be lowest. In a small room, the light system will generate enough heat to warm the garden without any need for a heater. Whenever you wish to raise the temperature by, say, five or 10 degrees, it is better to add more lights than a heater. The plants will benefit from the additional light, as well as from the heat they generate. And an electric heater, watt for watt, doesn't generate much more heat than a lamp and its fixture.

Composition of the Air

Air provides two essential ingredients for the living plant: oxygen and carbon dioxide. The plant uses oxygen for respiration in the same way we do. The oxygen is used to burn carbohydrates (CH_2O) and other food, yielding energy (ATP; see section 4) for the organism, and releasing carbon dioxide and water into the environment.

During photosynthesis, CO_2 is used to form carbohydrates. As part of photosynthesis, light energy is used to split water molecules, releasing oxygen into the environment. In plants, the net result from respiration and photosynthesis is that much more oxygen is released than consumed, and more carbon dioxide is consumed than released. The oxygen in the Earth's atmosphere is formed by photosynthetic organisms.

The similarity between plant and animal respiration ends at a cellular level. Plants don't have lungs to move the air. The passage of gases, whether oxygen or carbon dioxide, is primarily a passive process. The gases diffuse through microscopic pores called stomata, found in Cannabis on the undersides of the leaves. The plants can open and close their stomata, allowing moderate control of the flow of air. However, for good exchange of gases, the plants require adequate ventilation for air circulation.
{Cannabis is a C3 plant}

Cannabis is not particularly susceptible to a stuffy or stagnant atmosphere. A garden in the corner of a room that is open to the house will be adequately ventilated. Ventilation is not a problem unless the garden is large and fills a quarter or more of the space in a room. Gardens in small, confined spaces such as closets, must be opened daily, preferably for the duration of the light period. Plants growing in a closed closet may do quite

well for the first month, but they'll need the door opened as the plants begin to fill the space. The larger the plants get, the greater the need for freely circulating air.

When the weather is mild, an open, but screened, window is the best solution for ventilation. In large indoor gardens where there isn't much air circulation, a small fan is helpful. After germination, make spaces in the surrounding reflectors to allow air to circulate freely. Leave the spaces at the bottom, ends, and the tops of the garden. The higher the temperature or the humidity, the more the plants need good ventilation.

CO2

CO₂ is a natural, non-poisonous gas present in the atmosphere, which plants absorb and use during photosynthesis to synthesise sugars and organic compounds for energy and growth. Plants can effectively use CO₂ up to about .15 percent concentration, about five times the concentration (.03) naturally present in the atmosphere. Increasing the CO₂ dramatically increases the growth rate, often up to twice the rate of growth in plants in a natural atmosphere. Supplemental CO₂ systems are an inexpensive way serious gardeners dramatically increase a garden's yield. {And decrease fire risk.} {Picture Common emitter systems are safe, inexpensive, easy to setup, and may double the rate of growth in a garden.}

There are two good ways to increase the concentration of CO₂. Greenhouse growers use CO₂ generators which produce CO₂ by burning a clean-burning fuel such as propane or butane. The problems with CO₂ generators are that they require a fuel, operate with an open flame, and produce a lot of heat. These are not necessarily problems if the grow room needs to be heated, and if the room is constantly monitored.

For home-growers, the emitter system is more efficient, relatively cheap, safe, and easy to use. Many suppliers who advertise in High Times and Sinsemilla Tips offer complete emitter systems that come with a regulator, solenoid valve, flow-meter, timer, (sometimes distribution tubing), and detailed, yet simple instructions. You must rent compressed CO₂ gas tanks from a local compressed gas supplier or beverage company. The setup is not complicated or expensive, and a walk through the Yellow Pages should show several suppliers.

Since the CO₂ in the atmosphere is about .03 percent, and the maximum CO₂ concentration that your plants use is about .15 to .2 percent, set your emitter system to regulate a concentration of .12 to .17 percent CO₂ in the room. Don't worry if you don't understand. All systems are easy to install and come with easily understood instructions.

7.6 Humidity

Marijuana flourishes through a wide range of relative humidity. It can grow in an atmosphere as dry as a desert or as moist as a jungle. Under ordinary household conditions, the humidity will rarely be too extreme for healthy growth. The effects of the humidity on plant growth are closely tied to temperature, wind speed, and the moisture of the soil.

The relative humidity affects the rate of the plant's transpiration. With high humidity, water evaporates from the leaves more slowly; transpiration slows, and growth slows also. With low humidity, water evaporates rapidly; the plant may not be able to absorb water fast enough to maintain an equilibrium and will protect itself from dehydration by closing its stomata. This slows the transpiration rate and growth also slows. There is a noticeable slowing of growth because of humidity only when the humidity stays at an extreme (less than 20 percent or over 90 percent).

Cannabis seems to respond best through a range of 40 to 80 percent relative humidity. You should protect the plants from the direct outflow of a heater or air conditioner, both of which give off very dry air. During the first few weeks of growth, the plants are especially susceptible to a dry atmosphere. If this is a problem, loosely enclose the garden with aluminum foil, white sheet plastic, or other materials. This will trap some of the transpired moisture and raise the humidity in the garden. Once the seedlings are growing well, the drier household atmosphere is preferred.

Where the humidity is consistently over 80 percent, the plants may develop stem rot or grow more slowly. Good air circulation from open windows or a small fan is the best solution.

As long as the air is freely circulating, the plants will grow well at higher humidities. Dehumidifiers are expensive (over \$100) and an extravagance.

Humidity and Potency

As far as we know, there has been little work done correlating the relative humidity with potency. In the two related cases we've seen, 85, 117 neither study was intended to examine the effects of relative humidity and potency. However, a lower humidity (50 to 70 percent) produced slightly more potent plants than a higher relative humidity (80 percent and over).

A dry atmosphere seems to produce more potent plants. When the humidity is about 50 percent or less, plant development is more compact, and the leaves have thinner blades. When the atmosphere is humid, growth is taller and the leaves luxuriant with wider blades. The advantage to the plant is that wider blades have more surface and hence can transpire more water. The converse is that thinner blades help conserve water. Higher potency may simply be due to less leaf tissue for a given amount of cannabinoids and resin glands.

The temperature also influences the form and size of the leaves. At higher temperatures, the leaves grow closer together; under a cool regime, the leaves are larger, have wider blades, and are spaced farther apart 77. Possibly, cool temperatures yield slightly lower potency for much the same reason that a moist atmosphere does.

However, differences in potency caused by any of the growth factors (light nutrients, water, temperature, humidity, etc.) are small compared to differences caused by the variety (heredity) and full maturation (expression of heredity). For example, the humidity in Jamaica, Colombia, Thailand, and many other countries associated with fine marijuana is relatively high and averages about 80 percent.

However, try to keep the atmosphere dry. The atmosphere in heated or air-conditioned homes is already dry (usually 15 to 40 percent). For this reason, many growers sow so that the plants mature during the winter if the home is heated or in mid-summer if it is air-conditioned. As we mentioned, there should be no need to use dehumidifiers. Good air circulation and raising the temperature to 75 to 80F are the simplest means of dealing with high humidity.

Chapter Eight GARDENING TECHNIQUES

8.2 Thinning

Depending on the viability of the seeds, there should be several plants growing in each pot. Most growers thin to one plant per pot, but the plants don't have to be thinned until they crowd each other and have filled the garden with foliage. The longer you let them grow, the more potent they'll be.

It is virtually impossible to tell the gender of the plants when they are young. The normal ratio of males to females in Cannabis is one to one. Some farmers end up with more male plants because of their thinning practices. When the plants are less than a month old, the male plants often appear taller and better developed than the females. The male seedling uses more of its energy to develop its aboveground parts than the female. The female devotes more energy to establishing a strong root system. During the first few weeks, don't thin the plants by leaving only the tallest, or you'll wind up with a higher ratio of males. Try to leave seedlings that are healthy and vigorous and that are roughly at the same point of development.

To thin your garden, remove any plants with yellow, white, or distorted leaves. Remove the less vigorous and those that lag far behind in development. Cut the unwanted plants near the base; the root system can remain in the pot.

These harvested seedlings will be your first taste of homegrown grass. Usually they produce a mild buzz, but if you separate the growing tips from the large leaves, they may be more potent.

8.3 Transplanting

However you transplant, try to disturb and expose the roots as little as possible. If you transplant carefully, the plants will not exhibit delayed or slowed growth due to transplant shock.

Transplanting Seedlings

When the plants are a week to two weeks old, transplant to any pot that has no plants. First, moisten the soil in the pot from which you will remove the transplant and let it sit for a few minutes. Take a spade or a large spoon, and insert it between the transplant and the plant that will be left to

grow. Try to leave at least one inch of space from spoon to stem. Lever the spoon toward the side of the pot, in order to take up a good-size wedge of soil. Place the transplant in a prepared hole at the same depth that it was growing before. Replace the soil in both pots and moisten lightly again to bond the new soil with the original. If you are careful, a wedge of soil can be removed intact. The root system will not be disturbed and the plant will survive with little or no transplant shock. Do not fertilise a transplant for two weeks.

To prevent possible drop-off and wilting from shock, you may want to use Rootone or Transplantone. These safe powders, available at nurseries, contain root-growth hormones and fungicides. They won't be necessary if you transplant carefully.

Transplanting to Large Pots

Transplanting from smaller to larger pots is a simple procedure. The marijuana root system quickly fills small pots. To transplant, moisten the soil and let it sit to become evenly moist. Pick the potted plant up, and, while holding the base of the stem, rap the pot sharply against something solid. You might cover the soil surface with a piece of newspaper or aluminium foil, which makes the job cleaner. When it is done at the right time, the root system, with all the soil adhering, will pop out of the pot intact.

An approximate time guide for transplanting is shown in Table 17 (currently excluded from this guide). At these times, give or take a week, the plants should be root-bound and all the soil will adhere to the roots, making the transplanting clean and easy.

If the root system has not filled the pots by this time, wait a few weeks and the process will be easier. If the root system comes out in a small ball and much of the soil is empty of roots, then soil conditions are poor (usually poor drainage and over-watering) or you are transplanting much too soon.

If the root system doesn't easily pop out, run a knife around the sides of the pot. Sometimes the roots stick to the sides, particularly in paper and clay containers. Check to see if the drainage holes are plugged. Plugged holes stop air from displacing the soil, and the vacuum pressure prevents the soil from sliding out of the pot.

Table 17
Guide for Transplanting

Transplant	During
Six-ounce cups	Second to third week
Four-inch pots	Third to fourth week
Six-inch pots (half gallon)	Fourth to fifth week
Eight-inch pots (one gallon)	Seventh to eighth week
Two-gallon containers	About the tenth week

Transplant into a soil mixture that is the same as (or is very like) the one in the original pots. Otherwise, the soils may have different osmotic

properties, and the water may not disperse evenly. (This doesn't apply to small pots that are used for germination and are filled with vermiculture, Jiffy Mix, or other mediums.) Don't bury the stem. Keep the stem base at the same depth that it was growing. {Figure 47. Transplant when the plant is root-bound.}

Transplanting in Plastic Bags

To transplant plants that are in plastic bags, place the old bag into the larger-size bag. Put some soil mixture underneath, to bring the base of the stem to where the new soil surface will be. Cut the old plastic bag away and fill the side spaces with soil mixture. Two people make the job easier.

8.4 Supports for Plants

Under natural conditions, stems undergo stress from wind, rain, and animals. These stresses, which indoor plants do not ordinarily face, strengthen the stem. Indoor stems grow sturdy enough to support their own weight and not much more. Plant energy is used to produce more light-gathering leaf tissue, rather than wind-resistant stem tissue. Stems remain slender, usually about one-half to three-quarter inches at maturity. Since you are growing the plants for their leaves and flowers, this does not present a problem.

Healthy plants do not ordinarily need support. If many of your plants have weak or spindly stems, there is a deficiency in either light or nutrients (notably potassium). Simply not having enough light will cause the plants to elongate, with sparse foliage and weak growth. Too much red light will cause elongation, too, so make sure you include a strong blue light, if you are using incandescents or floodlights.

Hanging the lights higher than the recommended distances will cause the plants to elongate by rapidly growing up to the lights. Unlike sunlight, the intensity of artificial light diminishes dramatically with the distance from the lights. The plants respond by growing toward the light, seeking the higher intensity.

Under artificial light, some plants may need support during the seedling stage or because of accident. Depending on plant size, use straws, pencils, dowels, or standard plant stakes such as cane sticks. Set them in the soil and affix the stem with string, masking tape, or wire twists such as those that come with plastic trash bags. Do not tie string or wire tightly around the stem; make a loose loop. The stem will grow in girth and can be injured by a tight loop.

Probably the simplest method of support is to take a rigid piece of wire, form a "C" at one end and bend it to a right angle to the stem. Set the straight end in the soil and place the stem inside the "C." Pipe cleaners are ideal for seedlings. With larger plants, straighten a coat hanger and use the same method.

A common practice in greenhouses where tree seedlings are raised is to shake each plant once or twice daily. This practice simulates natural vibrations from the wind, and the plant reacts by increasing the growth around the stem. The stem grows thicker and stronger, and the tree can better fend once

it is transplanted. It works the same way with marijuana. A fan blowing on the plants will also work. These practices are useful if you plan to move your plants outdoors. Otherwise, healthy indoor plants that will remain indoors need no special stem strengthening.

8.5 Uniform Growth

The light intensity from artificial lights drops dramatically as the distance from the light source increases. When the plants are not of equal height, the shorter ones receive less light and consequently grow slower than the taller ones. This compounds the situation and, left to themselves, the shorter plants will stop growing and eventually die from lack of light.

It is important to keep all of the plants close to the lights. {Figure 48. Hang the fixture at an angle corresponding to that of the tops of the plants.} This encourages stocky, full growth and can make the difference between harvesting stems and harvesting smoking material.

One way to deal with uneven height is to line the plants up to the line of the plant tops. As the plants grow, move them to different spots in the garden to accommodate their different sizes. Or raise the shorter plants up to the lights by placing them on milk crates, tin cans, bricks, etc.

The quality and quantity of light emitted by a fluorescent is strongest in the middle and weaker toward the ends of the tube. Female plants require more light than males. Once the genders of the plants become clear, move the males to the ends of the system, thus leaving the stronger middle light for the females.

8.6 Pruning

Probably the easiest way to deal with uneven growth is to cut back the taller plants to the average height. You may find this emotionally difficult, but pruning will not harm the plant. Cutting off the growing shoot forces the plant to develop its branches. Some growers cut back all of their plants when they are three to four weeks old. Any horizontal space is quickly filled with growing branches and the plants grow full and robust.

The growing shoots are the most potent plant parts until the flowers appear. Generally, the potency increases with growth. By three months' age, most shoots will be high-quality smoke. You can cut shoots at any time; just don't overdo it. Give the plant a chance to grow and fill out to a good size. Severe pruning will slow growth. New growth may be distorted and abnormal, with a drop in potency.

Each time you cut a growing shoot, whether it is the stem tip or a branch tip, two shoots begin to grow from the nearest leaf axils. However, don't think that cutting all the growing shoots of a plant twenty times over the course of a season will yield a plant bearing over a million new shoots, or even that the plants will double their size if pruned. Pruning simply allows the plant to develop its branches earlier. The branches present more area to gather light and, hence, can grow to fill a larger space. However, the plant's size is basically determined by the seed's potential within the limitations of the environment.

Cutting the growing shoots or removing some leaves does not harm the plants. Plants are well adapted to the loss of parts to predators, wind, etc., in the natural world. When leaves are damaged or lost, the plant plugs the wound. The leaf isn't replaced or repaired, but new leaves are continually being formed from the growing shoots. The stem, since it connects all parts of the plant, is more important to the plant as a whole. When the stem breaks or creases, it is capable of repair. You can help the plant repair its stem by splinting the wound or somehow propping the stem up straight. Stems take about four or five days to heal.

When you cut the stem or leaves, you may see the plant's sap momentarily spurt before the wound is plugged. The sap contains primarily the products of photosynthesis, in the form of sucrose (table sugar). Smaller amounts of materials associated with the living organism such as minerals, amino acids, and enzymes are also present. In marijuana, the sap is usually colourless, although a bright red colour - it looks like blood - is not uncommon in later life. The red colour is due to haematin compounds and anthocyanin pigments that naturally build up in some varieties. The red colour may also indicate a nutrient deficiency, notably of nitrogen, phosphorus, potassium, or magnesium.

8.7 Training

Plants grow from the tips of their stems and branches. The growing tip (apical meristem) of the plant contains a hormone that acts as a growth inhibitor. This prevents the branches (lateral buds) from growing. The further a branch is from the growing tip, the less effect of the inhibitor. This is why some species of plants form a cone or Christmas-tree shape with the longest branches toward the bottom of the stem. This is also why the branches grow from the top of the plant when the tip is removed. Once the growing tip is removed, the next highest growing shoot(s) becomes the source of the inhibitor. Under artificial light, the bottom branches may not receive enough light to grow even though they are far away from the inhibitor. Usually the longest branches are toward the middle of the plant.

Some growers hate to cut the growing shoots on the main stem, since it forms the largest and most potent buds by harvest. But you can neutralise the effects of the inhibitor, without cutting the growing shoot, by bending the tip. This allows you to control the height of the plants, and forces them to branch. The top two to six inches of the stem are flexible. Bend it in an arc and secure it to the stem with a wire twist or string. Remove the wire twist in a few days so that the growing tip does not break itself as it twists up to the light. Don't bend the stem too far down. Keep it in the strong light or else it will stop growing. If you accidentally break the tip, you can splint it with matchsticks or ice-cream sticks secured with wire twists or tape until it heals. {Figure 49. The flexible tip is held in place with a wire twist.}

To develop large, full plants with well-developed branches, secure the growing tip once or twice for a few days while the plants are young (one to three months).

It is possible to train the tip so that the stem will form a series of "S"

shapes or even circles. During flowering, train the tips so that they grow horizontally. This method encourages thick, dense growth. The branch tips can also be trained. Keep bending any tips that grow above the others. This creates a garden filled with a cubic layer of vigorous flower clusters rather than a lot of stems.

We want to emphasise that when you get the knack of training the tips, you can more than double the yield of the most potent plant parts. {Figure 50. Stem trained in an "S" shape.} {Figure 51. Tops trained horizontally during flowering.}

Chapter Nine NUTRIENTS AND FERTILISING

9.2 Nutrients

There are about 15 elements known to be essential to plant life. Carbon, hydrogen, and oxygen are absorbed from air and water. The remaining 12 elements are absorbed primarily from the soil, in mineral (inorganic) forms such as NO_3^- and K^+ . They constitute a natural part of soil that becomes available to the plant as organic matter decays and soil particles such as sand and clay dissolve.

Soil elements that are necessary for normal growth are called nutrients. The elements nitrogen (N), phosphorous (P), and potassium (K) are considered major nutrients. The three numbers that appear on all fertiliser packages give the available percentage of these three nutrients that the fertiliser contains; and always in the order N-P-K. For example, 10-2-0 means 10 percent N, 2 percent P (actually, 2 percent P_2O_5), and no K (actually, no K_2O). Fertility is often measured by the amounts of major nutrients a soil contains. Relatively large amount of N-P=K are needed for lush growth.

Three other elements - calcium (Ca), sulphur (S), and magnesium (Mg) - are called secondary nutrients. Plants require less of these nutrients, and most cultivable soils contain adequate amounts for good growth.

Six remaining elements are called trace elements or micronutrients. As their name implies, they are needed in very small amounts. Commercial soils contain enough trace elements to sustain normal growth. The trace elements are also present in manures, humus, ash, and limestone.

Nitrogen

The amount of nitrogen a soil can supply is the best indication of its fertility. Nitrogen, more than any other soil nutrient, is inextricably linked with the living ecosystem. Nitrogen is continually cycled through living systems: from soil to plants and back to the soil, primarily by the activity of soil microorganisms. Nitrogen is essential to all life. Nitrogen is a key element in the structure of amino acids, the molecules which make up proteins. These, and all other biomolecules, are synthesised by the plant. Chlorophyll, genetic material (for example, DNA), and numerous enzymes and plant hormones contain nitrogen. Hence, N is necessary for many

of the plant's life processes.

Cannabis is a nitrophile, a lover of nitrogen. Given ample N, Cannabis will outgrow practically any plant. Ample nitrogen is associated with fast, lush growth, and the plant requires a steady supply of nitrogen throughout its life. Marijuana's requirements for N are highest during the vegetative growth stages.

Phosphorous

P is a constituent of energy-transfer compounds such as NADP and ATP, and molecular complexes such as the genes. The energy compounds are necessary for photosynthesis, respiration, and synthesis of biomolecules. Cannabis takes up large amounts of P during germination and seedling stages. During flowering and seed set, Cannabis' need for phosphorous is also high.

Potassium

K influences many plant processes, including photosynthesis and respiration, protein synthesis, and the uptake of nutrients. Just as with P, K uptake is highest during the earliest growth stages. K is associated with sturdy stems and resistance to disease in plants.

Calcium

Ca functions as a coenzyme in the synthesis of fatty compounds and cell membranes, and is necessary for normal mitosis (replication of cells). Plants take up much more Ca than the small amount necessary for normal growth. Ca is not added to soil as a nutrient; it is added to adjust the soil's chemistry or pH.

Sulfur

S is a constituent of certain amino acids and proteins. It is an important part of plant vitamins, such as biotin and thiamine, which are necessary for normal respiration and metabolism. (Plants synthesise all vitamins they need.) Most soils suitable for growing marijuana contain plenty of S.

Magnesium

Mg is involved in protein synthesis and metabolism of carbohydrates. Mg is the central element in the structure of chlorophyll molecules and hence has an important role in photosynthesis. Most mineral soils and commercial soils have a good supply of Mg.

Trace Elements

The trace elements (Fe, Mn, Mo, B, Cu, Zn) are particularly important in the coenzymes and catalysts of the plant's biochemistry. Many life processes, particularly the synthesis and degradation of molecules, energy transfer, and transport of compounds within the plant, depend on trace elements. Trace elements are not used in large quantities to spur growth, but are necessary in minute amounts for normal growth. Indoor soils rarely require an addition of trace elements.

All the nutrients are needed for normal growth. However, most of them are supplied by the potting soil. Ca, S, and the trace elements rarely present any problems. For most growers, fertilising will simply require periodic watering with a complete fertiliser, one that contains N, P, and K.

9.3 Application: Fertilising

To grow to a large size, marijuana requires a steady supply of nutrients. These can be added to the soil before planting or anytime during growth. Bulk fertilisers are added while the soil is mixed, as described in section 6. These include manures, composts, humus, and concentrated fertilisers, such as rose food. Once the plants are growing, never condition or mulch indoor soils with bulk fertilisers. they promote moulds and fungi and attract other pests to the garden. Concentrated fertilisers can damage the plants if they come in direct contact with the stem or roots.

While the plants are growing, nutrients are given in solution; they are dissolved in water, and the plants are watered as usual. Soluble fertilisers can be either organic or inorganic (chemical), and come in a wide range of concentrations and proportions of nutrients. Two organic fertilisers are liquid manure (about 1.5-1.0-1.5) and fish emulsion ((Some fish emulsion may contain whale by-products.)) (about 5-1-1). Chemical fertilisers commonly may have 20-20-20 or 5-10-5, or may contain only one nutrient, such as 16-0-0.

A 10-5-5 fertiliser is 20 percent soluble nutrients and 80 percent inert ingredients. a 30-10-10 has 50 percent available nutrients and 50 percent inert ingredients. There is approximately the same amount of N in one tsp. of 30-10-10 as in three tsps. of 10-5-5.

Actually, you can almost use any fertiliser, but the nitrogen content should be proportionately high, and there should be some P and L also present. For example, a 20-20-20 would work fine, as would a 12-6-6 or a 3-4-3, but not a 2-10-10 or a 5-10-0.

How much fertiliser to use and how often to fertilise depend primarily on the fertility of the soil and the size of the container relative to the size of the plant. Small plants in large pots usually do not need to be fertilised. Even in small pots, most plants do not need to be fertilised for at least the first month.

As the plants grow, they take nutrients from the soil, and these must be replaced to maintain vigorous growth. During the vegetative stage, even plants in large pots generally require some fertilising, particularly with N.

The rate of growth of indoor plants is usually limited by the amount of light and space, once adequate nutrients are supplied. At this point, an increase in nutrients will not increase growth. Your goal is to supply the plants with their nutritional needs without overfertilising and thus toxifying the soil.

Most fertilisers are designed for home use and have instructions for

fertilising houseplants. Marijuana is not a houseplant, and it requires more nutrients than houseplants. The extra nutrients that it needs may be supplied by the use of large pots and a fertile soil mixture. In many cases, you will need to fertilise only in the dosages recommended on fertiliser packages for houseplants. For instance, Rapid-Gro (23-19-17) is popular among marijuana growers; use one tablespoon per gallon of water every two weeks.

A typical program for fertilising might be to fertilise during the fifth week of growth and every two weeks thereafter until flowering. Then discontinue fertilising (or give at one-half concentration) unless the plants show a definite need for nutrients. It is better to fertilise with a more diluted solution more often than to give concentrated doses at longer intervals. (For instance, if instructions call for one tablespoon of fertiliser per gallon once a month, use one-quarter tablespoon per gallon once a week.)

Make sure that a fertiliser is completely dissolved in the water before you apply it. Put the recommended amount of fertiliser in a clear glass bottle and mix with about one cup of water. Shake vigorously and then allow it to settle. If any particles of fertiliser are not dissolved, shake again before adding the rest of the water. If you have difficulty getting all the fertiliser to dissolve, first add hot tap water. If the fertiliser still does not completely dissolve, you should use another fertiliser.

Never fertilise a dry soil or dry Soilless medium. If the medium is dry, first water with about one-half quart of plain water per pot. Let the pots sit for about 15 minutes so that the water is evenly dispersed in the pot. Then fertilise as usual.

It is difficult to give instruction for fertilising that will cover all garden situations. You want to supply the plant with its nutritive needs, but overfertilising can toxify the soil. Fertilising according to instructions for houseplants (both in frequency and concentration) should not toxify the soil. However, the plants may sometimes require more frequent or more concentrated fertilising. A good way to judge the plant's needs is not to fertilise one plant, double the fertiliser of another plant, and give the rest of the plants their normal dose. If the unfertilised plant grows more slowly, or shows symptoms of deficiencies, then probably all the plants are depending on soluble fertilisers and must be fertilised regularly. If the plants receiving the double dose grows faster than the other plants, increase the other plants' supply also. On the other hand, if there is little difference among the plants, then the soil is providing the plants with enough nutrients, and they either should not be fertilised or should be fertilised with a less-concentrated solution.

Because they are grown in a relatively small area, it is easy to overfertilise indoor plants. When plants are vigorous, look healthy, and are growing steadily, don't be anxious to fertilise, particularly if you have already fertilised several times with soluble fertilisers. Slow growth or symptoms of deficiencies clearly indicate the need for fertilising.

Overfertilising

In an effort to do the best for their plants, some people actually do the worst. Overfertilising puts excessive amounts of nutrients in the soil, causing toxic soil conditions. Excessive amounts of one nutrient can interfere with the uptake of another nutrient, or change normal plant-soil relations. Since it takes time for a build-up to occur high concentrations of nutrients generally encourage excellent growth until the toxic level is reached.

It takes less N than other nutrients to toxify the soil; hence there is less margin for error when using N. Too much N changes the osmotic balance between plant and soil. Instead of water being drawn into the plant, water is drawn away and the plant dehydrates. The leaves feel limp even though the plant is well watered. The plant will soon die. This tips of the leaves die first and very rapidly the leaves change colour, usually to gold, but sometimes to a brown or green-grey. This change in the plants is faster, more dramatic, and more serious than for any kind of nutrient deficiency.

You can save the plants by immediately leaching the pots as soon as the condition is recognised. Place the pots outdoors or in a sink or bathtub. Discard the top inch or two of loose dirt. Run lukewarm water through the soil until a gallon of water for each two gallons of soil has passed through each pot. The leaves recover turgor in one or two days if the treatment works.

Foliar Feeding

Foliar feeding ((Nitrogen fertilisers are usually NO₃ (nitrate) or NO₂ (nitrite), substances which are also used to preserve food. They have been shown to undergo reactions to form carcinogenic substances (nitrosamines). As with eating food treated with nitrates and nitrites (hot dogs, sandwich meats, etc.), there is a possibility that such substances might be ingested by eating or smoking foliar-fed plants.)) (spraying the leaves with fertiliser) is a good way to give the plants nutrients without building up the amount of soluble substances in the soil. After the first month, foliar feed the plants with, for example, fish emulsion or a chemical fertiliser. Use any fertiliser that states it can be used for foliar feeding even if it says "not recommended for foliar feeding houseplants." Use a fine-mist sprayer, such as a clean Windex or Fantastik bottle. Dilute the fertiliser according to directions (fish emulsion at one tablespoon per gallon) and spray both sides of the leaves. When foliar feeding, you should spray the plants with plain water the next day, to dissolve unabsorbed nutrients and clean the plants.

Foliar spraying is also a good way to treat plants suffering from nutrient deficiencies. Some nutrient deficiencies actually are caused by the soil's chemistry, rather than by the absence of the nutrient in the soil. Addition of the necessary nutrient to the soil may not cure the plants' problem, because the nutrient becomes locked in the soil, or its uptake may be limited by high concentrations of other elements present in the soil. Foliar feeding is direct, and if the plant's deficiency symptoms do not begin to clear up, then the diagnosis is probably incorrect.

9.4 Nutrient Deficiencies

Before Diagnosing

Before you assume the plant has a nutrient deficiency, make sure the problem is not due to other causes. Examine the plant leaves, and along the stem and in the soil.

Even under the best conditions, not all leaves form perfectly or remain perfectly green. Small leaves that grew on the young seedling normally die within a month or two. Under artificial lights, bottom leaves may be shielded from the light, or be too far away from the light to carry on chlorosynthesis. These leaves will gradually turn pale or yellow, and may form brown areas as they die. However, healthy large leaves should remain green at least three to four feet below the plant tops, even on those plants under small light systems. Under low light, the lower-growing shoots as well as the large leaves on the main stem are affected. Some symptoms of nutrient deficiencies begin first at the bottom of the plant, but these symptoms generally affect the lower leaves on the main stem first, and the progress to the leaves on the branches.

Although some deficiency symptoms start on the lower, older leaves, others start at the growing shoots or at the top of the plants. This difference depends on whether or not the nutrient is mobile and can move from the older leaves to the active growing shoot. Deficiency symptoms of mobile nutrients start at the bottom of the plant. Conversely, deficiency symptoms of immobile nutrients first appear on the younger leaves or growing shoots at the top of the plant. N, P, K, Mg, B, and Mn are mobile in the plant. Ca, S, Fe, and Cu are less mobile, and Zn are generally immobile.

A dry atmosphere or wet soil may cause the blade tips to turn brown. Brown leaf tips also may indicate a nutrient deficiency, but in this case, more tissue will turn brown than just the end tips.

Chlorosis and necrosis are two terms which describe symptoms of disease in plants. Chlorosis means lacking green (chlorophyll). Chlorotic leaves are pale green to yellow or white. Chlorotic leaves often show some recovery after the necessary nutrient is supplied. Necrosis means that the tissue is dead. Dead tissue can be gold, rust, brown, or grey. It is dry and crumbles when squeezed. Necrotic tissue cannot recover.

Symptoms of deficiencies of either N, P, or K have the following in common: all involve some yellowing and necrosis of the lower leaves, and all are accompanied by red/purple colour in stems and petioles. The simplest way to remedy these deficiencies is to fertilise with a complete fertiliser containing nearly equal proportions of three nutrients.

Nitrogen

N is the most common deficiency of Cannabis indoors or out. Nitrogen deficiencies may be quite subtle, particularly outdoors, where the soil may continuously provide a small amount of nitrogen. In this case the top of the plant will appear healthy, and the plant will grow steadily, but at a slow pace. The deficiency becomes more apparent with growth, as more and more of the lower leaves yellow and fall. The first sign is a gradual, uniform yellowing of the large, lower leaves. Once the leaf yellow, necrotic tips

and areas form as the leaves dry to a gold or rust colour. In small pots, the whole plant may appear pale (or lime colour) before many bottom leaves are affected to the point that they yellow or die. Symptoms that accompany N deficiency include red stems and petioles, smaller leaves, slow growth, and a smaller, sparse profile. Usually there is a rapid yellowing and loss of the lower leaves that progresses quickly to the top of the plant unless nitrogen is soon added.

Remedy by fertilising with any soluble N fertiliser or with a complete fertiliser that is high in N. If your diagnosis is correct, some recovery should be visible in three or four days. Pale leaves will regain some colour but not increase in size. New growth will be much more vigorous and new stems and petioles will have normal green colour.

Indoors, you should expect plants to need N fertilisation a few times during growth. Once a plant shows N deficiency, you should fertilise regularly to maintain healthy and vigorous growth. Fertilise at about one-half the concentration recommended for Soilless mixtures. Increase the treatment only if the plants show symptoms again. Once the plants are flowering, you may choose not to fertilise if the plants are vigorous. They will have enough N to complete flowering and you don't want to chance toxifying the soil at this late date.

Phosphorous

P deficiency is not common indoors, but may appear outdoors, particularly in dry, alkaline soils or in depleted soils, or during cool weather. Phosphorus deficiency is characterised by slow and sometimes stunted growth. Leaves overall are smaller and dark green; red colour appears in petioles and stems. The leaves may also develop red or purple colour starting on the veins of the underside of the leaf. Generally the tips of most of the leaf blades on the lower portion of the plant die before the leaves lose colour. Lower leaves slowly turn yellow before they die. Remedy with any soluble P-containing fertiliser. Affected leaves do not show much recovery, but the plant should perk up, and the symptoms do not progress.

Potassium

K deficiencies sometimes show on indoor plants even when there is apparently enough supplied for normal growth. Often, potassium-deficient plants are the tallest ((Potassium is associated with apical dominance in some plant species.)) and appear to be the most vigorous. Starting on the large lower leaves, the tips of the blades brown and die. Necrotic areas or spots form on the blades, particularly along the margins. Sometimes the leaves are spattered with chlorotic tissue before necrosis develops, and the leaves look pale or yellow. Symptoms may appear on indoor plants grown in a soil rich in organic material. This may be due to high salinity (Na) of some manures or composts used in the soil. Red stems and petioles accompany potassium deficiencies. K deficiencies that could seriously affect your crop rarely occur with indoor soils. However, mild symptoms are quite common. Usually the plants grow very well except for some necrotic spotting or areas on the older leaves. (This condition is primarily an aesthetic problem, and you may choose not to fertilise. See 19.3.)

K deficiencies can be treated with any fertiliser that contains potassium. Wood ashes dissolved in water are a handy source of potassium. Recovery is slow. New growth will not have the red colour, and leaves will stop spotting after a couple of weeks. In a K-deficient soil, much of the added potassium is absorbed by the soil until a chemical balance is reached. Then additional potassium becomes readily available to the plant.

Calcium

Ca deficiencies are rare and do not occur if you have added any lime compound or wood ash. But calcium is added primarily to regulate soil chemistry and pH. Make sure that you add lime to soil mixtures when adding manures, cottonseed meal, or other acidic bulk fertilisers. An excess of acidic soil additives may create magnesium or iron deficiencies, or very slow, stunted growth. Remedy by adding one teaspoon of dolomitic lime per quart of water until the plants show marked improvement. Periodically fertilise with a complete fertiliser. Foliar feeding is most beneficial until the soil's chemistry reaches a new balance.

Sulfur

S is plentiful in both organic and mineral soils. Liming and good aeration increases S availability. Hence S deficiencies should not occur in soils that are suitable for growing marijuana. However, sulfur deficiencies sometimes can be confused with N deficiencies and may also occur because of an excess of other nutrients in the soil solution. Sulfur-deficiency symptoms usually start at the top of the plant. There is a general yellowing of the new leaves. In pots, the whole plant may lose some green colour. Both sulfur and Mg deficiencies can be treated with the same compound, epsom salts ($MgSO_4$). Epsom salts, or bathing salts are inexpensive and available at drug stores.

Magnesium

Mg deficiencies are fairly common. They frequently occur in Soilless mixtures, since many otherwise all-purpose fertilisers do not contain Mg. Magnesium deficiencies also occur in mixtures that contain very large amounts of Ca or Cl. Symptoms of Mg deficiency occur first on the lower leaves. There is chlorosis of tissue between the veins, which remain green, and starting from the tips the blades die and usually curl upward. Purple colour builds up on stems and petioles.

A plant in a pot may lose much of its colour in a matter of weeks. You may first notice Mg symptoms at the top of the plant. The leaves in the growing shoot are lime-coloured. In extreme cases, all the leaves turn practically white, with green veins. Iron deficiency looks much the same, but a sure indication of Mg deficiency is that a good portion of the leaf blades die and curl. Treat Mg symptoms with one-half teaspoon of epsom salts to each quart of water, and water as usual. The top leaves recover their green colour within four days, and all but the most damaged should recover gradually. Continue to fertilise with epsom salts as needed until the plants are flowering well. If you are using soilless mixtures, include epsom salts regularly with the complete mixture. Because Mg deficiencies may indicate interference from other nutrients, foliar-spray with Mg to check your

diagnosis if the plants are not obviously recovering.

Iron

Fe deficiency rarely occurs with indoor mixtures. Iron is naturally plentiful in most soils, and is most likely to be deficient when the soil is very acid or alkaline. Under these conditions, which sometimes occur in moist eastern soil outdoors, the iron becomes insoluble. Remedies include adjusting the Ph before planting; addition of rusty water; or driving a nail into the stem. Commercial Fe preparations are also available. If the soil is acidic, use chelated iron, which is available to the plants under acidic conditions.

Symptoms of iron deficiency are usually distinct. Symptoms appear first on the new growing shoots. The leaves are chlorotic between the veins, which remain dark green and stand out as a green network. To distinguish between Mg and Fe deficiencies, check the lower leaves for symptoms. Iron symptoms are usually most prominent on the growing shoots. Mg deficiencies will also show in the lower leaves. If many of the lower leaves have been spotting or dying, the deficiency is probably Mg. Mg deficiencies are much more common than iron deficiencies in marijuana.

Other Trace Elements

The following deficiencies are quite rare. Trace elements are needed in extremely small amounts, and often enough of them are present as impurities in fertilisers and water to allow normal growth. Many houseplant fertilisers contain trace elements. Trace-element deficiencies are more often caused by an extreme pH than by inadequate quantities in the soil. If a deficiency is suspected, foliar-spray with the trace element to remedy deficiencies. Our experience has been that trace-element deficiencies rarely occur indoors. We advise you not to add trace elements to indoor soils, which usually contain large amounts of trace elements already because of the addition of organic matter and liming compounds. It is easy to create toxic conditions by adding trace elements. Manufacturers also recommend using amounts of trace elements that may be too high for indoor gardens; so use them at about one-fourth of the manufacturer's recommended dose if an addition is found to be necessary.

Manganese

Mn deficiency appears as chlorotic and the necrotic spots of leaf tissue between the veins. They generally appear on the younger leaves, although spots may appear over the whole plant. Manganese deficiencies are not common. Manganese is present in many all-purpose fertilisers. Mn deficiencies may occur if large amounts of Mg are present.

Boron

B deficiency may occasionally occur in outdoor soils. The symptoms appear first at the growing shoots, which die and turn brown or grey. The shoots may appear "burned," and if the condition occurs indoors, you might think the lights have burned the plant. A sure sign of boron deficiency is that, once the growing tip dies, the lateral buds will start to grow but will also die. B deficiency can be corrected by application of boric acid, which is

sold as an eyewash in any drugstore. Use one-fourth teaspoon per quart of water. Recovery occurs in a few days with healthy growth of new shoots.

Molybdenum

Mb deficiency occurs in outdoor soils, but rarely indoors. Mb is readily available at neutral or alkaline pH. Mb is essential for nitrogen metabolism in the plant, and symptoms can be masked for a while when N fertilisers are being used. Usually there is a yellowing of the leaves at the middle of the plant. Fertilising with nitrogen may remedy some of the yellowing. However, Mb symptoms generally progress to the growing shoots and new leaves often are distorted or twisted. Mb is included in many all-purpose fertilisers.

Zinc

Zn-deficiency symptoms include chlorosis of leaf tissue between the veins. Chlorosis or white areas start at the leaf margins and tips. More definite symptoms are very small, new leaves which may also be twisted or curled radially. Zn deficiencies may occur in alkaline western soils. Galvanised nails can be buried or pushed into the stem. Commercial preparations of zinc are also available.

Copper

Cu deficiencies are rare; be careful not to confuse their symptoms with the symptoms of overfertilisation. The symptoms appear first on the younger leaves, which become necrotic at the tips and margins. Leaves will appear somewhat limp, and in extreme cases the whole plant will wilt. Treat by foliar-spraying with a commercial fungicide such as CuSO_4 .

9.5 Soilless Mixtures

Soilless mixtures are an alternative to using large quantities of soil. Their main advantage is complete control over the nutrients that your plants receive. Soilless mixtures are also inexpensive and easy to prepare. They have a near-neutral pH and require no pH adjustment.

Soilless mixtures are made from soil components such as vermiculite, sand, or perlite. Soilless mixtures should be blended in such a way that they hold adequate water, but also drain well and do not become soggy. A good general formula is two parts vermiculite to one part perlite. About 10 percent coarse sand or gravel can be added to give weight and stability to the pots. Instead of vermiculite, you can use Jiffy-Mix, Metro-Mix, Ortho-Mix, Pro-Mix and other commercial soilless mixtures, which are fortified with a small amount of necessary nutrients, including trace elements. You can also substitute coarse sand for perlite.

Potting

It is best to use solid containers with soilless mixtures rather than plastic bags. Grow the plants in one- to three-gallon containers. There won't be much difference in the size of the plants in one-gallon or in three-gallon sizes, but you will have to water a large plant every day in a one-gallon container. (The plants can always be transplanted to a larger

container.) The pots must have drainage holes punched in the bottoms. Pot as usual, and add one tablespoon of dolomitic lime or two tablespoons of wood ash to each gallon of mixture.

Germinating

Plants may have problems germinating in soilless mixtures. The top layer of mixture often dries rapidly, and sprouts may die or not germinate. Young seedlings also seem to have difficulty absorbing certain nutrients (notably potassium), even though adequate amounts of nutrients are being added. Since this difficulty may retard growth, it is best to start the plants in small pots with soil. Use eight-ounce paper cups, tin cans, or quart milk containers cut in half. Mix three parts topsoil or potting soil to one part soilless mixture. Fill the starting pots and germinate as usual. When the plants are two to three weeks old, transplant to the soilless mixture. First moisten the soil, and then remove the soil as intact as possible. You might handle the transplant like making castles, by carefully sliding the moist soil out of the pot. Or you can cut away the sides of the container while you place the transplant in the soilless mixture. When watering, make sure you water around the stem to encourage roots to grow into the soilless mixture.

Peat pellets that expand are also good for starting seedling. Plant several seeds in each pellet, and place it in the soilless mixture after the sprouts appear.

Fertilising

Soilless mixtures can be treated with a trace-element solution. We have grown crops with no special addition of trace elements, and the plants completed their lives without showing symptoms of trace-element deficiency. In these cases there were apparently enough trace elements in the lime and the fertilisers that were used to provide the major nutrients. Many all-purpose fertilisers also contain trace elements. However, it is a good idea to treat soilless mixtures with a mild solution of trace elements before planting. Large plants can be treated a second time during the third or fourth month of growth. Do not use trace elements more often unless plants show definite trace-element deficiencies.

Iron is the only trace element that is needed in more than minute quantities. Iron can be supplied by mixing a few brads or nails into the soilless mixture.

Use any soluble fertiliser that is complete, that is, that contains some of each of the major nutrients. Choose one with a formula that is highest in N but contains a good portion of both P and K. For example, Rapid-Gro is 23-19-17 and works well for soilless mixtures.

Table 18 gives a formula that has worked well for us. The figures in it are a guide for estimating the amounts of fertiliser to use. When choosing a fertiliser by means of this chart, use N for a guide. For example, suppose the only fertiliser you can find that has good proportions of the major nutrients as a 20-15-15. Divide 5 (the figure for N in the table) by 20 (the figure for N in the fertiliser), and get the result 1/4. That is, the

fertiliser if four times as concentrated in N as you need; so you would use one-fourth the amount of fertiliser shown in Table 18. For instance, during the vegetative stage, you would give the plants one-half to three-fourths of a level teaspoon of fertiliser per gallon of water each time you water.

Table 18 - Guidelines for Fertilizing Soilless Mixtures

Growth Stage	N	P2O5	K2O	Amount
Seedling	5	3	4	1.5 to 2 tsp/gal
Vegetative	5	2	3	2 to 3 tsp/gal
Flowering	5	5	3	0.5 to 1.5 tsp/gal

It is also not necessary to fertilise in these ratios. You could use a 10-10-10 fertiliser throughout growth; you would use half the amounts listed in Table 18. The most important point is that the plant receive enough of each element, not that they receive specific proportions.

Fertilising according to volume of fertiliser is not very accurate, and also does not take into account other variables (such as variety, light, temperature, etc.) that determine the amounts of nutrients your plants can use. However, it is a simple and useful way of estimating the plant's needs. You can more accurately gauge the plants' needs by giving a sample plant twice the concentration of fertiliser, and another half the concentration. Their performance will give you an idea of whether you are using too much or too little fertiliser. Too much fertiliser is the most damaging condition; so when in doubt give the plants less rather than more. Do not continue to give the plants the recommended amounts of fertiliser if the sample plant that is receiving less nutrients is growing as well as the other plants.

Another way of monitoring the plant's growth is to grow a few plants in a standard soil mixture. This will show you whether the plants in the soilless mixture are growing as fast as they should, and will give you a reference for diagnosing deficiencies.

Besides providing N, P, K, and the trace elements, you must also give your plants secondary nutrients. Ca is added by mixing a tablespoon of lime or two tablespoons of wood ash when preparing the soilless mixture. (Calcium is usually present in water and in many fertilisers as part of the salts that contain nutrients, for example, $\text{Ca}(\text{NO}_3)_2$.) Magnesium and sulfur are both found in common epsom salts, MgSO_4 . Use one-eighth teaspoon of epsom salts to each teaspoon of 5 percent N. For example, if you are using a 20 percent N fertiliser, you would use half a teaspoon of MgSO_4 to each teaspoon of fertiliser. (Actually, enough sulfur is often present, either as part of the soilless mixture or as part of nutrient salts to allow growth.) Magnesium can also be supplied by using dolomitic limestone.

Soilless mixtures are something between soil mixtures and water cultures (hydroponics). With hydroponics, the plants are grown in a tank of water. The fertilisers are added in solution, and the water solution is periodically circulated by a pump.

Another variation on soilless mixtures is to add a small amount of soil or humus to the soilless mixture. Some examples are:

1. 4 parts soilless mixture to 1 part soil;
2. 8 parts soilless mixture to 1 part humus;
3. 15 parts soilless mixture to 1 part limed manure.

Overfertilising is less a problem with soilless mixtures than with soil, because of higher concentrations of salts are tolerable in soilless mixtures and because excess salts are easily flushed out of the mixture. A good idea is to flush each pot once after two months of growth, again after four months. Any time the plants show symptoms of overfertilisation, leach the pots immediately. Flood each pot with plain water so that it runs out the drainage holes. Continue flooding the pots until a couple of gallons of water have run through the pot. Don't fertilise for at least a week. Then fertilise with a more dilute solution that was used before. {Figure 51a. Over fertilisation. Leaves turn bright gold and die, starting at the top of the plant.}

Chapter Ten

DISEASES AND PLANT PESTS

Plants are considered diseased when their health or development is impaired enough that the adverse effects become visible to the eye. Disease may be caused by infectious microbes, such as bacteria or viruses, by pests such as insects, or by nutritional deficiencies or imbalances. However, for diseases that might affect your plants, there should be no need for a plant doctor. You'll be able to diagnose the symptoms after careful observation.

Leaves naturally drop from plants during the course of their lives. Not every leaf will develop perfectly or so. The small leaves that are formed during the first few weeks of growth normally die within three months. Leaves at the bottom of healthy plants often die because they are shielded by the upper instance, in a garden receiving only 80 watts of fluorescent light, the plants may stay green only up to three or four feet away from the lights. Lower leaves may turn pale and yellow and then dry to gold or rust colours.

10.2 Microbial Diseases

Because Cannabis is not native to the Americas, most of the microbial diseases that attack the plant are not found in this country. Homegrown Cannabis is remarkably free of diseases caused by microbes, and there is little chance of your plants suffering from these diseases. Fungal stem and root rots seem to be the only ones of consequence. These occur only because of improper care. Watering too often, coupled with a stagnant, humid atmosphere, encourages stem rot to develop. Stem rot appears as a brown or black discolouration at the base of the stem and is soft or mushy to the touch. Allow the soil to dry between waterings, and be sure to water around the stem, not on it. Wipe as much of the fungus and soft tissue away as possibly. If the rot doesn't disappear in a few weeks, treat it with a fungicide.

10.3 Nutrient Diseases

Diseases due to nutrient deficiencies (see section 9), are common indoors,

and their symptoms usually worsen with time, affecting more and more of the plant. Whole leaves may be pale, or turn yellow or white; the condition may first afflict the bottom, or top, or the entire plant at once. Deficiency symptoms often appear as spots, splotches, or areas of chlorotic (lacking green) tissue. Sometimes necrotic (dead) tissue appears that is copper, brown, or gray. However, before you search to section 9, carefully inspect the plants for any signs of plant pests.

10.4 Plant Pests

The indoor garden is an artificial habitat where the plants live in isolation from the natural world. For this reason, few of you will have any problems with plant pests. However, indoor plants are particularly susceptible to pests once contaminated. In nature, the pest populations are kept in check by their natural enemies, as well as by wind, rain, and changing temperatures. Without these natural checks, pests can run rampant through the indoor garden.

The most common and destructive pests are spider mites and whiteflies. Spider mites are barely visible to the naked eye; they are ovoid-shaped. Juvenile mites are transparent and change to green as they suck the plant's tissue. Adults are tan, black, or semitransparent. False spider mites are bright red. Mites are usually well-established before you discover them, because they are so difficult to see.

Whiteflies are white (obviously) but look like tiny moths rather than flies. The adults are about 1/16 inch long, and you may not see one unless it flutters by the corner of your eye. Then shake the plants. If the result looks like a small snowstorm, the plants are infested with whiteflies. {Figure 52. Left: Spider mite (x16). Right: A match head dwarfs tiny spider mites.}

The symptoms of infection by mites and whiteflies are similar. Symptoms usually appear on the lower leaves and gradually spread to the top of the plant. The first indications are that the plant loses vigour; lower leaves droop and may look pale. Look closely at the upper surfaces of the leaves for a white speckling against the green background. The speckles are due to the pests sucking the plant's chlorophyll-rich tissue. With time, the leaf loses all colour and dies.

Pests are easiest to find on the leaves that are beginning to show some damage. You can usually see mites and whitefly larvae as tiny dots looking up at the lights through the undersides of the leaves.

To find out which pest you have, remove some damaged leaves and inspect the undersides under bright daylight. With spider mites, if you discover them early, a leaf may show only one or two tiny dots (adults) and a sprinkling of white powder (eggs) along the veins. In advanced cases, the undersides look dusty with the spider mites' webbing, or there may be webbing at the leaf nodes or where the leaflets meet the petioles. With whiteflies, you usually see the adults first. On the undersides of the leaves the whitefly larvae look like mites, but there is no webbing, and there are tiny golden droplets of "honeydew" excreted by the adult whiteflies. {Figure 53. Mites appear as black specks when you look up to the lights from the undersides of

the leaves. Also see Plate 14.}

Take quick action once you discover plant pests. If the plants are less than a month old, you will probably be better off to clean out the garden, in order to eliminate the source of the pests, and start over. As long as the plants are healthy they can withstand most attacks. The more mature the plants are, the less they are affected by pests. Whiteflies and mites sometimes disappear from flowering plants, particularly the female flowers. Mites are difficult to eliminate completely. Often a holding action will save a good crop.

If only a few plants in your garden are infected, remove them. Or else, remove any leaves that show damage. If the plants are three or more months old, you might consider forcing them to flower while they are still healthy. Plants that are good-sized and still vigorous will usually stand up well to mites once they are flowering.

If you don't want to use insecticides, there are several alternative ways to keep the pests in check until flowering. Mix 1/8 to 1/4 pound of pure soap (such as Ivory flakes) thoroughly in one gallon of lukewarm water. Then cover each pot with foil or newspaper, invert it, and dip and swish the plant around several times in the soapy solution. Let it drip dry and rinse with clear water. Use the dunking procedure every week or two until the plants are larger. This is often enough to get the plants growing well and into flowering before the pest population can become a serious problem.

Two homemade sprays that can be effective are dormant oil sprays ((See Insects and Pests in the Outdoor Section.)) and hot pepper sprays.

To make hot pepper spray, mix four hot peppers with one medium onion and one clove garlic (213). Grind or chop and mash them along with some water. Cover the mash with water and allow it to stand a day or two. Add enough water to make two quarts. Strain through a coffee filter or paper towels in a funnel. Add one-half teaspoon of detergent and spray as you would an insecticide.

No one wants to use insecticides; yet they seem to be the only way to eliminate mites. There are a number of insecticides on the market that are relatively safe. Insecticides such as pyrethrum, rotenon, and malathion are relatively non-toxic to warm-blooded animals when used as directed. These are effective against many different plant pests besides mites and whiteflies. Additionally, they break down into harmless compounds such as carbon dioxide and water in a matter of days; so they do not persist in the environment.

Safe insecticides are used for vegetables. Follow all the package precautions. Do not use more, or more often, than recommended. Overuse can kill the plant. The label will list the number of days to wait before you can safely ingest the plant, usually from two to 35 days after spraying.

Both mites and whiteflies generally complete their brief life cycles in about one to two weeks. Because sprays are not effective against the eggs, repeat the spraying about once a week for three successive weeks to completely eliminate the pests. Since their generations are short-lived, some pests may become resistant to the spray. This can be a problem with

whiteflies. Try a different insecticide if the first one does not seem to be working.

Add a couple of drops of liquid detergent to each quart of insecticide solution. Detergent acts as a wetting agent and helps the insecticide to contact the pests and stick to the plant. Small plants can be dunked directly in the solution, the surest way to kill pests.

To spray the plants, start at the back of the garden so that you are working away from the plants already sprayed. Spray the entire plant and soil surfaces, paying special attention to the undersides of the leaves where pests tend to congregate. Stay out of the garden and keep the room closed that day.

Sulfur dusts can also be effective against mites and many other pests, and are safe to use. The easiest way to apply them is with a plastic "squeeze" bottle which has a tapered top. Make sure you dust the underside of the leaves.

Before using any insecticide, remove all damaged leaves. Do not use any insecticide during flowering. Rinse the plant with a clear water spray about one week after applying any insecticide, and once more before you harvest. Otherwise there may be residues left which will affect the taste of the grass.

There are several other pests that can be a problem, although they rarely seriously affect marijuana. Aphids are about 1/16 inch long and are black, green, red, or pink. They have roundish bodies with long legs and antennae. Some species have wings. They congregate on the undersides of leaves which may then lose colour and become curled or distorted. Aphids excrete honey-dew droplets on the undersides of the leaves which can attract ants. If ants are also present, set out ant traps, because the ants will spread the aphids to other plants. A few successive washings in soapy water or one or two sprayings of the insecticides mentioned above should eliminate aphids.

Mealy bugs are white, about 3/16 of an inch long, and look like small, flat sowbugs. They don't seem to like marijuana and avoid it if other plants are present. Mealy bugs can be removed individually with cotton swabs and alcohol.

Gnats are attracted to moist soil that is rich in partially decayed organic matter such as manures. To discourage gnats when using manures, cover the top few inches in the pot with the soil mixture and no manure. Drench the soil with malathion solution for gnats or any other soil pest. Flypaper will also help against gnats as well as whiteflies.

Some people don't mind having a few pests on their plants. Whether you want to eliminate the pests completely or simply keep them in check may come down to whether you mind hearing the snap, crackle, and poop as their little bug bodies heat and explode when the harvest is smoked. Commercial marijuana, or any marijuana grown outdoors, will contain innumerable bugs and other small lifeforms.

Prevention

Whiteflies and spider mites are extremely contagious. Mites can be carried to the plant on hands, clothing, or an animal's fur. Many houseplant pests can fly or float to the garden through open windows. Mites crawl through cracks in walls and foundations during autumn, seeking warmth.

Many houseplants are popular because they can withstand abuse and infections by common plant pests. Your houseplants may harbor mites for years without your knowledge. You can find out if your houseplants have mites by placing some marijuana seedlings among the houseplants. Mites seem to enjoy young marijuana plants so much that the plants show symptoms of mites in a matter of weeks of any are nearby.

Hopefully, you'll never have to deal with pests. Prevention is the best policy. Use soil that has been pasteurised or sterilised to avoid bringing pest eggs and larvae into the garden. Keep the garden isolated from other plants. Use separate tools for the marijuana garden and for other plants. Screen windows in the garden with wire screen or mesh fabrics such as nylon.

Chapter 11

MAINTENANCE AND RESTARTING

To start a new crop, it is best to begin with a fresh soil. This is especially true if the plants were in small pots or were root-bound.

If you have fertilised regularly, the soil may contain near-toxic amounts of salts. Most of the salts build up in the top two-inch layer of soil. To salvage large quantities of soil, discard the top three-inch layer of soil from each pot. Add fresh soil and bulk fertilisers. Thoroughly mix and repot in clean containers.

It is generally not advisable to use the same soil for more than two crops. Although the used soil may not support healthy growth for potted plants, it is an excellent addition to any garden soil. Spread the soil as you would a mulch. The salt concentration is quickly diluted and benefits, rather than harms, garden soil.

Periodically clean the tubes and reflectors to remove dust and grime. As with windows, this dirt substantially decreases the amount of light the plants receive. Fluorescents lose approximately 20 to 40 percent of their original output within a year's use. Generally the higher-wattage tubes decline more rapidly than standard-output tubes. Vita-lite tubes last the longest, followed by standard fluorescents. Gro-tubes are the shortest-lived, and most growers replace them after two crops. Older tubes can be used to start seedlings and during the first month of growth. Since the plants are small and the light system is low, the old tubes generate enough light for healthy growth. Replace incandescent bulbs after 500 light hours.

PART 3: OUTDOOR

CULTIVATION

Chapter 12 CHOOSING A SITE

There are several factors to consider when deciding where to plant, including sunlight, microclimate, availability of water, and condition of the soil. But the garden's security should be your first consideration. No matter what size your garden, rip-offs and confiscation are constant threats. But these risks can be minimised by careful planning and common senses.

In some countries, law-enforcement agencies take a tolerant attitude toward small gardens, and people grow Cannabis in their backyards. In other areas, police are not as enlightened and place an emphasis on cultivation busts. In either case, the larger the garden, the greater the potential danger. {Figure 55. A Nassau Country police officer stands in a field of marijuana plants in Lattingtown, Long Island.}

In Hawaii and California, where marijuana growing has become a booming business, helicopters have been a problem for commercial growers. Aircraft outfitted with visual or infrared equipment, dogs, and finks have all been used to seek out illicit plots. Aircraft equipment is least effective on steep slopes and where the vegetation is lush and varied. Where aircraft are a problem, growers prune marijuana to obscure its distinctive shape. The plants are difficult to detect from a distance when intercropped with bamboo, sunflowers, sugar cane, soybeans, or tall weeds (see Figure 60). Commercial growers often plant several small dispersed stands or many single plants, which are more difficult to detect and serve as insurance against total loss.

But rip-offs rather than the law are more of a problem for marijuana growers. From every section of the United States, reports confirm that marijuana theft has reached epidemic proportions, and even well-hidden plant fall prey to unscrupulous people. These lowlifes often search near hippie communities and popular planting areas. Their best ally is a loose lip; so keep your garden on a "need to know" basis.

12.2 Where to Grow

Given the value of marijuana, many people think they'll grow an acre or two. But it is much harder to find spots suitable for large-scale farming than to find small garden plots. Large gardens require more planning and commitment, and usually a remote area. They may need a lot more time, energy, and investment in materials and labor-saving machinery than smaller gardens.

A small but well-cultivated garden, say, ten by ten feet, can yield over four pounds of grass each crop. By planning realistically, you'll harvest a good stash of potent grass rather than a lot of disappointment.

Moat people who grow marijuana plant it in their backyards. They hide the plants from curious neighbours and passers-by with walls, fences, arbor, or similar enclosures. Some people plant Cannabis as part of their vegetables garden, pruning the plants to make them less conspicuous.

Gardeners often use ingenious ideas to keep their gardens secret. A woman on Long Island grows over thirty large plants in containers in her drained swimming pool. Although some of the plants reach a height of 12 feet, they can't be seen over the enclosing fence.

A couple living near Nashville, Tennessee, took the roof off their three-car garage and painted the walls white to create a high-walled garden. Other growers use sheds with translucent roofs.

Guerilla Farming

Many growers feel safer planting away from their property. Should the garden be discovered, they are not in jeopardy. On the negative side, they usually lose the close contact and control that a home gardener has.

Urban gardeners use makeshift greenhouses, rooftops, vacant lots, and city dumps. Vacant lots that are overgrown with lush weeds can support a good crop, if the marijuana plants get a head start on the indigenous weeds.

Fields, forest clearings, railroad rights-of-way, stream banks, runoff and irrigation ditches, clearings beneath high-tension lines, deserted farms and quarries, overgrown fields, and abandoned houses have all been used as garden spots. In areas where hemp is a problem weed, people plant seeds from high-potency marijuana in the same fields where the weedy hemp grows. Growers harvest the plants in late July before they flower and before the fields are watched or destroyed by law enforcers.

Larger growers often look for rough, unpopulated terrain that is accessible only by plane, helicopter, four-wheel-drive vehicles, or long hikes. They avoid areas which hunters and hikers are likely to use before harvest.

Serious growers often find unusual places to start gardens. A grower in Chico, California, hacks through two hundred yards of dense underbrush and bramble to reach his clearing. In Oregon some growers maintain fields which are a gruelling eight-hour uphill hike from the nearest road. Some Florida farmers commute to their island and peninsula gardens by boats. A master gardener in Colorado lowers himself by rope to a fertile plain 50 feet below a cliff.

A farmer in Hawaii wrote, "The main concern is to grow in an undetectable place where the plants can still get enough sun. This is becoming very difficult to find and some very elaborate subterfuges have been developed. People on Maui are growing plants suspended from trees and on tree platforms! Around here some people carry small plants in buckets far out on the lava fields where there is a light shading from Ohia trees and you don't leave tracks. Also people go into the sugarcane fields, tear out some cane, and put in their plants. I am sure many other things are being done."

12.3 Light

Marijuana is a sun plant. The plants will grow in partially shaded areas, but about five hours of direct sunlight are needed for development into a lush bush. Marijuana does best when it has direct sunlight all day. If it grows at all in a heavily shaded area, it will be dwarfed and sparse - a shadow of its potential.

Try to choose a place that maximises light. Flat areas get the most sunlight, but many growers prefer to use slopes and hillsides which help to hide the plants. Southern slopes usually receive more sun and stronger light than eastern and western slopes, which are shaded in the afternoon and morning, respectively. Northern slopes are rarely used, since they get the least sunlight and are also the coldest. Steeper slopes are shaded sooner than gradual slopes, and lower areas are shaded earlier than high ones.

Sunlight at high altitudes is more intense, because of the thinner atmosphere and the usually lower pollution. The atmosphere and pollutants at lower elevations absorb and scatter some of the solar radiation.

Backyard gardeners usually compromise between the need for maximum light and the need for subterfuge. An area that gets several hours of direct sunlight and bright unobstructed daylight for the rest of the day will do well. A garden exposed to the south usually gets the strongest light and is the warmest. Overhanging vegetation should be pruned so that the plants are shaded as little as possible.

Most marijuana strains are acclimated to tropical and semitropical latitudes, where the daytime is relatively short (10 to 14 hours, depending on season), but the sunlight is quite strong. At latitudes in the United States, the sun is not as intense (although in the summer the difference is small), but the days are longer, and the plants can grow extremely fast. It is not true that intense sunlight is needed to grow great marijuana. However, a summer characterised by clear sunny weather will usually produce a larger and slightly more potent crop than if the season is cloudy and rainy.

Sunlight can be maximised by adequate spacing and orientation of the garden. This is covered in section 14.

Chapter 13

SOIL

Of all the factors involved in growing plants, soil is the most complex. It has its own ecology, which can be modified, enriched, or destroyed; the treatment it receives can ensure crop success or failure.

There is no such thing as the perfect soil for Cannabis. Each variety can grow within a wide range of soil conditions. Your goal is garden soil within the range for healthy growth: well-drained, high in available nutrients, and with a near neutral (7.0) pH. Cannabis grows poorly, if at all, in soils which are extremely compacted, have poor drainage, and low in fertility, or have an extreme pH.

There are several soil factors that are important to a grower; these include soil type, texture, pH, and nutrient content. We will begin this chapter by

discussing each of these topics in succession, and will then turn to discussion of fertilisers, soil-preparation techniques, and guerilla farming methods.

13.2 Types of Soil

Each soil has its own unique properties. These properties determine how the soil and plants will interact. For our purposes, all soils can be classified as sands, silts, clays, mucks, and loams. Actually, soils are usually a combination of these ingredients. If you look carefully at a handful of soil, you may notice sand granules, pieces of organic matter, bits of clay, and fine silty material.

Sandy Soils

Sands are formed from ground or weathered rocks such as limestone, quartz, granite, and shale. Sandy soils may drain too well. Consequently, they may have trouble holding moisture and nutrients, which leach away with heavy rain or watering. Some sandy soils are fertile because they contain significant amounts (up to two percent of organic matter, which also aids their water-holding capacity. Sandy soils are rich in potassium (K), magnesium (Mg), and trace elements, but are often too low in phosphorous (P) and especially nitrogen (N). N, which is the most soluble of the elements, is quickly leached from sandy soil. Vegetation on sands which is pale, yellowed, stunted, or scrawny indicates low nutrients, usually low N.

Sandy soils can be prepared for cultivation without much trouble. They must be cleared of ground cover and treated with humus, manure, or other N-containing fertilisers. In dry areas, or areas with a low water table, organic matter may be worked into the soil to increase water-holding capacity as well as fertility. Sandy soil does not usually have to be turned or tilled. Roots can penetrate it easily, and only the planting row need be hoed immediately before planting. Growers can fertilise with water-soluble mixes and treat sandy soil almost like a hydroponic medium.

Sandy soils are also good candidates for a system of sheet composting (spreading layers of uncomposted vegetative matter over the garden), which allows nutrients to gradually leach into the soil layers. Sheet composting also prevents evaporation of soil water, since it functions as a mulch.

Silts

Silts are soils composed of minerals (usually quartz) and fine organic particles. To the casual eye, they look like a mucky clay when wet, and resemble dark sand or brittle clods when dry. They are the result of alluvial flooding, that is, are deposits from flooding rivers and lakes. Alluvial soils are usually found in the Midwest, in valleys, and along river plains. The Mississippi Delta is a fertile alluvial plain.

Silts hold moisture but drain well, are easy to work when moist, and are considered among the most fertile soils. They are frequently irrigated to extend the length of the growing season. Unless they have been depleted by faulty farming techniques, silts are rich in most nutrients. They often support healthy, vigorous vegetation. This indicates a good supply of N.

Mucks

Mucks are formed in areas with ample rainfall which supports dense vegetation. They are often very fertile, but may be quite acidic. They usually contain little potassium.

Mucks range from very dense to light sandy soils. The denser ones may need heavy tilling to ensure healthy root development, but the lighter ones may be cleared and planted in mounds. Mucks can support dense vegetation, and are often turned over so that the weeds thus destroyed form a green manure.

Clay Soils

Clays are composed of fine crystalline particles which have been formed by chemical reactions between minerals. Clays are sticky when wet, and can be moulded or shaped. When dry, they form hard clods or a pattern of square cracks along the surface of the ground. Clays are usually hard to work and drain poorly. Marijuana roots have a hard time penetrating clay soils unless these soils are well-tilled to loosen them up. Additions of perlite, sand, compost, gypsum, manure, and fresh clippings help to keep the soil loose. Clay soils in low-lying areas, such as stream banks, may retain too much water, which will make the plants susceptible to root and stem rots. To prevent this, some growers construct mounds about six inches to one foot high, so that the stems and tap roots remain relatively dry.

Clay soils are often very fertile. How well marijuana does in clay soils usually depends on how well these soils drain. In certain areas "clay" soils regularly support corn cotton. This type of soil will support a good crop of marijuana. Red colour in clay soil (red dirt) indicates good aeration and a loose soil that drains well. Blue or gray clays have poor aeration and must be loosened in order to support healthy growth.

A typical schedule for preparing a heavy clay soil In the late fall, before frost, turn soil, adding fresh soil conditioners, such as leaves, grass clippings, fresh manure, or tankage. Gypsum may also be added to loosen the soil. Spread a ground cover, such as clover, vetch, or rye. In early spring, making sure to break up the large clods, and add composts and sand if needed. At planting time, till with a hoe where the seeds are to be planted.

As the composts and green manure raise the organic level in the soil, it becomes less dense. Each year, the soil is easier to work and easier for the roots to penetrate. After a few years, you may find that you only need to turn under the cover crop. No other tilling will be needed.

Loams

Loams are a combination of about 40 percent each of sand and silt, and about 20 percent clay. Organic loams have at least 20 percent organic matter. In actuality, a soil is almost always a combination of these components, and is described in terms of that combination, e.g., sandy silt, silty clay, sandy clay, or organic silty clay. Loams range from easily worked fertile soils to densely packed sod. Loams with large amounts of organic matter can support a good marijuana crop with little modification.

13.3 Humus and Composts

Humus and composts are composed of decayed organic matter, such as plants, animal droppings, and microbes. Their nutrient contents vary according to their original ingredients, but they most certainly contain fungi and other microorganisms, insects, worms, and other life forms essential for the full conversion of nutrients. As part of their life processes, these organisms take insoluble chemicals and convert them to soluble forms, which plant roots can then absorb. Humus and composts hold water well and are often added to condition the soil. This conditioning results from the aerating properties and water-holding capacity of humus and composts, as well as balanced fertility.

Humus and composts have a rich, earthy smell, look dark brown to black, and may contain partially decayed matter, such as twigs or leaves. They are produced naturally as part of the soil's life process or can be manufactured at the site by gathering native vegetation into piles. Composts cure in one to three months, depending on both ingredients and conditions. Decomposition can be speeded up by turning and adding substances high in N. Composts are frequently acidic and are sweetened with lime when they are piled. This also shortens curing time, since the desirable microbes prefer a neutral medium.

13.4 Texture

Soil texture refers to density, particle size, and stickiness, all of which affect the soil's drainage and water-holding characteristics. The most important quality of the soil for marijuana is that it drains well - that is, water does not stand in pools after a rain, and the soil is not constantly wet. In a well-drained soil, the roots are in contact with air as well as water.

Cannabis does best on medium-textured soils: soils that drain well, but can hold adequate water. Loams, silts, and sands usually drain well and are loose enough to permit good root development. Some clays and most mucks are too compact to permit the lateral roots to penetrate and grow. In addition, they often drain poorly, and when dry they may form hard crusts or clods, a condition marijuana cannot tolerate.

Several simple tests will indicate the consistency and drainage qualities of your soil. Test when the soil is moist but not wet. First, dig a hole three feet deep to check the soil profile. In a typical non-desert soil, you will find a layer of decaying matter on the surface, which evolves into a layer of topsoil. Most of the nutrients available to the plant are found at this level or are leached down from it. The topsoil layer is usually the darkest. It may only be an inch thick or may extend several feet. When in good condition, the topsoil is filled with life. Healthy topsoil contains abundant worms, bugs, and other little animals, and is interlaced with roots. If you can easily penetrate the underlying topsoil with your hands, its texture is light enough for healthy root growth.

The next layer, or subsoil, may be composed of a combination of sand, clay, and small rocks, or you may hit bedrock. Sandy, rocky, and loamy subsoils

present no problems as long as the topsoil is at least six inches thick. Clay or bedrock often indicates drainage problems, especially if the spot has a high water table and stays wet.

Next scrape up a handful of soil from each layer. Press each handful in your fist, release it, and poke the clump with a finger. If it breaks apart easily, it is sandy or loamy. Clods that stick together, dent, or feel sticky indicate clay or muck.

To test for drainage, fill the hole with water. Wait half an hour to let the moisture penetrate the surrounding soil; then fill the hole with water again. If the water drains right through, you are working with sandy soil. If it doesn't drain completely within 24 hours, the soil has poor drainage.

13.5 pH

The pH is a measure of how alkaline (bitter) or acid (sour) the soil is. The pH balance affects the solubility of nutrients, and helps the plant regulate metabolism and nutrient uptake. The scale for measuring pH runs from 0 to 14, with 7 assigned as neutral. A pH below 7 is acid; a pH above 7 is alkaline.

Marijuana grows in soils with a pH range from 5 to 8.5, but it thrives in nearly neutral soils. Relative to other field crops, it has high lime requirements, similar to those for red or white clover or sunflower. But it does well in fields where plants with medium lime requirements, such as corn, wheat, and peanuts, are grown.

The solubility of nutrients is affected by soil type as well as by the pH. In soils with a high content of organic matter, all nutrients are soluble between 5.0 and 6.5. Phosphorous, manganese, and boron are less soluble at pH values above 6.5. Acid soils are usually found in the United States east of the 100th meridian and along parts of the West Coast, and a deep topsoil layer. Marijuana does best in acid soils when the pH is adjusted to a range of 6.3 to 7.0. {Figure 58. Map of pH for US.}

Mineral soils in the dry western states may be slightly acid to highly alkaline. Most nutrients are very soluble in these soils, as long as the pH ranges from 6.0 to 7.5. Some of these soils are too alkaline (over 8.5); so their pH must be adjusted to near neutral to ensure healthy growth.

Adjusting the pH

First test the soil pH in the garden area. Previous gardeners may have adjusted native soils, or your yard soil may have been trucked in to cover poor native soils, so that the pH of your garden soil may be different from that of other soils in the area. Different soils vary in the amount of material needed to adjust the pH. Sandy soils do not require as much as loam, and loam requires less than clays, partly because of the chemistry, and partly because of the density and physical qualities of the soils' particles.

Adjusting Acid Soils

Acidic soils are treated with limestone, which is expressed as an equivalent of calcium carbonate (CaCO_3). Limestone is usually quarried and powdered, contains large amounts of trace elements, and comes in different chemical forms: ground limestone, quicklime, and hydrated lime (which is the fastest acting form). Dolomitic limestone is high in magnesium and is often used to adjust magnesium-deficient soils, such as those found in New England. Marl (ground seashells) is also mostly lime and is used to raise soil pH. Eggshells are another source of lime. They should be powdered as finely as possible, but even so, they take a long time to affect the soil. Wood ashes are alkaline and very soluble; so they have an almost immediate effect.

Every commercial lime has a calcium carbonate equivalent or neutralising power which is listed on the package. To find out how much to use, divide the total amount of limestone required by the pH test (see Figure 59) by the calcium carbonate equivalent. For instance, a field requires fifty pounds of limestone, but the calcic limestone you are using has an equivalent of 1.78. Divide the 50 by 1.78. The resulting figure, about 29 pounds, is the amount required. Commercial limes also list the grade or particle size of the powder. In order of fineness they are: superfine, pulverised, agricultural grade, and fine meal. The finer the grade, the faster the action. {Figure 59. Approximate amount of lime required to adjust pH of a 7" layer of different types of soil.}

For best results, lime should be added at least four or five months before planting. In this way, the lime has a chance to react with the soil. But acid soils can be limed profitably and time before planting, or after, as long as the lime does not come into direct contact with the plants. Most growers add lime at the same time that they fertilise and turn the soil. That way, tilling and conditioning are handled in one operation. The lime should be worked into the soil to a depth of ten inches. Lime can also be added by spreading it before a rain. Make sure that the soil is moist enough to absorb the rain, so that the lime does not run off. Growers who have not adjusted the pH can dissolve lime in water before they irrigate. However, this is not advised if the water runs through a hose or pump, because mineral buildup may occur in the equipment.

Adjusting Alkaline Soils

Most alkaline soils have a pH no higher than 7.5, which is within the range for optimum growth. Soils that are too alkaline can be adjusted by adding gypsum, which frees insoluble salts, and include iron, magnesium, and aluminium sulphate. Marijuana has a low tolerance for aluminium; so marijuana growers should use iron or magnesium sulphate in preference to aluminium sulphate. Sulphur and gypsum are worked into the soil in the same manner as lime.

{Table 19.}

Some growers correct alkaline soils by adding an organic mulch or by working acidic material into the soil. Cottonseed meal, which is acidic and high in nitrogen, can also be used. As it breaks down, cottonseed meal neutralises the soil. Pine needles, citrus rinds, and coffee grounds are all very acidic, and can be used to correct alkaline conditions. The addition of soluble nitrogen fertilisers aids the breakdown of these low-nitrogen

additives. (See Table 22 in the section on "Fertilisers" in this section.)

Adjusting Alkali Soils

Alkali soils (pH usually above 8.5) are hardpacked and crusty, and sometimes have an accumulation of white powdery salts at the surface. They may not absorb water easily and can be extremely difficult to work. To prepare alkali soils with a permeable subsurface for cultivation, farmers leach them of their toxic accumulation of salts. The soil is thoroughly moistened so that it absorbs water. Then it is flooded so that the salts travel downward out of contact with the roots. Gypsum can be added to free some of the salts so that they leach out more easily. Gypsum can be added at the rate of 75 lbs per 100 sq.ft., or 18 tons per acre. Leaching requires enormous quantities of water, an efficient irrigation system, and several months.

{Plate 1. Skylights are a good source of bright, unobstructed light. Thai plant (closest) and Colombian plants reached over 14 feet in six months.

Plate 2. Top: A hidden garden using fluorescent light, foil reflectors, and bag containers. Plants are ten weeks old. Bottom: Simple to construct dome greenhouse in southern California. At two months, some of these plants are six feet tall.

Plate 3. Upper left: Stem of a female plant. Upper right: In full sunlight, a pruned plant can grow incredibly dense. Bottom: A garden in the wilds of Oregon mountains.

Plate 4. Marijuana does well in most gardens. Top: Here a female plant is in early bloom at five months. The main stem was clipped at three months (Berkeley). Middle: Lower branches are spread out to catch the sun. Bottom: A female bud about two weeks before harvest. Leaves show some damage from leafhoppers (insects shown).

Plate 5. A giant sinsemilla cola grown from Mexican seed in northern California.

Plate 6. Top: Purple colours often appear late in life, when vigour is waning. Lower left: Resin glands glistening on a purple, female flowering shoot. Lower right: Yellow male flowers and purple leaves against a normal green leaf.

Plate 7. Top: Male flowers at different stages in development. A line of resin glands can be seen on the anthers of the open flowers. Lower left: Resin glands lining the pollen slit of an anther (x40). Middle right: Male flowers in full bloom. The leaves are covered with fallen pollen. Lower right: Gland heads may fall with the pollen grains. Mature grains are spherical in field of focus (x40).

Plate 8. Top: Resin glands on the lower (adaxial) surface of a small, fresh leaf blade. Integrals are one millimetre (x16). Middle and lower left: Stalked glands are concentrated along the veins of the lower leaf surface (x40). Lower right (x100).

Plate 9. Top: Upper (adaxial) fresh leaf surface. Left of picture, from

left to right: Sharp-pointed cystolith hair, stalked gland, and tiny bulbous gland (x40). Lower left: Upper surface of a Thai leaf (x16). Lower right: Upper surface of fresh homegrown Colombian leaf (x40).

Plate 10. A young female flower (homegrown Colombian). Resin glands are not yet fully developed (x16).

Plate 11. Top left: A mature female flower from the same plant is in Plate 10. The flower bract is swollen from the ripe seed it contains. Notice the well-developed resin glands (x25). Top right: A mixture of seeds from common marijuana varieties shows comparative size. Bottom: The tip of a sinsemilla flower at harvest. Notice cream-coloured stigmas to the left and the fresh, clear resin glands (x40).

Plate 12. Upper and lower left: An overly ripe sinsemilla flower bract. Many gland heads are brown or missing (top, x16; bottom, x40). Upper and lower right: Carefully handled Thai weed with intact glands. Notice the high concentration of glands and very long stalks on this bract (top, x16; bottom, x40).

Plate 13. Upper and lower left: A Colombian Gold. Gland contents are brown and stalks have deteriorated on this bract (top, x16; bottom, x40). Top right: Hawaiian; well-handled and showing little deterioration (bract x40). Middle right: Gland heads easily detach from stalks when overripe (leaf vein x40). Lower right: Stalked glands on both upper and lower leaf surfaces beginning to brown (leaf margin x40).

Plate 14. Top: Whitefly larvae and their honeydew excretions on the lower surface of a leaf. Middle left: Leaf showing whitefly damage and a tiny adult. Lower left: White speckles on leaves indicating mite damage. Lower right: An overdose, or overuse of pesticide, can kill the plant.

Plate 15. Upper left: Healthy green plant next to a N-deficient plant. Middle left: Ultraviolet burn. Plant was moved outdoors without conditioning. Lower left: "Bonsai" marijuana grown from a cutting. Upper right: Mg-deficient plant has chlorotic leaves dying from their tips. Lower right: Afghani variety, with characteristically wide leaf blades, show minor symptoms of N deficiency (pale leaves and red petioles).

Plate 16. Upper left: Male flowers lose some green and turn "blond" during slow drying. Upper right: Cigar joints made with undried marijuana, which is wrapped with lone blades of fan leaves before drying. Bottom: Sequence shows change in colour in one day from sun curing. {Unfortunately, all the plates are in black and white.}}

Another method of reclaiming alkali soils is by adding a thick mulch and letting it interact with the soil during the winter. The mulch should be about nine inches thick, or 130 lbs or more per 100 sq.ft. This thick layer neutralises the salts and also helps to retain moisture.

Nutrients

Marijuana is a high-energy plant which grows quickly to its full potential in a fertile soil that is rich in available nutrients. Nutrients are found

in the soil's parent materials: sand, clay, humus, minerals, rocks, and water. Nutrients dissolve in soil water (soil solution), which is then absorbed by the plant. In complex chemical processes, roots release ions in exchange for nutrients that are dissolved in the soil solution.

The soil acts as a reservoir for the nutrients. Most of them are in non-exchangeable forms: that is, they do not dissolve, or dissolve only slightly in water. Only a small percentage of the total reserve is free at any time as the result of chemical processes or microbial action. Healthy soils maintain a balance between free and unavailable nutrients, so that the plants they support continually receive the right amounts of required nutrients. Alkali soils have large supplies of compounds which are extremely soluble. The solution is so concentrated that alkali soils are often toxic to plants.

There are three primary nutrients, N (nitrogen), P (phosphorus), and K (potassium). These are the nutrients that gardeners are most likely to be concerned with and which most fertilisers supply. Soils are most likely to be deficient in one of these nutrients, especially N.

In addition to the primary nutrients, soil supplies plants with three secondary nutrients, Ca (calcium), Mg (magnesium), and S (sulfur), and seven micronutrients: iron, boron, chlorine, manganese, copper, zinc, and molybdenum. Although deficiencies of all the secondary and micronutrients are reported from various parts of the United States, serious deficiencies do not occur often. ((For a discussion of the symptoms of nutrient deficiencies in marijuana, see section 9.))

Marijuana absorbs nutrients primarily through a fine network of lateral roots which grow from the taproot. Lateral roots may spread over an area with a diameter of five feet, and may go as deep as the roots can penetrate. Plants in deep sandy soils or in soils that have porous mineral subsoils may grow roots as deep as even seven feet. Roots which can absorb nutrients from a larger area are more likely to fulfil the plants' needs than are shallow roots which result in shallow topsoil layers over compacted subsoils. When the roots have a large area from which to absorb nutrients, the soil does not need to be as fertile as when the roots are restricted to a small area by poor soil or by being grown in pots.

You can get a good indication of soil fertility by observing the vegetation that the soil supports. If the vegetation is varied, has a lush look to it, is deep green, and looks vigorous, it is probably well-supplied with nutrients. If the plants look pale, yellowed, spindly, weak, or generally unhealthy, the soil is probably deficient in one or more nutrients.

Testing

Agricultural colleges, County Extension Agents, and private companies perform soil analyses for a small fee from a sample you mail to them. The tests include nutrient, pH, and texture analyses, and are very accurate. There are also simple-to-use test kits available at nurseries and garden shops which give a fair indication of soil fertility and pH. Test results include a suggested fertiliser and lime program catered to the soil's individual requirements for the crop to be planted. Marijuana has nutrient

requirements similar to those for corn, wheat, and sugarcane, and prefers just a little more lime (a more alkaline soil) than those crops; so soil can be fertilised as it would be for those crops.

Soil tests are one indication of soil fertility. They test for available nutrients, but not for reserves that are held in the soil. Test results may also vary because of recent rainfall, changes of moisture content, and seasonal changes. Most soil tests do not measure the ability of the soil to make nutrients available. This is a very important factor when considering a fertiliser program and should not be overlooked. As an example, an uncultivated field showed only moderate amounts of N available, and indicated a need for N fertiliser. The vegetation - tall grass, weeds, and bush - had a healthy look and was dark green, and the lower leaves remained healthy. Obviously, the soil was able to supply an adequate amount of N to the plants, which withdrew it from the soil solution as it became available. The soil and plants had reached a balance, and the soil solution slowly became more dilute over the course of the season.

To a great extent, the soil's ability to maintain a constant and adequate supply of nutrients depends on the soil's humus content. Humus can support dense populations of microorganisms. As part of their life processes, microorganisms decompose organic matter in the humus. Nutrients contained in the organic matter are released by microbes as simply inorganic molecules (e.g., NO_3) which can dissolve in soil water. Generally, soils with a high humus content can keep plants supplied with more nutrients than soil tests indicate.

The Primary Nutrients

If you look at any fertiliser package, you will note three numbers on the package. They stand for N-P-K, always in that order. Marijuana does best in a soil which supplies high amounts of N and medium amounts of P and K.

Nitrogen

The availability of N is the factor most likely to limit the growth of marijuana. For fast healthy growth, marijuana requires a soil rich in available N. Nitrogen is constantly being replaced in the soil solution by microbial breakdown of organic matter. Some microorganisms can use N directly from the atmosphere. They release N as waste in the form NO_3 , which is the primary form in which plants absorb N. A small amount of N is also dissolved in falling rainwater. When the soil is moist, it loses N through leaching and to plants. In its available form (NO_3 , NO_2 , NH_4), N is very soluble and may be carried away with runoff or may drain into the subsoil.

Probably the most accurate method of measuring a soil's ability to produce N is by the percentage of organic matter in the soil (see Table 20). Organic matter releases N at a rate that is determined by the type of soil, the temperature, and the moisture. Generally, the more aerated and warmer the soil, the faster organic matter decomposes and releases N. Most professional testing services report the percentage of organic matter, and some sophisticated kits can also test for it.

In its available state, N is tested in two compounds, ammonium (NH_4) and

nitrate (NO₃). Test results are converted into PPM (parts per million) of N and then added to arrive at the total amount of N available in the soil. The formulas to convert nitrate and ammonium to N are (NO₃) * 0.226 = N, (NH₄) * 0.78 = N. Each PPM indicates 10.7 pounds of N per acre available in the top 7.87 inches. If the soil level is deeper, there is probably more N available. If it is shallower, less is available. But a test for available N gives only a fair approximation of the soil's ability to feed the plant. An individual test may be untypical because of recent leaching or depletion during the growing season.

An intensively cultivated crop of hemp takes about 250 pounds of N per acre or six pounds per 1,000 square feet from the soil during the growing season. When the plants are spaced well apart, the crop does not require as much N.

Fields which have more than 200 lbs of available N per acre (or 4.5 lbs per 1,000 sq.ft.) at the start of the growing season require no additional fertilisation. Soils with less available N will probably yield a larger crop if they are given additional N. Actually, the amount of N that can profitably be used depends on the soil and its potential to produce N as well as on other factors: how fast N is lost, the soil depth, and moisture content.

One way to calculate the amount of N to add to the soil is to build your soil to an "ideal" level. For example, an Iowa silt loam may test about 1.6 pounds of N per 1,000 sq.ft. and an organic content of 3 percent. Together, the available and potential N total about 3.2 lbs per 1,000 sq.ft. To increase the available N to 4.5 per 1,000 sp.ft., you would need to add 1.3 lbs of N.

Phosphorus

P is an important nutrient which is used directly by the soil bacteria as well as by the plant, so that an increase in the amount of P in the soil often results in an increase of N. Because of P's low solubility, it is rarely leached from the soil. It is usually found in the greatest concentration in the soil's top layers, where it accumulates as a result of decomposition of organic matter.

In slightly acid organic soil, up to one percent of the total P is available at any time. The total amounts of P in soils range from 1,000 to 10,000 lbs per acre. For example, a typical Kansas prairie soil has 3,000 lbs per acre. In soils with a lower pH, more of the P is tied up in insoluble compounds of iron or aluminium. In highly alkaline soils, the P forms insoluble compounds with calcium.

Insoluble P reacts with the dilute acids that are released during decomposition of organic matter. These compounds are available to the plants. Both the chemical processes in which P is released and the organic processes of decomposition occur faster in warm soils.

If P is available, young plants absorb it rapidly, and may take in 50 percent of their lifetime intake by the time they are only 25 percent of their adult size. Young plants grown outdoors in cold weather may grow slowly until the soil warms up and more P is available. Older plants grown

out of season in cold weather sometimes exhibit purple leaves. This condition may result from a P deficiency, because of the unavailability of P at low temperatures.

Most soil-test kits test available P, but the nutrient value of P is usually expressed as phosphoric acid (P₂O₅), which is converted using the formulas $P * 2.3 = (P_2O_5)$, $(P_2O_5) \text{ divided by } 2.3 = P$. Any soil that has available P of 25 lbs per acre (0.58 lbs per 1,000 sq.ft.) or more is well-supplied with P. Stated in terms of phosphoric acid, this is $25 * 2.3 = 57.5$ lbs per acre (1.33 lbs per 1,000 sq.ft.).

Most inexpensive soil kits test available P. Soil that test less than 1 PPM or 10.7 lbs per acre (0.25 lbs per 1,000 sq.ft.) of available P should be tested to make sure there are adequate reserves, or can be fertilised to assure maximum yield. Soil-test kits give only a fair indication of the P available. A low reading may indicate the plants are absorbing P as fast as it breaks down from its unavailable form, especially during early growth! The main factors affecting the rate at which P becomes available are the total amount of reserve P in the soil and the pH.

Most professional soil analyses include a report of reserve P. Generally soils with reserve P of 3,000 lbs per acre (70 lbs per 1,000 sq.ft.) do not need additional P. Intensively cultivated and cropped fields may have had their reserve supply depleted, and will lock up available P that is supplied as fertiliser until a balance is reached.

Potassium

K is found in adequate quantities in most soils which have a pH within the range needed for growing marijuana. K is held in soils in three forms: unavailable, fixed, and readily available. Most K is held in the unavailable form as part of the minerals feldspar and mica. But a small percentage of the total K in any soil is held in fixed, slightly soluble forms. Some of these can be absorbed and used directly by the plant. The exchangeable K is equal to a fraction of the fixed K. Each soil maintains a balance or ratio of unavailable to fixed and to exchangeable forms. Organic soils have a higher percentage of K in the fixed or available form than mineral soils. As K is used by the plants, some of the unavailable K goes into the more available forms. Plants can use K in both the soluble and the fixed forms.

Most clays and soils that are well-limed have adequate reserves of K. Acidic soils generally have low K reserves. Mucks, silts, and peats have low reserves of K, and have little capacity to hold it chemically when it is applied. Sands have K reserves, but little capacity to convert it to a fixed or available form. Most western soils have adequate reserves of K. The exchangeable K in soils becomes fixed if the soil dries out; so the available K of a recently dried soil is usually low.

K is tested in its elementary state, but when described as a nutrient, it is given as potash (K₂O). The formulas for converting are $K * 1.2 = (K_2O)$, $(K_2O) \text{ divided by } 1.2 = K$. Soils with 180 lbs or more of available potash per acre (4 lbs per 1,000 sp.ft.) have an adequate supply. The total reserve K should test no lower than 900 lbs per acre (21 lbs per 1,000 sq. ft.).

The Secondary Nutrients

Magnesium (Mg), calcium (Ca), and sulfur (S) are usually found in adequate quantities in soils suitable for growing marijuana. However, some New England soils do have Mg deficiencies. Soils which have a neutral or near-neutral pH almost always have adequate Ca and sulfur levels.

Magnesium deficiencies are corrected by adding 50 to 100 lbs of Mg per acre (2.25 lbs per 1,000 sq.ft.). The most inexpensive way to add Mg is to use a dolomitic limestone for adjusting soil pH. Dolomitic limestone is about 12 percent Mg (see Table 21); so 800 lbs of it are needed to supply 100 lbs of Mg. Dolomitic limestone releases Mg to the soil gradually. For faster action, epsom salts (magnesium sulfate, MgSO₄) can be used. Five hundred lbs of epsom salts are required to supply soil with 100 lbs of Mg. Mg deficiencies can also be corrected by using foliar sprays. Dissolve one ounce of epsom salts in a gallon of water and spray all foliage.

{Picture The relationship between soil pH and relative plant nutrient availability. The wider the bar, the more the availability. This chart is for soil types recommended in this book..

{Nitrogen - pH of 6.3 to 8
Phosphorus - 6.5 to 7.5
Potassium - 6.5 to 9
Sulfur - 6 to 9
Calcium - 6.7 to 8.5
Magnesium - 6.5 to 8.5
Iron - <4 to 6
Manganese - 4.7 to 6.5
Boron - 5 to 7 or 9
Copper and Zinc - 5 to 7
Molybdenum - 7}}

Micronutrients

Micronutrients are used by plants in minute quantities, and most soils contain enough of them to meet plant requirements. Home gardeners and guerilla farmers seldom encounter any micronutrient deficiencies. But heavily cropped lands sometimes develop a deficiency of one or more micronutrients because of crop depletion. Micronutrients are made available to the plants only if there is a delicate balance in the soil chemistry, and it is easy to create toxic conditions by adding them to soil when they are not needed. For that reason, soils should be treated with micronutrients only when symptoms occur or when the deficiency is known by analysis or past experience. Only small quantities of additives are required for treatment. Manures, composts, other organic fertilisers, lime, rock powders, and ash contain large quantities of trace elements. Active organic additives quickly release micronutrients in a form that is available to the plants.

Boron

Boron deficiencies in marijuana occur in acid soils as a result of depletion by heaving cropping. The areas most affected by it are vegetable fields in the mid-Atlantic states, alfalfa and clover fields east of the Mississippi, and truck farms and orchards in the Northwest. Boron is found in phosphate

fertilisers, gypsum, and lime, and is the main ingredient of boric acid and borax. When borax or boric acid are used, they are applied at the rate 10 to 20 lbs per acre. They are used as a foliar spray at the rate of 1 ounce per gallon of water.

Chlorine

Chlorine deficiency does not normally occur. Some chemical fertilisers contain chlorine, and toxic conditions occur infrequently. Toxic chlorine conditions are eliminated by leaching.

Copper

Copper deficiencies occur infrequently in truck farms in Florida, California, and the Great Lakes region. Wood shavings and tobacco contain large amounts of copper. A foliar spray composed of 1 ounce each of calcium hydroxide and copper sulfate (a fungicide) per gallon of water is used by commercial vegetable growers.

Iron

Iron deficiencies occur in orchards west of the Mississippi and in Florida, and in alkaline soils in which iron is largely insoluble. Lowering soil pH often solves the problem. Chelated iron, which is water-soluble, is available at most nurseries and quickly supplies iron even when pH is extreme. Humus and seaweed are excellent sources of iron.

Manganese

Manganese deficiencies occur in the Atlantic states, the Great Lakes area, Utah, and Arizona. Manganese is found in manure, seaweed, and some forest leaf mould (especially hickory and white oak). Manganese deficiencies can be corrected by using a foliar spray of manganese sulfate at the rate of 0.5 to 1.0 oz. per gal. Soil is sometimes treated with manganese sulfate at the rate of 20 to 100 lbs per acre. In neutral or alkaline soils, most of the manganese sulfate becomes fixed and unavailable to the plants by the end of the growing season.

Molybdenum

Molybdenum deficiencies occur primarily along the Atlantic and Gulf coasts and in the Great Lakes region. Plants need extremely small amounts of molybdenum, less than 1 PPM in leaf and stem tissue. Molybdenum deficiencies occur when the soil is too acidic. By raising the pH level, one can make molybdenum available.

Zinc

Zinc deficiencies occur in soils throughout the U.S., primarily because of heavy cropping. It is most likely to occur in acid-leached sandy soils, and in neutral and alkaline soils where it is insoluble. In soils with high amounts of available P, zinc is also unavailable. Many deciduous tree leaves and twigs, composts, slag, and rock phosphate contain large amounts of zinc. Zinc sulfate is used as foliar spray at the rate of 3 oz. of zinc sulfate

per gallon of water, or as a soil treatment at the rate of 100 lbs per acre. Some orchard growers drive galvanised nails into the trees to provide zinc.

13.6 Fertilisers

Most soils can benefit from a realistic soil-conditioning program. Most organic programs build soil, and minimise leaching and runoff. Programs using chemical fertilisers emphasise immediate increase in yield and a minimum of labor. The approach that you use should be tailored to the soil's needs and to your situation and goals. For example, a home gardener interested in building soil quality can easily add manure or compost to his garden. But a guerilla farmer may use concentrated chemical fertilisers, which are easy to transport to a remote area. A farmer cannot use the labor-intensive techniques which a small planter might use as a hobby. Many gardeners use both organic and inorganic fertilisers.

Organic Fertilisers

Organic fertilisers are usually less concentrated than chemical mixes. Their bulk consists of fibrous materials which condition the soil by aiding drainage and increasing the organic content and water-holding capacity. As they are decomposed by microbial action, the nutrients they contain are released in soluble form. Since this is a gradual process, there is little chance of creating toxic conditions.

Manures and composts are basic, all-purpose conditioners. They contain adequate amounts of most of the nutrients that marijuana absorbs from the soil and can be used generously. Uncomposted manures are "active" and should be used only in the fall. Over the winter they compost in the ground. Composts and composted manures can be added in the spring. Table 22 lists some common organic fertilisers which are usually available. Some of them, such as bone meal and granite dust, break down slowly and are available only after a period of time. Others are low or lacking in one or more of the major nutrients. Organic fertilisers can be combined to provide a complete balance.

Chemical Fertilisers

Most chemical fertilisers act quickly because all the nutrients are in soluble form. They are usually more concentrated than organic fertilisers, and can toxify the soil and kill the plants when they are overused. Fertilisers come in various concentrations and ratios of nutrients. All packaged fertilisers list the percentages of N-P-K (actually n-(P₂O₅)-(K₂O)). Also listed is the potential acidity or alkalinity, that is, the number of pounds of lime or sulfur required to counteract pH changes caused by the fertilisers. Chemical fertilisers are often incompatible with each other; so home gardeners who use them should buy them pre-mixed or as a complete component fertiliser set.

Solubility is a major problem with commercial fertilisers. In irrigated areas as well as areas with rainfall during the growing season, they are likely to be leached away; so they must often be applied several times during the growing season. A typical program might be to fertilise at planting and every six weeks thereafter until the beginning of flowering.

When spreading fertilisers during the growing season, do not let them come into direct contact with the roots. An easy way to fertilise during the growing season is to make a small trough between rows with the corner of a hoe. Fertiliser is placed in the depression. Some new chemical formulas release nutrients during the length of the growing season, and therefore need only one application.

Amounts to Use

The amounts of nutrient needed per acre and per 1,000 sq.ft. are shown in Table 23. Soils rich in one nutrient may be average or deficient in another. To calculate the required amount of a specific fertiliser, divide the amount of nutrient required as listed in the chart by the percentage of nutrient in the fertiliser. For instance, to add 5 lbs of N to an area by using bloodmeal, divide 5.00 by 0.15. The total comes to a little more than 33 lbs. Dried cow manure contains about 1.5 percent N. About 333 pounds of it are needed to supply 5 lbs of N. Urea, a chemical fertiliser, contains 46 percent N. Only 11 pounds are required to supply 5 lbs of N.

Planning a Garden Fertiliser Program

Now let's plan some garden fertilisation programs, to help some cultivators in three areas which have different soils and climates: New England, Kansas, and Florida. We'll see how growers with different goals adjust their garden soil.

New England

Most New England soils, and many soils in humid temperate areas, have a thick layer of humus which supplies N. New England soils also contain moderate amounts of P, but they are low in K.

Our first gardener has a typical New England soil in his backyard. From tests and observation he thinks his soil contains moderate amounts of N and P, but is low in K. A test indicated a pH of 5.8. He plans to start preparing his ten-foot-square plot (100 sq.ft.) in the fall, before frost. By planting time, he expects his backyard garden to have a pH of 6.7 and a balanced, fertile soil.

From Figure 59 he finds that the soil requires about 8.1 lbs of lime. He has decided to adjust the pH by using dolomitic limestone (with a calcium carbonate equivalent of 0.45) because farmers in the area sometimes complain of Mg deficiencies. Dividing 8.1 by 0.45, he finds that the soil requires 18 lbs of limestone. (Lime requirements divided by calcium carbonate equivalent equals the amount of limestone needed.)

He guesstimates that the N content of his soil rates between fair and medium, and figures the soil can use almost 0.2 lbs of N. He has decided to spread fresh manure from a nearby stable mixed with lime. In the spring he will turn this into the soil; at the same time, he will add manure composted with hay and table scraps. The fresh horse manure contains about 0.44 percent N. To find out how much manure he needs, he divides 0.2 (the amount of N required) by 0.0044. The total comes to about 45.5 lbs. (Nutrient required divided by percentage in fertiliser equals amount of fertiliser

needed.) The manure also contains 0.17 percent phosphoric acid (P₂O₅) and 0.35 percent potash (K₂O), referred to hereafter in this chapter as P and K, respectively. Multiplying 0.17 percent (0.0017) and 0.35 percent (0.0035) by 66 lbs, he finds that he has added 0.11 lbs of P and 0.23 lbs of K. (Lbs of fertiliser times percentage of nutrient in fertiliser equals amount of nutrient in fertiliser.)

BOX F

Chemical fertilisers usually supply P in the form of superphosphate or triple superphosphate. These chemicals are manufactured by mixing rock phosphate with acids. Potassium is supplied by means of muriate of potassium (K and chlorine) or sulfate or potash, which are mined in the Southwest and purified. All these chemicals are soluble and are available to the plant. But a portion of them gradually reacts with the soil and becomes fixed or unavailable. As this portion becomes unavailable, it increases the total reserve in the soil, which reaches a new balance of available to unavailable nutrients than before fertilisation.

Bone meals and rock phosphate, the most commonly used organic sources of P, and granite dust, a source of K, are not readily available, but increase the total reserve of nutrients and gradually increase the total amount of available nutrients. However, there is some time lag before these nutrients are available to the plant. They are usually applied in large amounts, at about three times the weight calculated for fertilisers of that concentration. But one treatment lasts four years or more, because the fertilisers remain fixed in the ground until they are used. {Table 24}

From Table 23 he finds that the soil requires about five ounces of P. How many ounces of P is 0.11 lbs? He multiplies 0.11 by 16, the number of ounces in a pound, and finds that the total is about 1.75 ounces. The soil requires another 3.25 ounces. Bone meal is about 20 percent P. To supply three ounces of P, about a pound of bone meal is required. But bone meal breaks down slowly, and is therefore applied at three times the rate used for other fertilisers; so our cultivator uses 3 lbs.

Since the K content of this New England soil is poor, about 0.3 lbs of K is required. The manure has already supplied 0.2 lbs; so the soil requires another 0.1 lb. Our cultivator decides to use wood ashes from his fireplace. Wood ashes are about 7.0 percent K. He divides 0.1 by 7 percent (0.07) and finds that the soil can use at least 1.4 lbs of ashes. He adds this in the spring just before planting, because the ashes are highly soluble. Over the winter, such highly soluble nutrients would leach away or become unavailable.

Our grower knows that some of the N in the fresh manure that was added in the fall will leach away during the winter. But the manure compost that he adds in the spring will more than make up for any losses.

A New England farmer not far from the cultivator has been rotating his field

from corn and marijuana to alfalfa and pasture for the past ten years. Each fall he adds 7 tons of manure per acre. Except for occasional additions of lime, no other fertilisation is necessary.

A rural New England grower has decided to plant in a remote mixed-forest area. The first 10 inches of soil is a rich compost of humus. It is full of life: insects, worms, and other creatures. The grower has decided to increase the fertility of the soil by using chemical mixes and dolomitic lime. He is cultivating in three clearings with a total area of about 1,000 sq.ft. He guesstimates that the soil is medium in N and P, but poor in K. It is also acid. He applied enough lime to correct the soil's natural acidity and the pH of the fertiliser.

Using Table 23, he decides that he should purchase a mix with a ratio of 50 parts of N, 10 parts of P (reading from the medium line), and 120 parts of K (from the poor line), that is, a ratio of 5-1-12. A local nursery sells commercial fertiliser with nutrient percentages of 10-5-25, close enough to the desired ratio. By taking the total amount of N required for a medium soil as listed in Table 23 (19 ounces), and dividing it by the N in the fertiliser (10 percent or 0.10), the rural grower finds the total amount of fertiliser required (190 ounces, or a little less than 12 lbs). The other nutrients are automatically added in the same ratio.

Kansas: A cultivator in Kansas decides to plant along a hidden stream bank. The banks are covered with lush vegetation as a result of runoff that contains soluble fertilisers used on nearby farms. The cultivator feels that additional fertilisers are not necessary, since the vegetation is so lush.

Another grower in Kansas found that her soil was very low in N and P, but high in K, typical of dry midwestern and western soils that support scrub vegetation. It had a nearly ideal pH. She started to prepare her 200 sq.ft. garden in the spring after the rain season ended. Using Table 23, she found that it required 3.5 lbs of N, 6 ounces of P, and no K. Activated sludge (5-3-0) was available at the local garden centre. To find out how much sludge her garden required, divide 3.5 by 5 percent (or 0.05). The total comes to 70 lbs.

Florida: A grower planting 500 sq.ft. on a deserted ranch in central Florida started with a very sandy soil whose pH was 4.9 because of sulphurous water in the ground. From Figure 59, she found that the soil required about 35 lbs of lime. To adjust the pH, she used 14.0 lbs of a limestone with a calcium carbonate equivalent of 2.5.

The soil had virtually no organic matter, and she was not sure she could use the same location next year; so she decided to apply soluble mixes throughout the growing season. From Table 23, she found that "poor" required 28 ounces of N, 4 ounces of P, and 24 ounces of K. A chemical fertiliser with nutrient percentages of 15-5-10 was on sale at a local discount store. To find out how much fertiliser is needed to supply 28 ounces of N, divide 28 by 15 percent (or 0.15); the result is about 186 ounces of N, or about 11.5 pounds. Since the other nutrients are supplied at the same proportions or at higher proportions than are required, no supplements are needed at planting time. But additional feedings will be required periodically during the growing season.

13.7 Techniques for Preparing Soils

Each garden situation is unique, and many factors help determine which garden techniques you should use. These include the soil's condition, the size and location of the garden, commitment, and personal preferences. Each technique affects the microecology in its own way. Home gardeners may use techniques that are impractical for a farmer or guerilla planter. But all growers have the same goal when they prepare soil for planting: to create a soil environment conducive to growing a healthy, vigorous plant.

BOX G Fertilising Cannabis Depends on the Crop

Historically, Cannabis is known to require high fertility. In a fertile soil, Cannabis can outgrow practically any annual plant. Cannabis also is a known depletor of soils. This is true particularly with marijuana, since seeds, flowers, and leaves comprise the harvest. Hence it's necessary to fertilise the plants each year. Hemp, on the other hand, comes from the Cannabis stem, and the fibre consists primarily of cellulose (C₆H₁₀O₅)_n. When hemp is grown, all plant parts except the fibre are returned to the soil; so the nutrients are also returned. Moderate fertilisation, if any, is all that's required for hemp farmers.

If you are already growing a vegetable garden, the chances are that your soil is in pretty good shape for growing marijuana. However, vegetable gardens may be a little acidic, particularly east of the 100th meridian. The soil should be prepared in much the same way that it is prepared for corn cultivation, with the addition of lime to raise the pH to near neutral.

Tilling

Gardens which may not have been planted recently (in the last three or four years) require more work. It is best to begin preparing the soil in the fall, before the first frost. This can be done using a spade or shovel. The ground is lifted from a depth of six or eight inches and turned over so that the top level, with its grass and weeds, becomes the bottom layer. Large clumps are broken up with a blade or hoe. Larger areas can be turned with a power hoer or rototiller. Conditioners, such as fresh leaves, composts, mulching materials, pH adjusters, and slow-release fertilisers are added and worked into the soil, so that they begin to decompose during the winter. It is especially important to add these materials if the soil is packed, mucky, or clay-like. Soluble fertilisers should not be added in the fall, since they leach to the subsoil with heavy rains.

In the spring, as soon as the ground is workable, turn it once again. If the soil still feels packed, add more conditioners. If you are using manure or other organic materials, make sure that they are well decomposed and small clean and earthy. Fresh materials tie up the N in the soil while they cure, making this nutrient unavailable to the plants. Commercial fertilisers and readily soluble organics, such as blood meal and wood ash, are added at this time.

The ground can also be seeded with clover or other legumes. Legumes (alfalfa, clover, vetch, etc.) are plants which form little nodules along their roots. The nodules contain bacteria which live in a symbiotic relationship with the plant. As part of their life processes, these bacteria absorb gaseous nitrogen from the air and convert it into a chemical form the plant can use. During its life cycle, clover uses up most of the N, although some leaks into the surrounding soil. But when the plant, or any of its leaves, die, the contents become part of the soil. The process of growing a cover crop and turning it into the soil is sometimes called green manuring.

After the last threat of frost, at about the same time that corn is planted, the soil should be worked into rows or mounds, or be hoed. At this time, the seeds should be planted. If any concentrated fertiliser is added to the soil, it should be worked into the soil and should not come into direct contact with the seeds.

The actual amount of tilling that a given soil requires depends on soil condition. Sandy soils and light loams may need no turning, since they are already loose enough to permit the roots to penetrate. Turning may break up the soil structure, damaging its ecology. These soils are easily fertilised, by using soluble mixes or by the layering technique described below. Soils which are moderately sandy can be adjusted by "breaking" and levered or pushed, but the soil is not raised. This is done about every six inches, and can be accomplished quickly. Farmers can loosen sandy soil by disking at five or six inches.

Some gardeners mulch the soil with a layer of leaves or other materials to protect it from winter winds and weather. This helps keep the soil warm so that it can be worked earlier in the spring. In states that border west of the 100th meridian, this helps prevent soil loss due to erosion from dry winds. Soil often drains well in these areas, and the ecology of the soil is better served when it is left unturned. At season's end, marijuana's stem base and root system are left in the ground to help hold topsoil. The next year's crop is planted a cover crop, such as clover, or alfalfa, which holds the soil and also enriches the nitrogen supply.

Layering

Layering is another method of cultivation. The theory behind this program is that in nature the soil is rarely turned, but builds up, as layer after layer of compostable material falls to the ground. This material, which contains many nutrients, gradually breaks down, creating a rich humus layer over a period of years.

The layering method speeds up the natural process. Since gardens are more intensely cultivated than wild fields, new material is required to replenish the soil nutrients. Gardeners like Ruth Stout "sheet compost," that is, they lay down layers of uncomposted material and let it decompose at the same time that it serves as a mulch. But most gardeners prefer to use material which is already composted. The compost shrinks and builds the topsoil layer about an inch for every six inches of compost. After several years, the soil level will be raised considerably, and the top layers will be an extremely rich, porous medium which never needs turning. In order to prevent a spillover of the soil, gardeners usually construct simple beds (using

boards) to contain the garden areas.

Layering is most successfully used on porous soils, especially sands, which contain little organic matter. It can also be used with clay soils. However, experienced growers say that clays should be turned several times before the technique is used, or the first couple of harvests will be small.

Planting a cover crop such as clover will give the soil structure. As more compost is added, the clover is covered and the new seed planted. The clover, with its N-fixing properties, remains a permanent cover crop. When marijuana seeds are to be planted, a planting row is easily tilled with a hoe. The clover protects the soil from sun-baking and its resulting water loss, and makes it harder for weed seeds to get started.

Tilling and layering are basic methods which are used with many variations. In some ways, there almost seem to be as many gardening techniques as there are gardeners. For instance, one gardener bought three cubic yards of topsoil and a cubic yard of composted steer manure. He mixed the material and filled raised beds with it to a depth of 18 inches, and had an instant high-power garden. Another grower made compost piles in his raised troughs during the winter. By planting time, the compost was complete and filled with earthworms. The beds became warmer earlier, and he could plant sooner.

A midwestern gardener used marijuana as a companion crop in much the same way Indians used corn. In between the marijuana, she planted beans and squash. She didn't get many stringbeans and only a few squash. But she believes that the beans gave the plants extra N, especially during the first six weeks, and the broad squash leaves protected the soil from the hot August sun.

A gardener in Georgia had such a sticky clay soil that a shovel once got stuck in it. He dug holes two feet deep and two feet wide with a power auger and filled them with a fertile mix of two parts sand, one part clay, three parts topsoil, and one part chicken manure. He claimed that his plants grew six feet in 10 weeks. Filling holes with a rich soil mixture is popular with guerilla farmers, who often must plant in poor native soils.

Mulching

Mulching is a labor-saving technique that many gardeners and farmers use for a multitude of reasons. A mulch placed on the ground before fall frosts helps the soil retain heat and protects it from winds and freezing temperatures. In the spring the mulched soil becomes warmer earlier in the season, and can be planted several weeks sooner than usual. A mulch cover keeps the seedlings' roots warm and eliminates a lot of weeding, since most weed seedlings cannot pierce the cover.

During the summer, mulches keep the ground cooler and more moist by absorbing and reflecting light and reducing surface evaporation. These are important points for farmers in dry areas. The water savings can be 50 percent or more.

Any plant or animal material will do for mulch. Gardeners use hay or straw, leaves, composts, manures, sawdust, bark, or plant clippings in two- to

six-inch layers. A barber in Palo Alto uses hair. Baled hay is inexpensive and easy to use as a mulch. Round hay bales unroll in a long sheet that is easy to spread over the ground, and square bales can be pulled apart into tile-like squares.

Mulches create an ideal environment for earthworms and microorganisms which condition and enrich the soil. These organisms require a relatively cool, moist, dark environment. The mulch develops a dry outer crust which reflects light, keeping the underlayers cool and moist. Materials such as leaves, bark, and sawdust decay slowly because they do not contain enough nitrogen to maintain dense populations of decomposing microorganisms. Manures and composts contain more nitrogen and decay more quickly.

With few exceptions, mulches can be applied practically any time of the year, but the best time is probably in the fall, after the crop is harvested and before the ground has frozen. Leaves, plant clippings, and straw are applied in a thick layer from six to ten inches deep. Hay is layered two to six inches deep. Denser substances, such as manures and composts, should be mixed with straw and leaves to aid decomposition. This mixture is spread in an even layer, about two to four inches deep, over the entire surface of the garden. If winds pose a problem by blowing the mulch away, you can cover it with newspapers or sheets of plastic held down with rocks. If your area is dry, give the mulch a good soaking once before frosts.

By the spring, much of the material will seem to have disappeared. But underneath the top layer, you will find a soft-textured, earthy-smelling humus, teeming with worms, insects and other small animals. This is a sign of a healthy ecosystem and a fertile soil.

Some people apply mulch in the spring, placing it between rows as they sow the seeds. The mulch keeps weeds from competing with the seedlings, absorbs the sun's warmth, and releases nutrients to the soil.

In cold areas, such as Montana, New England, and Alaska, growers place black plastic sheets over the soil. These absorb the sun's heat, allowing the soil to be planted sooner. The seedlings develop quickly in the warmer soil. The plastic is removed once the seedlings are well-established.

Newspapers and white plastic can be used to decrease water loss during the summer. They also reflect light back to the plants.

One innovative grower from western Colorado placed a sheet of white plastic over her garden and cut out holes wherever she plant the seeds. Though it is quite dry where she lives, she didn't need to water the plants until late July. And she had no problems with any weeds.

Containers

Containers are another option open to grower. Plants can be grown full-size in containers which are at least five gallons (larger would be better). Fill them with high-grade topsoil, or a plating mixture as described in section 6. Planters are a convenient compromise where the soil is particularly poor or for the home gardener who does not wish to get into large-scale gardening. But remember, eight good-sized plants can yield over four pounds

of grass.

Plants in pots need to be watered frequently, but require much less total water than a garden. The gardener can also move the plants. Some gardeners use this technique to maximise the amount of sun the plants get during the day, or as the sun's position changes with the season. And growers can easily induce early flowering by moving the plants to a darkened area. {Figure 61. Containers are convenient for outdoor gardens.}

Almost any large container that can withstand the weight of moist soil and which has holes for drainage is suitable. Containers which held toxic chemicals, herbicides, insecticides, or other possibly harmful substances should be avoided.

We have seen all kinds of ingeniously made containers. Some growers use old bathtubs, and others use wooden packing crates or bushel baskets. A simple wood container 18 inches wide, eight feet long, and 18 inches deep was made by a New Jersey grower, who grew six plants in it. Trash cans, plastic containers, barrels, and even rubber tyres have been used. One grower grew plants in one-cubic-foot bags of soil by cutting a five-inch-diameter hole in the top and poling holes for drainage. To assure drainage, growers sometimes fill the bottom of each container with a six-inch layer of stones or gravel; if you are planning to move such container, lightweight perlite would be more suitable.

13.8 Guerilla Farming

Guerilla growers often use the same techniques as home gardeners. But the soil that they start with is sometimes marginal, and the gardens are in remote, hard-to-get-to areas; so they modify the techniques to fit their needs. When it is impractical to carry bulky organic fertilisers to the growing site, guerilla farmers use highly concentrated commercial mixes. Compost and soil adjusters are gathered from the surrounding area, and the simplest, most light-weight tools are used. Some growers use horses or mules to carry equipment and material, and then use the animal to plough. The animals are quiet and, naturally, require no external power source. Experienced growers say that the animals can work as fast as or faster than a rototiller.

It is hard to generalise about details of guerilla farming, since much depends on the specific circumstances, which can vary greatly. For instance, a grower who plants along the fertile bank of a midwestern stream may not need to do more than pull out weeds and till the actual planting area. But a grower planting on a mountain slope may have to "build a soil," since soil and nutrients are washed from the slopes and down to the valleys by rainfall. For this reason, we will cover several situations separately: forest; washed-out steep areas; swamps and marshes; stream banks; grasslands and fields; and arid soils.

Forest Clearings

Clearings in forests have always been popular places to plant because they offer security from detection. They vary greatly in drainage qualities, fertility, and pH. The drainage qualities of forest soils depend on the

depth of the humus layer and the structure of the underlying subsoil. But most of the forest remaining in the U.S. is sloped, and water that is not absorbed by the soil runs off.

Soils are created in forests from the leaves, branches, animal droppings, etc., which accumulate on the forest floor. The first trees to grow are long-leaf pines, such as jack pines, which can grow in relatively infertile soils. Their roots penetrate deep into the subsoil to obtain some nutrients. Short-leaf pines, conifers, and firs appear as the humus accumulates, since they require a more fertile soil than long-leaf pines. Pine-forest soils vary in fertility from poor to fair, and are usually quite acidic. In the Northeast their pH may be as low as 3.5, but generally the pH ranges from 5.0 to 6.0. In order to support a high-energy, lime loving crop like marijuana, they require fertilisation and liming. Long-leaf pines sometimes grow in compacted clay soils, which also requires tilling.

As the soil evolves, deciduous trees (tree that drop their leaves each winter), such as oak and maple, may begin to grow. Deciduous forests, sometimes called broad-leaf or hardwood forests, have the best soils. These forest floors are covered with bushes, grasses, mosses, and other small plants. They have an adequate rainfall and a humus-rich soil, which is porous, holds water well, and can support a healthy marijuana crop, although additions of nitrogen fertilisers would probably spur growth. Hardwood forest soils have a pH range from 6.0 to 7.5. The soil in timbered forest land has a much smaller humus content, especially if it has been clearcut.

Mountain Soils and Washed-Out Steep Areas

Mountain slopes characteristically have little soil matter; their surface is composed largely of rocks, gravel, and sand. For longterm use they could be terraced so the newly formed soil is not washed away, but most growers are interested in more immediate results. These "soils" do not provide much of an anchor for marijuana's taproot and do not permit a network of lateral roots to form. Many of these soils also suffer from a low water table, since they drain rapidly. But there may be some sand and a bit of organic matter built up along gullies or in depressions or other natural traps. Such soil has usually had most of its nutrients leached out, but may contain some phosphates and potassium and considerable amounts of trace elements. The easiest way to adjust these soils is to use a well-balanced, slow-release, concentrated fertiliser. Bloodmeal, with its high N, works well with these soils.

One grower in the badlands of North Dakota used a timed-release 32-9-26 fertiliser in his "rock garden." He spread it just below the surface at the beginning of the growing season. Every time that it rained, his plants received nutrient-rich water. Toward the middle of the season, he noticed the lower leaves begin to pale, so he fertilised them periodically with urea. Heavy rains leach soluble fertilisers away, and in rainy areas they need to be applied three to four times during growth.

Containers can also be used in this environment. Growers use plastic bags or folded milk cartons instead of backpacking with a column of containers. When they get to the site, they fill the bags with a mixture of sand, as much as they can find, and gravel. The greater the ratio of sand to gravel, the

longer the container will hold water.

One grower doublelayers heavy-duty polyethylene bags, and lines them with heavy-duty paper cement sacks or burlap bags. He fills the bag with gravel, then pours in sand and shakes it. He says that the mix is just about right when it looks like a can filled with gravel with sand in the spaces. He carries on a watering and feeding program much as he would for any hydroponic system.

Swamps, Marshes, or Bogs

These soils are very high in fibrous organic material, but are low in calcium and in available N, P, K, and Mg, which are leached from the soil or are insoluble because of the low soil pH. Since these soils are constantly wet, Cannabis roots cannot come in contact with air; as a result, the plant's growth is stunted, and the lower stem becomes susceptible to stem rot. These soils need to be adjusted to support a healthy crop of marijuana; they must be drained, fertilised, and limed. On a small scale, the easiest way to modify them is by constructing raised mounds, hills, or rows, at least one foot wide at the top and two feet high. The raised areas drain well, leaving relatively dry soil. Wood chips, chopped brush, sawdust, or perlite may be added to keep the mound light and the soil loose and aerated.

Wet soils are usually highly acid and should be limed. Once the lime interacts with the soil, nutrients which were locked up become available to the plants. Since these soils are rich in organic matter and have a high rate of microbial action after they are loosened and limes, they may need little fertilisation.

Grasslands and Fields

These soils are usually fairly fertile and can support a worthwhile crop with little effort. They are usually well-drained, although they may be a little too dry or too wet. (If they have unusually large numbers of earthworms, they are probably a little too wet.) Their pH is usually between 5.5 and 6.5, although it may range up to 7.0. These soils are usually loams, which need only tilling in a two-foot radius, three or four inches deep, around each plant. All weeds and grass should be pulled from the area. Some growers mulch the cultivated area with newspapers, leaves, or dead grass. A grower in the Midwest adds crushed eggshells and a commercial timed-release fertiliser when he plants. He feels that this "extra boost" makes the difference between an adequate crop and a bountiful crop. Other growers periodically fertilise with soluble mixes. Some of these soils have to be irrigated during the long summer droughts. If they aren't, the plants won't die, but they will not grow to full size.

Stream Banks and Canal Ditches

These are some of the most convenient areas for growers to plant, since they provide an ample supply of water, which may contain fertiliser runoff. Stream banks are an area that marijuana naturally colonises, and the planter usually needs only to cultivate the area to be sown, and cut surrounding bush so that the young plants can compete with established plants. If the surrounding vegetation looks pale and stunted rather than lush green and

vigorous, the soil should be fertilised. These soils are sometimes low in calcium, which dissolves readily in water. Lime should be added to correct for acidity.

Sometimes the ground is a little too wet early in the growing season, although it dries out later on. Planting on hills or mounds is often used to solve this problem.

Arid Areas

Soils which have a low water table and dry out by June or July need to be irrigated to grow marijuana successfully. When irrigation is not feasible, growers plant along drainage ditches, streams, and canals, or look for green spots which indicate springs or underground reservoirs. Other growers use containers to minimise water loss. One grower in Arizona dug holes two feet wide and three feet deep, and lined the sides with thin polyethylene. He said that when he watered during the summer drought, he did not lose much water to the surrounding soil.

Arid soils usually have little organic matter, and drain quickly with extensive runoff. Some of them have a subsurface layer of clay, and therefore hold water on the surface until it evaporates. In any case their texture can be improved greatly by working in organic matter. The soil should be loosened at least two feet down. This loosening allows the taproot to develop deeply so that it can reach underground water during the drought.

Arid soils more often drain well, are alkaline, and contain P, K, and trace elements, but are low in N. Fish meal, cottonseed meal, blood meal, or manure may be the only additive the soil needs.

Chapter 14 PLANTING AND TRANSPLANTING

After the soil is adjusted, you are ready to prepare it for planting the seed. Sowing is an important process, since the post-germination or seedling stage is the most critical for Cannabis. You can increase the seedlings' chance of survival by sowing the seeds properly.

14.2 When to Plant

Most hemp-growing manuals advise that the seeds should be planted about two weeks after the last threat of frost, which is the same time that corn is planted. As a rule of thumb, you need not plant until this time in areas that have a growing season of five months or more. These areas include most of the United States, except for Zone One (see Figure 62) and mountainous areas of the country.

Growers in northern areas report that plants have survived light evening frosts with little or no damage. We think of marijuana as a tropical plant, experiencing no chills in its native climes. But the mountainous areas of marijuana cultivation in Mexico and Colombia often have frosts during the growing season. One grower, describing spring (April) conditions in

Nebraska, reported "plants (from tropical seed) three and four inches tall were covered with snow in the evening. By midafternoon all the snow had melted, and those little sprouts were healthy as could be."

Early-season sprouts do face more risks than later-germinating plants do. A lingering freeze or chill can weaken or kill them. Sometimes seeds or seedlings get washed away by heavy rains or flooding, or become infected from wet soil. They are also prey to hungry herbivores, who savour the tender young shoots, especially in the early spring, before the native plants have sprouted. These predators include rabbits, groundhogs, rats, mice, and possibly squirrels and cats, as well as large animals, such as deer, cattle, and sheep. Birds frequently eat the seeds and young shoots, especially if the ground looks planted. Snails and insects, such as cutworms and leafhoppers, also eat seedlings. Don't let this impressive list of dangers dim your enthusiasm. Although these problems do occur, they can be controlled or prevented with a little bit of planning (see section 16).
{Figure 62. Average date of last expected spring frost for US.}

As you can see in the Spring Thaw map (Figure 62), the last date of expected frost varies from early February in parts of Florida, Louisiana, Texas, California, and Nevada to mid-June in the coldest regions of New England and the Midwest. Planting time varies locally, as well as regionally. Fields which receive direct sun warm faster than partially shaded ones. Fields covered with a layer of compost or fresh manure, or with black plastic sheets, retain more heat and are ready to plant sooner than other fields. Mountainous areas often vary considerably in planting time. Higher ground usually stays cold longer than low-lying areas. Since soil is dark, it heats quickly when exposed to sunlight. Soil is usually warmer in the late afternoon.

The time that the soil warms also depends on the weather. During severe winters, a deeper layer of soil becomes frozen than during mild winters; so it will take longer to thaw. Soil below this layer is insulated by the ice and remains unfrozen. Spring weather, rainfall, flooding, and cloud cover also affect the soil's temperature.

Actually, the only way to know whether or not a field is ready to plant is to feel it and look at it. Examine the soil in early morning. It should be easy to work, rather than hardened from ice. There should be no large frozen clods of soil or other organic matter. There should also be no fine crystalline ice particles which glimmer in sunlight.

For fall harvest, sow outdoors after March 21, the first day of spring and the turn of the Equinox, when there are equal lengths of sun-up and sun-down. There are an additional 20 to 30 minutes of light before dawn and after sunset, for a total of 13 hours of daylight. When plants are started earlier, they may flower prematurely because of the short days. The plants may also be subject to sex reversal, and more males may develop.

There is little advantage to starting Cannabis before April. Each plant has a certain genetically defined potential for growth and size. As long as the plants have enough time to grow and develop, usually five or six months, this potential is realised (some Colombian and Asian varieties may need longer to develop). Plants started before spring grow no larger in size than

plants started during April. The younger plants are virtually indistinguishable from the older ones by harvest, and plants which are started earlier face more risks of detection and destruction. {Figure 63. Average date of earliest expected fall frosts for the US. Information about Australia can be found in an Atlas.}

However, if you are faced with a short growing season, you can get a head start by germinating the seeds a week to six weeks before the local planting time, and transplanting the seedlings outdoors at about the same time seeds would be planted in your area. You can also hasten planting time by covering the area to be sown or planted with a clear (or black) plastic sheet, which will warm the ground by the greenhouse effect.

14.3 Preparing to Sow

Growers use three basic techniques to sow marijuana: rows, hills, and broadcast. Each method is suitable within a certain range of conditions and has its own advantages and disadvantages.

Rows

Rows are convenient to use, especially for large areas. They are constructed easily using a hoe, plough, or tiller.

Rows facilitate the care of gardens and fields by setting up an organized space in which the plants and surrounding area can be reached easily by the gardener. Weeding, watering, thinning, pruning, and harvesting can be accomplished very quickly. Larger fields are planted in rows to accommodate ploughs, planters, and cultivators. They are essential when fields are flood-irrigated. Furthermore, they provide a way to use space in the most efficient possible manner. But rows make detection easier, since they have an orderliness that plants do not exhibit in nature.

On sloping and hilly ground rows are a major factor in soil conservation: such soil is easily carried away in windstorms and in the runoff after rain. For this reason, rows on hilly and sloping ground are contoured: curved to run perpendicular to the slope.

Space rows two to six feet apart; plant seeds every four to eight inches ((In any description of planting which we give, we refer to 100 percent viable seeds. In this case, for example, if seeds are tested (see section 3) and have a viability of 50 percent, sow the seeds two to four inches apart. If they have a viability of 33 percent, sow them one to two inches apart.)) (See Box H.)

To construct a row, break up any large clods on the surface of the soil. In a garden-size area this is easily done by striking them with the tongs of a rake. In larger areas a tiller or externally powered cultivator can be used. Then level the soil.

If you need to irrigate or have problems with excessive moisture, use a hoe to raise the soil in alternate rows of hills and trenches. Pat the crests of the hills with the hoe or a shovel so that they are an inch or wider at the top, and four to eight inches high than the trenches.

BOX H Plant Size and Spacing

Plants vary tremendously in size and branching habits because of many factors, including variety, soil fertility, length of growing season, amount of light received by the plant, water, spacing, and pruning. As a result, one can have no firm rule about how far apart plants should be spaced.

An individual full-grown plant may have a diameter at its base as wide as ten feet or as small as 18 inches. Most conical-shaped varieties (Colombian and Jamaican) grow between seven and 12 feet tall, and have a width between four and six feet. Mexican plants are somewhat taller and thinner, with a base diameter of three to five feet. Some exotic Indian, Central Asian, and Central African plants may have a diameter only one or two feet across. The descriptions are generalisations; there are many varieties within each country, and much variation within each variety.

Pruned plants have a much wider base than unpruned ones. Plants pruned at the fourth internode and again a month later sometimes grow twice as wide as an unpruned plant.

In order to catch as much sun as possible, rows should be orientated along a north-south axis, perpendicular to the course of the sun. The advantage of lush rows is more pronounced in southern than northern latitudes, but the solar-energy differential in north-south versus east-west rows is significant at all latitudes in the United States, and becomes more important on steep slopes. Another factor is the orientation of the garden as a whole. Plants sown in a square plot whose sides point northeast and southeast get about 10 percent more light than ones in a plot whose sides point due north and due east.

Hills

Hills and mounds are especially convenient for small plots. Low hills are often camouflaged to look like natural or wild stands, and are very useful in areas in which the land is too wet in the spring, because the hills drain above the ground level. They are easily adapted to meet unusual requirements. For example, a grower in New Mexico planted a doughnut-shaped hill eight feet in diameter and two feet thick, leaving a centre hole four feet in diameter. He placed a portable plastic tub in the hole after punching pinholes around the edges. To water he just filled the tub. In the swampy Everglades, two industrious farmers constructed a giant hill-row three feet thick and three feet high. The hill had such a good drainage that it kept the plant roots well-drained even during the rainy season.

Hills are usually constructed between two and five feet in diameter. Small hills are usually planted with 15 to 20 seeds, and large ones may be sown with as many as a hundred. The hills are spaced three to 10 feet apart, so that each groups of plants gets a maximum amount of light. Hills can grow more than you would at first suspect. For instance, if you were to grow a hill three by three feet, you could harvest six to nine large plants. Their foliage would extend two and a half feet beyond the hill, for a total of about thirty square feet of foliage space.

Broadcast Seeding

Broadcast seeding is the fastest and easiest way to sow, but is not an efficient way to use seed. Seeds are simply tossed or shaken onto the prepared ground, at the rate of about forty per square foot, and are then usually pressed into the soil with a light roller or by foot. This method is most effective in moist soils. Many of the seeds never germinate or die immediately after germination. The faster growing ones naturally stunt the others by shading them. This method is often used by guerilla farmers who want the stands to look natural and who wish to plant large areas quickly. An experienced grower can sow several acres a day by hand using this method.

Seed Count

There are approximately 2,300 medium-sized seeds in an ounce, or about 85 per gram. An acre is about 43,000 sq. ft., or a square 208 feet on side. To plant an acre in rows two feet apart with a seed every four inches requires about 90,000 seeds or 39 ounces (1,100 grams, or two pounds, seven ounces). At this rate, a ten-by-ten plot requires about 2.5 grams of seed.

A typical hill field has four-foot-wide hills spaced about seven feet apart. A typical hill and surrounding area accounts for approximately 100 square feet. There are approximately 430 hills in an acre. If each of these is planted with 100 seeds, the field requires about 43,000 seeds, which weigh about 18 ounces.

Broadcasting requires a lot more seed. At the rate of 40 seeds per square foot, a grower uses about 2.3 ounces in a ten-by-ten plot. An acre requires about 47 pounds, or 21 kilograms of seed.

How to Plant

Finally, after the soil is adjusted, and the rows or hills are built, it is time to actually plant the seeds and watch your garden begin to grow. If you are growing with clover as a cover or companion plant, dig it up to a depth of four inches and chop up the soil. Water the soil to the point that it feels almost wet. Drill a hole with a seed drill, stick, or pencil, then drop one seed into the hole, cover it gently, and pat the soil down again. Marijuana seeds are large enough to handle individually; so each one can be planted separately.

How deep one digs the holes depends on the kind of soil in which one is planting. Light woodsy or organic soils are planted 1/2 to 3/4 inch deep, so that the stem is held firmly in an upright position. Sands and light loams are planted 1/2 inch deep. Heavy loams and clay are planted 1/4 to 1/2 inch deep, so that the sprout's energy is not expended before it breaks through the soil.

If you are broadcast seeding, you can increase the germination rate tremendously by screening a layer of soil over the seeds to help keep them moist. Seeds that dry out weaken or die.

In a garden that has been mulched, lift away the mulch cover at each place you plant, and sow the seed in the underlying soil.

In soft-textured soils, instead of digging or poking holes, press each seed to the desired depth, and cover or pat the soil smooth.

14.4 Germination

The seeds need constant moisture in order to germinate. Therefore, the ground should be well-watered. Keep the soil moist by watering it with a light spray whenever it begins to feel dry. This may mean watering the immediate area once a day. You can keep the soil moist and hasten germination by covering the planted area with transparent glass or plastic. Most of the seeds should sprout in a period ranging from three days to two weeks. This variation depends on variety, age and condition of seed, and soil temperature; the warmer the soil, the faster the rate of germination.

Once they have germinated, the seedlings should be kept moist until the roots grow deep enough to absorb an adequate supply of water from the subsoil. If the ground is still moist from spring rains, as it is in many of the eastern regions, you may not have to water at all. On the other hand, there are sections of the West which are completely dependent on irrigation.

When the seedlings are only an inch or two tall, you can protect them from heavy rains or frosts by using drinking glasses, jars, or paper or plastic cups. You can protect larger plants with containers from which the bottoms have been removed. Transparent containers warm the soil by the greenhouse effect, capturing light and turning it into heat. In warm weather, use white or translucent containers, which prevent burn by reflecting some light and diffusing the rest. Containers also keep the soil moist, serve as plant markers, and protect the plants from some enemies. A grower in Berkeley, California, used cracked fish tanks to protect plants in the early spring. A guerilla farmer in the Poconos puts up four posts, one at each end of a row. She uses them as a frame for clear polyethylene covering, creating a small greenhouse.

Growers in Zone Five sometimes harvest a spring crop by transplanting indoor-grown, two-month-old plants outdoors right after the last frost date. The naturally short days and long nights trigger the plants into flowering. (See Transplanting below, and the discussion of the photoperiod in section 3.)

If started after May 15, marijuana may not have time to reach its full size or flower. This problem mainly affects growers in Zone One and in mountainous areas. But even if the plants do not grow to full size or flower, you can still harvest a potent crop of preflowering tops, which may be almost as potent as ripe buds. The harvest is not as large as a crop of buds, but it is more than worth the effort.

14.5 Transplanting

Seedlings and young plants are transplanted after the last threat of frost. If the growing season in your area is less than five months, you may want to start the plants indoors, or in cold frames, transplanting when the weather permits. A 10-by-four foot cold frame can easily hold 60 two-month-old plants. The cold frame can be constructed with two-by-two's or branches

gathered at the site. Cover the frame with a double layer of six- or eight-mil polyethylene plastic or similar material. Attach the plastic to the frame with tacks or staple-gun tacks. If the area is unprotected from the elements, slant the roof so that rain will run off. If the area is windy, place rocks or branches along the frame to add weight. Orient the cold frame to face the south.

In areas with a growing season of six months or more, plants will not necessarily get larger if they are started earlier than normal. Plants started at normal planting time catch up to the older plants by season's end. It serves no purpose to start plants before about March 21, the spring equinox.

Where there is no threat of frost (in Hawaii, southern Florida, and parts of Texas, Louisiana, and California), growers can raise a winter crop. Grow the plants for two or three months under artificial light. Plants get off to a faster start under artificial lights than natural light during the winter months. Move or transplant them before the beginning of March. Most strains will flower because of the short days (less than 12 hours of light) and fill out to well formed plants by the end of May when they are ripe.

For the normal summer crop, seedlings should be transplanted after the last threat of frost. The best time to transplant is on a rainy or cloudy day, which allows the plants to adjust to the new environment without the strain of intense sunlight. Plants grown in a cold frame or sunny window adjust more easily than plants grown under fluorescent lights. Plants grown under artificial light usually show evidence of shock when they are moved to sunlight. Near sea level they may lose some of their green colour and appear pale or yellowed. At high altitudes, such as mile-high Denver, the leaves may actually burn, turn brown, and fall. Healthy plants usually recover quickly by adjusting the new growth to the changed conditions. However, plant can be conditioned to the new environment by being placed in a partially sunny area, preferably where they are shaded during the middle of the day and receive either morning or late-afternoon sunlight. The plants need about a week to adjust.

Seedlings grown in planting pellets for up to 10 days after germination can be placed directly in the soil. Peat pots should be scored with a knife so that the lateral roots can penetrate the pot more easily. Seedlings started in milk cartons or flower pots should be removed from the container so that the roots are disturbed as little as possible. Plan on using a pot size which is root-bound by the time that you transplant. (For the relationship between pot size and number of weeks, see Table 17.) To transplant, water the area to be transplanted and the plant. Then dig a hole a bit larger than the pot and loosen the surrounding and underlying soil. Place the plant in the hole, and pack the soil so that the stem base is at the same depth that it was growing at before. Firm the soil and water the area.

In areas where ripoffs are expected, such as parts of Hawaii and California, some guerilla farmers transplant individual plants (one to each site) to sites which are widely spaced over the countryside. In this way they may lose some, but at least not all, of their plants to ripoffs.

Each plant (one to three months old) is transplanted to a cone-shaped hole,

two to three feet deep by two feet across the top. This strategy is well-suited to areas with poor soil. Since much of the hole is taken up by rootbound soil, it is easy to gather enough topsoil and sand to fill the hole. The gathered soil should also be mixed with organic or slow-release fertilisers which provide ample N and P.

Chapter 15 CARING FOR THE GROWING PLANTS

15.2 Weeding

Marijuana is a fast-growing annual whose survival depends on its ability to compete with other fast-growing weeds. At the end of each season, plants growing in a wild stand may cover the ground with thousands of seeds per square foot. Many of these are relocated by wind, runoff, and birds, and some are destroyed or die. Other never receive the conditions they need to germinate; and of those that do germinate, many die as seedling. The remaining plants compete with each other and with other weeds for the available light, nutrients, and water. Even so, wild stands may be as dense as forty plants per square foot. In order to survive the competition, Cannabis expends a great deal of its energy during the first two months growing a main shoot which is taller than the surrounding vegetation. Then it develops lateral branches which shade the shorter plants. With their source of energy - light - cut off, the shaded plants stop growing and often die.

When you cultivate - that is, eliminate weeds - the rate of germination and survival of your plants is increased enormously. Growers using clover, sheet composting, or mulch as ground cover can expect very little interference from weeds during seedling development. But plots of fertile, aerated, and cleared soil are open to colonisation by a wide range of plants; so you may have to weed several times before the marijuana's dominance is assured.

When you weed, make sure not to pull out any weed seedlings which may have roots in the same area as the Cannabis roots. Instead, cut the weeds slightly below the surface with a clipper, scissors, or your fingernails. Weeds more than six inches away can be safely pulled. Leave them to dry right on the soil. As they dry and decay, they return the soil's nutrient to it.

Growers plagued with weeds can cover the soil with mulch, paper, or polyethylene sheets. One grower found that two computer sheets fit exactly between the rows. Another used torn drapes as a temporary ground cover.

Once Cannabis has established dominance over an area, the other weeds are not able to interfere with its growth. But if there is wide spacing between the plants, the weeds may have open space and start to grow rapidly. Keep these weeds clipped short if water or nutrients are scarce.

15.3 Watering

Marijuana requires an ample supply of water to live and grow. The actual

quantities that it needs depend on the plant's size, the gardening techniques, type of soil, temperature, wind, humidity, and intensity of light. A vigorous plant may transpire several gallons of water a day during the hot summer months. If it receives less water than it needs, it stops growing, wilts, and then dries out. {Figure 66 Areas with less than 30 inches of rain usually require some irrigation.}

Seedlings

Marijuana germinates best in a moist soil. Within a week, it grows a taproot three or four inches long. By the end of the first month, the root system may stretch over an area a foot and a half in diameter and go more than one foot down. Until then, the soil should not be allowed to dry out. Plants which have germinated during warm, sunny weather may need to be watered until the roots have grown deep enough to reach sub-soil moisture. When the soil three inches below the surface feels dry, seedlings should be watered, preferably by using a watering can or the spray setting on a hose. Gently water the soil, making sure not to disturb the seedlings or the soil surrounding. The soil should be thoroughly saturated so the moisture percolates down, encouraging the roots to grow deep. If the surface is only lightly watered, the roots may grow near the surface, leading to water problems as the soil gets drier during the summer.

After the first month, Cannabis does best when the soil goes through alternating moist and dry periods. This alternation allows the lateral roots to come into contact with air. By the end of the growing season, the root system may penetrate the soil to a depth of six feet or more. As long as they are not blocked by solid rock or dense clay, the roots grow by following a trail of moisture. If the trail leads deep, the roots follow. The deeper layers of soil are less likely to dry out during hot, dry weather.

Older Plants

As a rule of thumb, Cannabis over a month old should be watered when the soil about six inches deep feels dry. But this rule provides only a rough indication that the plants need water, because there may be deeper sources of water that are not apparent. The most obvious indication of a problem is wilting. A more subtle one is slow growth during the (ordinarily fast-growing) vegetative stage.

Since you want to wet the lower layers, you should thoroughly saturate the soil. If the soil is completely saturated, it should hold water for a minimum of a week. Usually only two or three waterings a month are required by a garden that is completely dependent on irrigation.

The most efficient way to water is to let the water slowly seep into the soil, so that all the organic particles which hold the water are saturated. If the soil is very dry, and the water beads or runs off and is not absorbed, add household laundry detergent at the rate of one or two grams per gallon of water. It acts as a wetting agent, which breaks the surface tension. Once the soil is treated with a wetting agent, it usually absorbs water throughout the growing season.

In drier areas where corn, cotton, and other deep-rooted crops are irrigated, marijuana also requires an additional source of water. But in areas where there are patches of wild hemp or where deep-rooted crops grow by using available ground water, marijuana does not need to be watered, although additional water may increase its growth.

Box I

Water in General

Deep soil layers retain water much longer than the top layers. To encourage the development of a deep root system, saturate the ground when you water. The roots follow the moisture trail.

Water conditions also vary from field to field. For instance, many mid-western farmers plant along the banks of meandering streams. Even in dry areas, these plants have a natural source of water. Mountainous areas are usually well-drained and dry out before valleys do. Low-lying fields remain moist later, and are saturated by runoff from higher ground. In browned areas, farmers look for green spots which indicate underground streams, springs or runoff. Planters look for deserted wells or active water mains with leaks. Fields high in organic matter retain moisture longer than other fields, and mulching may cut water evaporation by 50 percent.

Watering Techniques

Gardeners may supply water by using a bucket, can, or water-hose. But growers with larger plots often rely on waterpumps to deliver river, lake, or well water to their gardens. Irrigation canals, drainage pipes and ditches, and water mains are sometimes convenient sources of water. The two most efficient methods of watering are the drip hose, which seeps water around the plant, and hand watering into an enclosed area around the plant's stem.

There are several kinds of drip hoses. Some have perforations every three to six inches along their length. These are useful when marijuana is planted in rows or large hills. Another kind is actually a kit, consisting of a main feeder hose and several side hoses two to four feet long. Each side hose has a metal bulb at the end which can be adjusted to regulate water flow. The bulb lies near the plant stem. A drip bottle was invented by a grower in the dry area of Nebraska who was only growing a few plants. He punched pinholes in the bottom of several one-gallon milk jugs and placed a jug near each plant. The jugs slowly watered the garden. Every few days, he refilled the jugs from a nearby irrigation ditch. As the plants grew larger, he placed more jugs around them. The drip method moistens the soil slowly, but does not flood it; so the soil and its nutrients are not washed away. Since this method allows you to decide exactly where the water goes you need not waste any on non-productive land.

Growers sometimes use elaborate setups, such as battery-electric, hand- or foot-powered, ram- or windmill-driven pumps. Foot-powered pumps are probably the most convenient for small plots. They are extremely lightweight (just a little heavier than a bicycle), inexpensive, easy to construct and disassemble, and virtually silent. Since you have much more power in your legs than in your arms, foot-powered pumps can do more work, and do it

faster, than hand-powered pumps.

Electric pumps are relatively quiet and pump an enormous amount for their small size. But they require a source of electricity. They cannot be used unless there is a power line available, although there are car alternators available which produce 110-volt current.

Gasoline pumps and electric generators are heavy and noisy. Even with a muffler, they can be heard for miles in some country areas. They require a source of fuel, and often an elaborate setup, including rigid feed tubing, fuel tank, and platform. But once they are in place, they can deliver a tremendous amount of water. They are usually used by farmers growing large plots. Sometimes growers dig a hole in which they store and run the equipment. This setup helps muffle the sound and keeps the machinery in good working order.

Ram- and windmill-powered pumps use running-water and wind energy, respectively. They come in many sizes and are often used to fill water tanks for later use. They can also be used to generate electricity to run electric pumps. They require no fuel, are usually silent, and can be constructed inexpensively.

But some farmers have devised other methods for getting water to their plants.

A farmer growing near Tucson, Arizona, trucks water to her plants twice a week using a pickup truck and four 55-gallon barrels. She attaches a garden hose to her tanks, and siphons the water to her garden, 200 feet downhill.

Two foresighted farmers in Texas carried twenty 30-gallon plastic trash cans and lids to their garden. During the spring rains, they filled the containers from nearby gullies. By the end of the rainy season, they had collected enough water to carry them through the summer drought.

A homesteader in Oregon's dry eastern section dammed a gully by using an earth stabiliser, plastic, wood and cement, and pipe. During the winter his private reservoir filled.

Farmers near Atlanta tapped into a city water main. The pressure from the water main allowed them to pipe water uphill.

15.4 Thinning

If the soil is kept moist during germination, most of the viable seeds that you planted will germinate and the seedlings will soon start to crowd each other. This happens frequently when the plants grow on their own. Then they grow into a dense hedge-like mass dominated by a few plants. The dominant plants typically have long internodes and a long sturdy stem with little branching. The shorter, bushier plants are shaded by the taller ones and become stunted from the lack of light. By thinning, you give the plants that are left enough room to grow to their full potential, and you choose the ones that you think will grow to be the best for smoking. Leave the plants that have dense foliage, are branching, and, later in the season, the ones that are the most potent.

Thin the plants as soon as they begin to touch or crowd each other. This should be repeated as often as necessary. Seeds sown six inches apart in rows two feet wide require thinning several times during the season. But guerilla farmers sometimes let the plants compete so that the garden looks more like a wild stand.

There are two methods used to thin: cutting the stem at the base so that the entire plant is destroyed, and cutting just the tops so that the plant's growth is thwarted, and the uncut plants shade it. The cut plants remain relatively inactive, and do not use much water or nutrients, but they do shade the ground and use otherwise wasted space.

15.5 Staking

Outdoor-grown plants rarely need staking. When the stem bends from the wind or rain, tiny tears in the structure develop. These are quickly mended by the plant: it grows new cells which increase the girth of the stem and make it stronger. But plants which are suffering from nutrient deficiencies or are top-heavy because of competition may need to be staked. Heavy rain sometimes cause the plants to fall over, especially if they have shallow root systems which cannot hold the added weight.

To stake, drive a sturdy rod six inches from the stem and deep enough into the ground to be able to give the plant support. Then tie the stem to the stake with wirer twists or string.

If the stem or the branch is cracked, pinched, or bent at the base, its position should be corrected and held firmly with a splint. The splint can be held with masking tape. In a few days the plant grows tissue to support the damaged area.

15.6 Pruning

Growers prune (clip or top) their plants to increase productivity, prevent detection, or to harvest early smoke. In the near future, new laws will decriminalise or legalise marijuana cultivation. These laws will probably limit legal cultivation either by the total gardening area or by the number of plants an individual or group may cultivate. Gardeners limited by space will maximise yield by cultivating a dense stand of tall, unclipped marijuana. Growers permitted to grow only a few plants will grow the largest, most productive plants possible. This is done by giving the plants the best possible growing conditions and a lot of space between plants to maximise light and minimise competition for water and nutrients.

Unpruned marijuana develops in one of three classic shapes, depending on variety. Many Mexican and Thai varieties develop into a tall, narrow bush no wider than three feet and shaped like a poplar tree. Colombian, Cambodian, Indian, and some south Mexican and Vietnamese varieties are Christmas-tree shaped. Some Moroccan and Afghani varieties have complex branching and naturally grow into small, dense bushes, about five feet tall. Marijuana usually grows to its full height by early September. Most of the marijuana plants you are likely to cultivate will grow to between eight and fifteen feet tall. Some Hawaiian and Thai varieties average between twelve and

twenty feet tall.

Increasing Yield

When marijuana is clipped to increase the number of growing shoots, the total yield at season's end may not be increased. Provided that soil and water are not limiting to growth, each plant can reach a maximum size when given enough room. The more surface area the plant presents to light, the closer it will get to its maximum potential. Where the plants are grown with much space between them, clipped plants can yield more than unclipped plants, especially if the branches are spread out to maximise the light on the plant. When the plants are grown close together, the taller a plant is, the more sunlight it will receive, and hence the larger the possible yield.

Some growers prefer to harvest a top stem that is thick with buds (colas). The largest colas form on the main growing shoot of unclipped plants. When the growing shoot is clipped from a plant, the new shoots and leaves grow slower and smaller than the main shoot of an unpruned plant because the capacity for growth is spread out over several shoots. When a plant is clipped early in the season, most of the difference in lead and bud size is made up by harvest time.

Marijuana can be pruned at any time during the seedling or vegetative growth stage, but you should prune plants when they are young if you plan on harvesting growing shoots during the season. A seedling clipped anywhere from the fourth to sixth node will usually form at least six strong growing shoots that can be harvested during the third or fourth month. If these shoots are cut again while the plant is still young, marijuana often develops into a small, very compact, hedge-like bush.

Yield can be increased by spreading the plant's branches so that more light reaches the inner growth. Cannabis stems are bent most easily when they are still green and fleshy, nearer to the new growth, but the whole plant can be bent to form a gentle arch with the top of the main stem in a horizontal position. Within a few days the side branches along the top will begin to grow vertically, competing with the main stem. They will soon develop their own horizontal side branches. To bend a plant, tie the main stem loosely with a cloth or heavy string. Tie the other end of string to a heavy weight or anchor on the ground. Don't put too much pressure on the stem as this tears some of the roots and weakens the plant. You can bend the plant a little each day until the plant is in the desired position.

You may also increase yield by bending only the growing tip. This encourages the side branches to develop sooner than they naturally would. Only the flexible part (about the last foot) is bent. To bend the top, use stiff wire or wire twists used for plastic bags and wrapping vegetables. Fasten the other end of the wire lower in the stem to hold the tip in position. {(See Figure 49.)}

A common mistake that cultivators make is pulling off the large leaves on the main stem (sun or fan leaves), when the plants are young. These leaves are removed by cultivators who believe that their removal will cause the undeveloped side shoots to grow. But fan leaves are net producers of sugar and energy, which are used by the side shoots to begin growth. Rather than

encouraging new growth, the removal of fan leaves slows growth. The plant will also be more susceptible to attacks from pests and predators.

When the plant is several weeks old and growing well, the difference between plants with their leaves removed and those left intact may not be large. The biggest difference can be seen when leaves are removed from branches just prior to, or during, flowering. The buds that form from leaf axils with leaves removed are noticeably smaller than those where the leaves have been left on the branch.

Detection

Cannabis can be detected from both the ground and the air. From the ground, marijuana is revealed by its familiar shape, unmistakable leaves, and odour. Tall plants are usually more conspicuous than shorter ones. From the air, stands may have a different colour than the surrounding vegetation, especially where natural vegetation is not as lush as marijuana. Individual plants usually have a circular profile when viewed from above; this can be altered by bending or pruning the plant. Varieties which are naturally tall-growing may need to be cut several times during the season to keep them hidden.

Plants are sometimes cut back severely, to much as half their height when they get too tall, but this may damage the plant. A less drastic topping technique is to remove the top foot of growth. Whenever new shoots get too tall they are clipped. But the plants should not be severely pruned late in the season when the growth rate has slowed (preflowering), because there will be fewer branches left on which buds can develop.

If you are trying to conceal plants behind a fence or wall, start bending or pruning the plants early, at about one month of age. By starting early and continuing to prune during the vegetative growth stage, you will train the plant to branch and fill up the area. If you wait until the plants are already tall, you may have to cut the plants back severely or clip shoots continuously.

15.7 Gardening Tips

Transplant Older Plants

A friend of ours was warned that his garden had been spotted by local authorities. Rather than cut down his four-month-old plants, he decided to transplant them. He dug the plants out, leaving a ball of soil about two feet square around the roots of each one. He wrapped each soil ball tightly in a plastic bag to transport it, and placed the plants in newly dug holes in a different spot. He kept the plants well-watered. After a few days, they recovered from transplant shock and started to grow once again.

Transplanting large plants is not easy to do, but it could save a crop. The marijuana root system is not very extensive when the plants are in fertile soil with plenty of water; the tap root may only be six inches long on a ten-foot plant.

Wind Protection

Hemp Cannabis planted closely together has been used by farmers to form a windbreak to protect other crops. If you are growing in an especially windy area such as the Midwest, you may wish to plant a perimeter of tightly spaced Cannabis to protect your garden. Construct a rope and stick fence against the windbreak to hold the plants upright and prevent them from falling into the central garden. Simply keeping the plants clipped short is a simpler approach.

Inducing Flowering

Growers may wish to induce their plants to flower early, especially in the North, where the growing season is short. Plants in containers can be moved to a dark area for 12 hours of darkness or more per day. Black sheets of polyethylene film, dark plastic bags, and large appliance cartons can be used to provide periods of uninterrupted darkness. Use the dark treatment nightly until the plants are flowering (usually after one to two weeks of long-night treatments).

Winter and Spring Crops

In southern parts of the U.S., Hawaii and parts of California, you can grow more than one crop in a season. Greenhouses that stay above freezing can also be used for year-round growing. Plants started during the winter or early spring get naturally long nights and flower early, when they are relatively small, usually no more than four feet tall. Flowering can be postponed by breaking the long nights with short periods of light. This extends the vegetative growth period, yielding older, larger plants at flowering. Start breaking the night period with artificial light when the plant is about a month old. Continue the treatment until you want the plants to flower. (See the discussion of photoperiod in section 3.)

Spring crops can be trimmed of buds when mature. The plant is left in the ground, and as the daylength increases, the plant will renew vegetative growth and flower once more in the fall. Plants can also be started in November or December indoors under lights and planted outdoors in February for harvest in April or May. The plants will grow faster under lights than they would outdoors under the weak winter sun. When they are placed outdoors, the long nights will induce flowering. By April the sunlight gets much stronger, perfect for flower development. Plants placed outdoors in February adjust easily to sunlight. Even so, they should be conditioned so that they do not suffer severe burn, as described in the Transplanting section in section 14.

Rejuvenation

Plants grown in areas where the weather is mild can survive winter when there are no heavy freezes. During the winter the plants will grow very slowly, but as soon as the weather warms, and the light gets more intense, the plants respond. This technique can also be used to obtain a second growth crop during Indian summers. The second growth is not as vigorous as the original, but it does increase the total harvest.

To prepare plants for rejuvenation, leave three or four pairs of lower branches with leaves on the plant when you harvest. The leaves need not be

large, but they must be green. Water and fertilise the plants. Within a few days the plants will show new growth.

The authors observed an outdoor container composed entirely of plants which survived a mild San Francisco Bay Area winter. These developed healthy second growth the following summer and flowered again in the fall. Some growers in Hawaii claim that their plants are three years old and that the plants have yielded as many as six crops of buds. Perennial marijuana plants also grow in Jamaica and Thailand.

Water Deprivation

Many cultivators begin to limit the amount of water their plants receive as soon as the flowers start to appear. Other growers give their plants as little water as possible after the middle of the plant's life. The plants are given small amounts of water only when they begin to wilt. (See section 9 on the reasons for stressing the plants.)

Under water stress many of the leaves may die and fall from the plant. Sometimes the plants appear "burned," and turn brown or gold. At harvest, water-stressed plants may only have buds left on them and these may have the colour, resin, and harshness typical of Colombian grass. These plants yield less grass at season's end. Not only are they smaller overall, but many of the leaves will have fallen away.

Water stress can be difficult to control in areas with heavy summer rain. Water-stressed plants often make up for their smaller size by a rapid burst of growth after a heavy rain. One method of control is to cover the ground with plastic sheets when it rains so that most of the water runs off.

Tacks and Nails

Some growers hammer nails or tacks into the stems of plants several weeks before harvest. Many growers use long thick nails; others prefer to use several half-inch-long tacks. The nails are usually placed at the base of the stem. This is supposed to "increase potency." {Figure 72. Wilted plant. Unless watered it will die.}

Stem Splitting

This is a popular way to stress used by cultivators in the United States. The stem is split (not cut) at the base to form a space through the stem. Growers place a rock, small piece of wood, an old Cannabis stem, or piece of opium (in Africa) in the split. Sometimes the wound is bound with cloth or plastic. We don't recommend this procedure, and advise you to be careful not to kill the plants and ruin the harvest.

Varieties

Outdoor growers are well-advised to plant several varieties of marijuana, because some varieties adapt to their new environment better than others. Also, each variety (and to small extent, each plant) has its own bouquet. By planting several varieties, cultivators assure themselves a varied selection of smoking material.

In areas with short growing seasons, many tropical varieties do not have a chance to flower. But immature material from these varieties may be more potent than mature flowers of a plant grown from seed of lower-quality grass. For instance, compare a flowering Mexican with a Colombian that doesn't. The Colombian may be better because the difference in varieties is so great. On the other hand, the Mexican may be better because it is flowering and has reached its full potential.

Intercropping

It is well-known that certain plants may be antagonistic to other species of plants, and that there are also beneficial relationships between species. Cannabis is known not to grow well among spinach 222. Although tomatoes and tobacco have been recommended as crops to avoid when growing marijuana, because of pests and diseases that these plants may harbor 67, marijuana grows very well in healthy tomato patches. Growers have also commented on how well marijuana grows when planted with corn, sugarcane, and beets.

Chapter 16

INSECTS AND OTHER PESTS

Outdoors, where it functions as part of an ecological system, marijuana is less susceptible to insect attacks than it is indoors. In an outdoor environment, insects are subject to the vagaries of the weather, food supply, and predators. And marijuana grows so fast that insects usually do little damage. Plants, plant eaters, and predators usually maintain an equilibrium which minimises damage. But this balance is disturbed by tilling and gardening, and may take a while to re-establish itself.

The soil surrounding your plants may be teeming with insects, and it would be unnatural not to see some on your plants. Most insects do not eat marijuana. The few that do are the food which helps to keep a small population of their predators alive. Insects in the garden need to be controlled only when there is a real threat of damage.

Marijuana is most vulnerable in its early stages. After the plant increases production of the cannabinoids and resins at the eighth or ninth week, most insects are repelled. When the plants are small, an occasional munch affects a relatively larger part of the plant. That same bite affects a relatively smaller part when the plant is larger.

The insects that infect marijuana indoors - aphids, mealy bugs, mites, and whiteflies - do best in humid conditions with constantly warm temperatures. Outdoors they rarely inflict much damage on marijuana. The pests that are most likely to damage marijuana are leafhoppers, treehoppers, cucumber beetles, thrips, flea beetles, several kinds of caterpillars, snails, and slugs. The younger the plants are, the more susceptible they are to attack. Your prime goal is to protect the plants during the first two vulnerable months. You need to keep the pest population low, so that the damage is relatively light. The pests don't have to be eliminated, only kept under control.

There are many ways to keep pests from damaging your crops. These fall into one or more of several categories: biological control; capture traps and barriers; home remedies; and chemical insecticides.

16.2 Biological Control

The theory behind biological controls is that methods for control of pests can be found within nature. These methods are safer to humans and less damaging to the environment than commercial insecticides. Gardeners have many forms of biological control at their disposal, including companion planting, use of predators, and sprays made from plant extracts or ground-up insects.

Companion Planting

Some plants, including marijuana in its later stages, produce resins or essences which repel or kill plant pests. Some of them are general repellents that affect a broad range of plant pests; others affect specific species. Generally, the heavily scented plants, such as spices, mints, and other herbs, are most likely to have these qualities.

Some of the more familiar plants used to protect gardens are the Alliums, or onion family, with garlic, chives, green onions, and other oniony-type plants as members. This group repels a broad range of plant pests such as aphids, spider mites, flea beetles, potato bugs, bean beetles, and many other insects, as well as rabbits and some deer. They are easily planted around the garden or between the marijuana plants. Just plant onion bulbs or the cloves from a garlic bulb so that the top of the bulb is about one inch deep. One garlic bulb yields quite a few cloves; so a large garden requires only a few bulbs.

Geraniums are reputed to repel leafhoppers and many kinds of beetles. These plants prefer a dry soil, thrive in full light, and usually grow two feet tall. Geraniums should be interspersed with the marijuana, or potted geraniums can be set out if problems develop. Tansy (*Tanaetum vulgare*) is a tall, fragrant, woody perennial which grows five feet tall. It protects against cut-worms, beetles, cucumber beetles, and other eaters and borers.

Mints repel many insects and are sometimes used as mouse repellents. They are especially useful for the control of the flea beetle. They thrive in semi-shaded areas with rich soil.

Marigolds can be planted to eliminate nematodes. They are fast-growing annual plants which flower profusely. They come in many varieties, ranging in height from six to 30 inches. They grow in a wide range of soils and do best in the sun. The scented varieties - usually nonhybrids - offer the most protection.

All companion plants must be planted close to the plants to be protected, since their repellent qualities spread only a short distance beyond their circumference. They are effective when they are planted before the damage is apparent, and offer long-term protection. They are used when a pest is expected. For instance, growers in the San Francisco Bay Area expect rose

leafhoppers to attack their plants. Since geraniums grow in the area as perennial plants, some growers plant them permanently in the garden. As the geraniums develop into small bushes, the hoppers leave, never to return.

Predators

Many of the insects in your garden are called beneficials, because they perform a useful service in the garden. Some of them eat decaying matter; others help in the pollination process; and some pry on insects which damage crops. Almost everyone is familiar with the ladybug, which eats aphids and insect eggs and has a voracious appetite. They are available commercially by the pint. The praying mantis eats slow-moving insects. When it first hatches, it starts out on aphids and mites. But as it grows larger, it eats bigger insects and worms. Mantis-egg cases are foam-like, straw-coloured masses which contain 100 to 300 eggs. These cases are sold commercially but can also be found in the late fall in bushy areas. Another insect which is sold commercially as a plant protector is the green or brown lacewing. It has golden eyes, looks fragile, and flies erratically. But in their larval state, lacewings eat thrips, mites, caterpillar eggs, scale, leafhopper nymphs, aphids, and mealybugs. The trichogamma wasp is an egg parasite which lays its eggs in the eggs of over 200 species of insects, including many moths and butterflies which hatch into worm pests. *Cryptolaemus* is used to destroy mealybugs. Adults are released when mealybugs appear in the spring. They seek out the mealybug colonies and lay their eggs. When the eggs hatch the larvae wander around the infested area and eat the young mealybugs.

The use of commercially bred or gathered predators is most feasible in large gardens or fields. The insects may not have much effect on small gardens, since they wander off to find food and may never return. Try to buy from manufacturers who intentionally do not feed their product before shipping. Hungry predators are more likely to stay and eat the pests.

Insects are just one groups of predators. Birds such as purple martins, robins, blue jays, chickadees, and even starlings and English sparrows eat large quantities of insects and other small pests. They can be attracted to the garden by placing a feeder, bird houses, and water in the area. When plants get larger, some gardeners let chickens, ducks, or geese run through the garden. In a short time, they pick it clean of pests and weeds. Reptiles and amphibians, including frogs, toads, snakes, lizards, and turtles, all eat garden pests and should be encouraged to make a home in the garden.

Homemade Repellents and Insecticides

Another way to control garden pests is to make sprays from plants which repel insects by using a juicer or blender or by baking a tea. Ingredients can be found in most kitchens. Chile pepper, garlic, coffee, horseradish, radish, geranium, and tobacco are the usual mainstays of herbal sprays, although most strong-smelling herbs and spices have some repellent qualities. Many gardeners experiment to see what works in their garden. For instance, if an insect which bother marijuana stays clear of a nearby weed, a tea or blended spray made form that plant may control the pest. But try it on only one plant (or part of a plant) first, because the spray may also be harmful to the marijuana.

Garlic is probably the most popular ingredient for general-purpose sprays made from kitchen ingredients. A typical formula is to soak three ounces of chopped or minced garlic in a covered container of mineral oil for a day. Then, slowly add a pint of lukewarm water in which a quarter ounce of real soap (Ivory will do) has been dissolved. Stir and let stand several hours, then strain. Use as a concentrate, adding between 20 to 100 parts water to one part concentrate.

Other recipes call for boiling the garlic or for grinding or juicing it. Some brewers add other spices to the basic formula. One recipe calls for one clove garlic, three cayenne peppers, one onion, a quarts ounce of soap, and sufficient water to blend. Let it sit for three or four days before using, and use one part concentrate to 20 parts water. Homemade tobacco teas are sometimes used as insect sprays. Use one cigarette in a quart of water. Let it brew 24 hours before using.

Snails and slugs are attracted by yeast solutions, which are easily prepared from cooking yeast, sugar, and water. This is also why gardeners have success trapping these leaf munchers in bowls of stale beer. Place deep-sided containers at the soil level. The pests slide in and drown.

Gardeners should not overlook handpicking as a viable method of pest control. The foot or a quick thumb and forefinger can eliminate large numbers of pests and can keep a small garden pest-free. Collect the bugs and drop them in a tin can with some alcohol to kill them. Early morning is the best time to collect pests, since they are slower-moving until the sun warms them.

Snails, slugs, earwigs, and some other insects gather in cool, moist areas during the heat of the day. By providing just such a space in a garden, many of these pests can be located and destroyed. Place pieces of cardboard or boards around the garden; look under them each day.

Home Remedies

Gardeners and farmers have discovered and invented ingenious ways to control insects without harming the environment. Some of the more popular ones are listed here, but there are many more, each suited to a particular situation.

Soap and water is an effective control measure for mealybugs, mites, leafhoppers (nymph stage), leaf miners, and aphids. Simply wash the plants thoroughly with a solution of two tablespoons of soap dissolved in a gallon of water. Rinse the soap off thoroughly. (Some growers feel that the addition of kerosene or alcohol makes the solution more effective, but these can harm the plants and dissolve THC.) This treatment does not eliminate all of the pests, and may need to be repeated weekly, but it does keep them under control.

Sprays are sometimes made from healthy insects, which are caught, ground up, and then sprayed back onto the plants. When the pests come in contact with the spray, they become infected with the pathogen and get sick. This method is very effective, and is considered safe, but it is not easy to capture sick insects. A variation in this technique was described in the October 1976 Organic Gardening and Farming Magazine, in which a spray was made from

healthy insects. In a followup article in the May 1977 issue, the authors theorised that any population of insects contains pathogens. If enough insects are collected, some of them are sure to be sick, and they contain enough germs to spread the disease. To make an insect spray, capture about a hundred pests. (Make sure not to include any beneficial insects or the spray may also work against them.) Using a blender, mix them with a cup of spring water, strain, and dilute with enough water to spray your garden.

Whenever making or storing sprays, use a glass container. Metal or plastic ones may react with the chemicals that the liquids contain.

Another home remedy for the control of mites and aphids is a mixture consisting of a half cup of milk in four cups of wheat flour, added to five gallons of water. When it is sprayed on the undersides of the leaves, it suffocates the insects and then flakes off as it dries.

Some growers use mulches to control insects. Cedar chips repel beetles, moths, mites, and mealybugs. Aluminium foil is used for aphid and thrip control on small plants; the reflected light disorients them and they do not land on the plants. A sprinkling of cream of tartar eliminates ants, and boric acid kills roaches. Sulfur powders, available at nurseries, are used to control mites and fungus infections.

Organic Insecticides

Pyrethrum, rotenone, and ryania are effective insecticides which come as powders (dusts) or sprays. They are concentrated form of naturally occurring plant substances, and are considered harmless to warm-blooded animals when used as directed.

Ryania, which is found in the roots of a tropical shrub, is most effective against chewing insects, worms, and larvae, which it incapacitates, rather than kills.

Rotenone is a general-purpose insecticide with little residual effect; that is, it breaks down soon after application, and is therefore one of the safest insecticides. Two or three dustings during the seedling stages afford protection against most insects and bugs.

Pyrethrum is one of the most powerful natural insecticides, and is effective against a wide range of pests. It is also relatively nontoxic to bees and ladybugs. Pyrethrums are found in the pyrethrum plant as well as in chrysanthemums. They are non-persistent, and in small doses may make the insects sick without killing them. These insecticides are available at many nurseries and may provide the surest, easiest form of protection against serious insect attack.

Barriers and Traps

In gardens and small farms, insects and other pests are sometimes controlled by the use of traps and barriers that prevent them from reaching the marijuana. When the plant are young, they can be protected from cutworms, caterpillars, snails, and slugs by a collar that is buried an inch into the ground and is six inches high. Some growers face it with aluminium foil,

which many insects seem to dislike. One ingenious grower painted collars with molasses to capture the crawlers. She also caught a significant number of leafhoppers. Commercial stickums such as Tanglefoot can also be used to trap insects.

Snails, slugs, and some crawling insects are repelled by a border perimeter of lime, potash (wood ash), sulfur, sharp sand, or cinders. Place a thin layer, six inches wide, around the perimeter of the garden, or around each plant. Flea beetles and some other flying insects are repelled by wood ashes dusted on the leaves. The powders are water-soluble; so they should be replaced after a heavy rain. Crawling pests sometimes have a hard time reaching plants grown in containers or raised beds.

Flying insects, such as leaf and treehoppers, can be prevented from getting to plants by barriers made from cheesecloth. Other growers place cardboard sticky with glue between plants, and then shake the plants. The cardboard catches a good proportion of them. One innovative grower in Palo Alto, California, placed a furniture crate, with the top cut off and with Tanglefoot spread on the inside, around each of his six plants. He said that by shaking the plants, he eliminated leafhoppers in four days.

16.3 Chemical Insecticides

Insecticides were developed as an easy way to control pests. They have an immediate dramatic effect, but the long-range damage that they do to the entire ecological system is sometimes overlooked. The chlorinated hydrocarbons, such as DDT, DDC, Aldrin, Kelthane, and Dieldrin, were the most dangerous commercial insecticides. They affect warm-blooded animals and are no longer available. (In no case should any of these be used.)

Diazinon, Sevin, and Malathion are three insecticides which are often used in nurseries to protect vegetable crops. They are considered safe for warm-blooded animals and have a limited residual effect, since they break down in a few days. But these insecticides are not too selective and may kill beneficials as well as pests. Sevin is the most toxic and kills the widest range of insects, including bees.

These chemicals come as sprays, powders, and baits, formulated for specific pests. They should be used only when an intolerable situation has developed. Plants should be harvested only after the required safety period has passed since application. This period is from two to 35 days, and is specifically listed on all insecticides that can be safely used. Insecticides should be used and handled carefully, following instructions, wearing protective clothing, with no children or pets around. It is advisable to use a mask when applying dusts and to work upwind.

16.4 Common Pests

Cucumber Beetles

Cucumber beetles are about a quarter-inch long and look a lot like ladybugs. There are several species of cucumber beetles. The striped beetle is found east of the Rocky Mountains. It is yellow, has two or three black stripes running down its back, and has a black head. The spotted cucumber beetle has

a yellow-green back with 11 or 12 black spots and a black head. There are related species, such as the banded cucumber beetle, throughout the United States. The larvae of all varieties are white, turning brownish at the ends, slender, about one-third inch long.

Cucumber beetles do the most damage in the early spring, when the adults come out of hibernation and begin to eat the new growth and leaves. These leaf-eating adults damage young marijuana, especially when there is a scarcity of other food. They also transmit bacterial diseases and viruses to the plants. Within a few weeks after they come out of hibernation, they lay their eggs at the base of plant roots. The larvae of the striped cucumber beetle feed only on melon- and cucumber-type plant roots. The spotted-beetle larvae are fond of corn, and are known as the "Southern cornroot worm" in some places.

The best way to prevent cucumber-beetle attacks is to keep the areas that you plant isolated from corn and melon plantings. Heavy mulching or tilling destroys the pests when they are hibernating. Late plantings minimise damage inflicted by cucumber beetles.

Cucumber beetles can be controlled by use of Rotenone or Malathion. Dust several times during seedling growth. These beetles are also prey to many insects, including the common garden soldier beetle, predator flies, wasps, and nematodes. Hand picking is also an effective control for cucumber beetles.

Thrips

Thrips are slender, yellow or brownish, winged insects about 1/25 inch long. They have fragile wings which keep them aloft while they are blown by the wind. Thrips have a cone-shaped mouthpart, which they use to cut stems in order to suck plant juices. The larvae look like adults, but are smaller and wingless. Most thrips feed on a range of plants, especially onion and other bulbs, and marijuana is at most a marginal part of their diet. A well-cultivated marijuana plant can outgrow and damage that thrips are likely to inflict.

Thrips hibernate in plant debris during the winter and begin sucking in early spring. They lay eggs during warm weather, and can produce a new generation every two weeks. Since thrips eat a varied diet, keeping the garden area clear of weeds is an effective control. Thrips can also be controlled by turning debris under, so that their nesting sites are destroyed.

Thrips can be controlled by use of tobacco sprays. Rotenone, or Malathion. Aluminium-foil mulches are effective thrip repellents. The light reflected from the foil confuses their sense of direction.

Flea Beetles

There are many species of flea beetles. The adults range in size between one-twentieth and one-fifth of an inch, and are usually black or metallic green or blue. They are called flea beetles because they use their enlarged hind legs to jump like fleas when disturbed. Many flea beetles are

host-specific, and probably only a few species munch on marijuana.

Flea beetles hibernate in plant debris. By ploughing the debris under, their hibernation places are eliminated, and there should be few pests the following spring. Flea beetles are repelled by a mixture of equal parts of wood ashes and limestone sprinkled on foliage every few days. Containers of the mixture may also be placed around the plants. Garlic sprays also repel flea beetles. The chemical poisons used specifically for flea beetles are stomach poisons, which break down slowly and may not be safe to inhale. Home remedies are best for flea beetles.

16.5 Vertebrate Pests

Mammals Until it develops a hard fibrous main stem, usually at about two months, the young marijuana plant attracts rodents, including mice, rabbits, moles, squirrels, groundhogs, and rats, as well as raccoons. Cats are probably the best means of rodent control. They stalk small prey, go after any movement, and are active at night, when most of these animals forage. Young plants are often protected from rodents by placing a coffee can with top and bottom removed around each plant. When the plants get bigger, they can be protected from rabbits and other animals with a wire fence three feet in height. A double layer of one-inch chicken wire is most effective. But many animals can climb or burrow; so more ingenious methods are needed to protect the plants. Rodents, especially moles, are repulsed by castor beans and castor oil. A formula that gardeners sometimes use is two parts castor oil, one part detergent, mixed to a consistency of shaving cream in a blender. Use a tablespoon of concentrate per gallon of water. Spray or mist the solution on the plants.

Rabbits shy away from blood, bloodmeal, and tankage. To use, sprinkle the powder around the perimeter of the plot in a band about a foot wide. They can also be mixed into a concentrated solution and applied as a spray. However, the smell of blood may attract mongoose or other predators, which dig up the garden in search of flesh. Noise from radios, chimes, and bells deter some animals, and human smells such as hair and urine may also deter some animals. In dry areas, a half-filled bucket of water is an effective rodent trap. The animals fall in and drown.

Deer seem to go out of their way to munch on tender marijuana leaves, but generally don't bother marijuana after it has grown for a few months. Gardeners and farmers use many ingenious techniques to keep them away from crops. Sturdy fences are the best deterrent. The fences should be about 10 feet high: the bottom five feet should be made up of single strands of wire string at two-foot intervals. The wire strands prevent deer from jumping the fence. Some growers use fresh blood, dried blood, or bloodmeal to deter them, placing it in either powder or liquid form around the perimeter of the garden. Other growers claim that human hair, or manure from predators such as wolves, bears, lions, and even dogs, keeps them out. Lion urine (glands extract) is available commercially, and is said to be an effective deterrent against many animals. {Figure 73. Tin cans protect against cutworms and many other plant eaters.}

{Figure 74. Fat rat munching marijuana.}

{Figure 75. Problem solved; or, never underestimate the power of a peanut.}

{Rat caught in mouse trap.}}

Birds

On the whole, birds are beneficial, rather than harmful, in the garden. Most of the common species, including English sparrows, robins, swallows, wrens, finches, bluejays, bluebirds, and starlings, eat insects and other garden pests as a substantial portion of their diet. The only time that birds may be harmful is during planting, when they sometimes feed on the planted seed. The main culprits seem to be starlings, sparrows, and crows. They can be kept off the planted areas physically, by means of plastic netting or fencing, which is sold commercially for the purpose, or by using scarecrows, aluminium strips, or noise makers. Once the plants have germinated, birds are no longer a threat and should be encouraged to nest in the area, since they are an ideal biological control for plant pests.

Chapter 17

GENETICS AND SEX IN CANNABIS

Sex is an inherited trait in Cannabis, and can be explained in much the same terms as human sexuality can. Like a human being, Cannabis is a diploid organism: its chromosomes come in pairs. Chromosomes are microscopic structures within the cells on which the genes are aligned. Cannabis has 10 pairs of chromosomes ($n=10$), for a total of 20 chromosomes ($2m=20$).

One pair of chromosomes carries the primary genes that determine sex. These chromosomes are labelled either X or Y. Male plants have an XY pair of sex chromosomes. Females have XX. Each parent contribute one set of 10 chromosomes, which includes one sex chromosome, to the embryo. The sex chromosome carried by the female ovule can only be X. The one carried by pollen of the male plant may be either X or Y. From the pollen, the embryo has a 50/50 chance of receiving an X, likewise for Y; hence, male and female progeny appear in equal numbers (in humans, the sperm carries either an X or a Y chromosome.)

17.2 Flowering

Male Plant

Under natural light, males usually start to flower from one to four weeks before the females. Where the photoperiod is artificially controlled, as with electric lights, males respond quickly (in about a week) to a change to short photoperiods and usually show flowers sooner than the females.

Male flowers develop quickly, in about one to two weeks on a vigorous plant, not uniformly. Scattered flowers may open a week or more before and after the general flowering, extending the flowering stage to about four weeks.

The flowering stage continues to demonstrate the male's tall, relatively sparse growth. Most of the flowers develop near the top of the plant, well above the shorter females. The immature flower buds first appear at the tips of the main stem and branches. Then tiny branches sprout from the leaf

axils, bearing smaller clusters of flowers. The immature male flowers are closed, usually green, and develop in tight clusters of knob-like buds. The main parts of the male flowers are five petal-like sepals which enclose the sexual organs. As each flower matures, the sepals open in a radiating pattern to reveal five pendulous anthers (stamens).

Inside the ovoid, sac-shaped anthers, pollen grains develop. Initially, pollen sifts through two pores near the top of the anther; then, starting from the pores, longitudinal slits slowly open (zipperlike) over the course of a day, releasing pollen to the wind. Once a flower sheds pollen, it shortly dies and falls from the plant. Normally, male plants begin to die one to two weeks after the bulk of their flowers have shed pollen. Healthy males may continue to flower for several more weeks, but secondary growth seldom has the vigour of initial bloom.

Female Plant

The female plant generally starts to flower later than the male, under either natural light or an artificially controlled photoperiod. Female marijuana plants flower when the average daily photoperiod is less than about 12 to 13 hours. However, some varieties and individuals may flower with a photoperiod of over 14 hours. Some Colombian varieties may not respond until the photoperiod falls below 12 hours for a period of up to three weeks.

The duration of flowering also depends on the particular rhythm of the variety, as well as growing conditions, and whether or not the plant is pollinated. Within these variables, females maintain vigorous growth and continue to rapidly form flowers for a period that ranges from 10 days to about eight weeks.

Females generally do not grow much taller during flowering. Growth emphasises a "filling out," as flower clusters develop from each leaf axil and growing tip. Normally, the flowers arise in pairs, but the pairs form tight cluster of 10 to over 100 individual flowers that are interspersed with small leaves. These clusters are the "buds" of commercial marijuana. Along the top of the main stem and vigorous branches, "buds" may form so thickly that the last foot or more of stem is completely covered. Usually the leaves that accompany the flowers tend toward simpler structure, until each leaf has one to three blades. {Figure 76. Female in full bloom.}

The visible parts of the female flower are two upraised stigmas, one-quarter to one-half inch long, usually white or cream, sometimes tinged with red, that protrude from a tiny, green, pod-shaped structure called the floral bract. This consists of modified leaves (bracts and bracteoles) which envelop the ovule or potential seed. The mature bract is a tiny structure, about 1/8 inch across and 1/4 inch long. When fertilised, a single seed begins to develop within the bract, which then swells until it is split by the mature seed.

Bracts are covered more densely with large resin glands than is any other part of the plant, and are the most potent part of the harvest. Resin glands may also be seen on the small leaves that are interspersed among the flowers.

The differences between male and female Cannabis become more apparent as the plants mature. The same can be said of the differences between varieties. Often, two varieties may appear to be similar, until they actually flower and fill out to different forms. These appear in many ways: some varieties maintain opposite phyllotaxy with long internodes throughout flowering; bud sizes vary from about one-half inch to about three inches, with a norm of about one to two inches; buds may be tightly arranged along the stem, yielding a "cola" two feet long and four inches thick; and some varieties only form buds along their main stem and branch tips, with a few "buds" forming along the branches.

{Figure 77. Upper left: Buds form thickly into colas along the top of the main stem and branches (full bloom). Upper right: A cola about two feet long. Lower left: A huge leafy cola. Lower right: Long, slim buds form late in the year when light is weak. (these four colas are from Mexican plants.)}

When a female is well-pollinated, growth slows and the plant's energy goes into forming seeds and thus into the continuation of the species. Some plants (but only the more vigorous ones) will renew flowering even when pollinated. Females that are not well-pollinated continue to form flowers rapidly. This extends the normal flowering period, of 10 days to four weeks, up to eight weeks or more.

Individual flowers are pollinated by individual pollen grains. In a matter of minutes from its landing on a stigma, the pollen grain begins to grow a microscopic tube, which penetrates the stigma and reaches the awaiting ovule wrapped within the bracts. The pollen tube is a passageway for the male's genetic contributions to the formation of the embryo (seed).

The union of the male and female complements of genes completes fertilisation and initiates seed formation. The stigmas, having served their purpose, shrivel and die, turning rust or brown colour. On a vigorous female, the seeds reach maturity in about 10 days. When growing conditions are poor, the seed may take five weeks to ripen to full size and colour. Naturally, all the flowers do not form, nor are they pollinated at the same time - and there will be seeds that reach maturity weeks before others do. Although each flower must be individually fertilised to produce a seed, a single male plant can release many millions of pollen grains. A large female plant can produce over 10,000 seeds.

17.3 Sexual Variants in Cannabis

Cannabis has been studied for many years because of its unusual sexuality. Besides the normal dioecious pattern, where each plant bears exclusively male or female flowers, it is not uncommon for some plants to have both male and female flowers. These are called hermaphrodites, or monoecious plants, or intersexes. Hermaphroditic plants form normal flowers of both sexes in a wide variety of arrangements, in both random and uniform distributions.

Natural Hermaphrodites

Some hermaphrodites seem to be genetically determined (protogenous). That

is, they naturally form flowers of both sexes given normal growing conditions. Possibly genes carried on the autosomes (the chromosomes other than the sex chromosomes) modify the normal sexual expression. Monoecious varieties have been developed by hemp breeders in order to ensure uniform harvests.

It is also possible that these particular are polyploid, which means they have more than the usual two sets of chromosomes. This kind of hermaphrodite may have XXY (triploid), or XXYY or XXXY (tetraploid) sex chromosomes. However, no naturally occurring polyploids have ever been verified (by observation of the chromosomes) in any population of Cannabis. Polyploids have been induced in Cannabis by using mutagens, such as the alkaloid colchicine.

Whatever then genetic explanation may be, one or more of these natural hermaphrodites may randomly appear in any garden. They are sometimes faster-maturing, have larger leaves, and are larger in overall size than their unisexual siblings. They usually form flowers of both sexes uniformly in time and distribution, and in some unusual patterns. For example, from Mexican seed, we have seen a plant on which separate flowering cluster consisted of both female and male flowers: and upper section of female flowers had upraised stigmas, and a lower section of male flowers dangled beneath the female flowers. In other plants from Mexican seed, the growing tips throughout the plant have female flowers; male flowers sprout from the leaf axils along the main stem and branches. Plants from "Thai" seed sometimes form male and female flowers on separate branches. Branches with female flowers tend to predominate, but branches having mostly male flowers are located throughout the plant.

Abnormal Flowers, Intersexes, Reversals

Gender is set in the new plant at the time of fertilisation by its inheritance of either the X or the Y chromosome from the male (staminate) plant. With germination of the seed, the environment comes into play. Heritage sets the genetic program, but the environment can influence how the program runs. (Sexual expression in Cannabis is delicately balanced between the two.) The photoperiod, for example, controls the plant's sequence of development. Also, the plant's metabolism and life processes are dependent on growing conditions. When the environment does not allow a balance to be maintained, the normal genetic program may not be followed. This is mirrored by abnormal growth or sexual expression.

{Figure 78. Upper left: Abnormal flowers. Lower left: Male flowers on a female plant. Upper right: Sexes on separate branches. Lower right: Male flower in female bud (reversing).}

Abnormal Flowers

Abnormal sexual expression includes a whole range of possibilities. Individual flowers may form abnormally, and may contain varying degrees of both male and female flower parts. For instance, a male flower may bear a stigma; or an anther may protrude from the bracts of a female flower. Abnormally formed flowers are not often seen on healthy plants, although if one looks hard enough, a few may be found in most crops. When many of the

flowers are abnormal, an improper photoperiod (coupled with poor health) is the most likely cause. Abnormal flowers sometimes form on marijuana grown out of season, such as with winter or spring crops grown under natural light.

Intersexes and Reversals Much more common than abnormally formed flowers is for the plant's sex to be confused. One may find an isolated male flower or two; or there may be many clusters of male flowers on an otherwise female plant, or vice versa. These plants are called intersexes (also hermaphrodites or monoecious plants). Intersexes due to environment causes differ from natural hermaphrodite in having random distributions and proportions of male and female flowers. In more extreme cases, a plant may completely reverse sex. For example, a female may flowers normally for several weeks, then put forth new, sparse growth, typical of the male, on which male flowers develop. The complete reversal from male flowering to female flowering also happens.

All other things being equal, the potency of intersexes and reversed plants is usually less than that of normal plants. If there are reversals or intersexes, both of the sexes will usually be affected. Female plants that reverse to male flowering show the biggest decline. Not only is the grass less potent, but the amount of marijuana harvested from male flowers is negligible compared to the amount of marijuana that can be harvested from a normal female. Plants that change from male to female flowering usually increase their potency, because of the growth of female flower bracts with their higher concentration of resin. Female flowers on male plants seldom form as thickly or vigorously as on a normal female. Between the loss in potency and the loss in yield because of females changing to males, a crop from such plants is usually inferior, in both yield and potency, to one from normal plants.

Environmental Effects

Many environmental factors can cause intersexes and sexual reversals. These include photoperiod, low light intensity, applications of ultraviolet light, low temperatures, mutilation or severe pruning, nutrient imbalances or deficiencies, senescence (old age), and applications of various chemicals (see bibliography on sex determination).

The photoperiod (or time of planting using natural light) is the most important factor to consider for normal flowering. In 1931, J. Schaffner (105) showed that the percentage of hemp plants that had confused sexual characteristics depended on the time of year they were planted. Normal flowering (less than five percent of the plants are intersexes) occurred when the seeds were sown in May, June, or July, the months when the photoperiod is longest and light intensity is strongest. When planted sooner or later in the year, the percentage of intersexuals increased steadily, until about 90 percent of the plants were intersexual when planted during November or early December.

Marijuana plants need more time to develop than hemp plants at latitudes in the United States. Considering potency, size, and normal flowering, the best time to sow for the summer crop is during the month of April. Farmers in the south could start the plants as late as June and still expect fully

developed plants.

If artificial light is used, the length of the photoperiod can influence sexual expression. Normal flowering, with about equal numbers of male and female plants, seems to occur when the photoperiod is from 15 to 17 hours of light for a period of three to five months. The photoperiod is then shortened to 12 hours to induce flowering. With longer photoperiods, from 18 to 24 hours a day, the ratio of males to females changes, depending on whether flowering is induced earlier or later in the plant's life. When the plants are grown with long photoperiods for six months or more, usually there are at least 10 percent more male than female plants. When flowering is induced within three months of age, more females develop. Actually, the extra males or females are reversed plants, but the reversals occur before the plants flower in their natural genders.

Some plants will flower normally without a cutting of the photoperiod. But more often, females will not form thick buds unless the light cycle is cut to a period of 12 hours duration. Don't make the light cycle any shorter than 12 hours, unless the females have not shown flowers after three weeks of 12-hour days. Then cut the light cycle to 11 hours. Flowers should appear in about one week.

Anytime the light cycle is cut to less than 11 hours, some intersexes or reversed plant usually develop. This fact leads to a procedure for increasing the numbers of female flowers indoors. The crops can be grown for three months under a long photoperiod (18 or more hours of light). The light cycle is then cut to 10 hours. Although the harvest is young (about five months) there will be many more female flower buds than with normal flowering. More plants will develop female flowers initially, and male plants usually reverse to females after a few weeks of flowering.

Of the other environmental factors that can affect sexual expression in Cannabis, none are as predictable as the photoperiod. Factors such as nutrients or pruning affect the plant's overall health and metabolism, and can be dealt with by two general thoughts. First, good growing conditions lead to healthy plants and normal flowering: female and male plants occur in about equal numbers, with few (if any) intersexes or reversed plants. Poor growing conditions lead to reduced health and vigour, and oftentimes to confused sex in the adult plant. Second, the age of the plants seems to influence reversals. Male plants often show female flowers when the plant is young (vigorous) during flowering. Females seven or more months old (weaker) often develop male flowers after flowering normally for a few weeks.

Anytime the plant's normal growth pattern is disrupted, normal flowering may be affected. For instance, plant propagated from cuttings sometimes reverse sex, as do those grown for more than one season.

17.4 Sexing the Plants

The female plant is more desirable than the male for marijuana cultivation. The female flowering clusters (buds) are usually the most potent parts of the harvest. Also, given room to develop, a female generally will yield twice as much marijuana as her male counterpart. More of her weight consists of top-quality buds.

Because the female yields marijuana in greater quantity and sooner you can devote your attention to nurturing the females. Where space is limited, such as in indoor gardens and small outdoor plots most growers prefer to remove the males as soon as possible, and leave all available space for the females. To harvest sinsemilla (seedless female buds), you must remove the male plants before they mature and release pollen.

Differences in the appearance of male and female Cannabis become more apparent toward maturation. During the seedling stage, gender is virtually impossible to distinguish, although in some varieties the male seedling may appear slightly taller and may develop more quickly.

We know of no way to discover gender with any certainty until each plant actually forms either pollen-bearing male flowers or seed-bearing female flowers. However, certain general characteristics may help. Using guidelines like the following, growers who are familiar with a particular variety can often predict gender fairly accurately by the middle stage of the plant's life.

Early Vegetative Growth

After the initial seedling stage, female plants generally develop more complex branching than the male. The male is usually slightly taller and less branched. (Under artificial light, the differences in height and branching are less apparent throughout growth.)

Some plants develop a marked swelling at the nodes, which is more common and pronounced on female plants.

Middle Vegetative Growth

In the second to fourth months of growth, plants commonly form a few isolated flowers long before the actual flowering stage begins. These premature flowers are most often found between the eighth and twelfth nodes on the main stem. Often they appear near each stipule (leaf spur) on several successive nodes, at a distance two to six nodes below the growing tip. These individual flowers may not develop fully and are often hard to distinguish as male or female flowers. The fuzzy white stigmas of the female flower may not appear, and the male flowers seldom opens but remains a tightly closed knob. However, the male flower differs from the female; it is raised on a tiny stalk, and the knob is symmetrical. The female flower appear stalkless and more leaflike.

The presence of premature female flowers does not assure that the plant is a female, but premature male flowers almost always indicate a male plant. Unfortunately, it is much less common for male plants to develop premature male flowers than for female flowers to appear on either plant. For example, in one garden of 25 mixed-variety plants, by age 14 weeks, 15 plants showed well-formed, premature female flowers with raised stigmas. Eight of these plants matured into females and seven became males. Only two plants showed premature male flowers and both of these developed into males. The eight remaining plants did not develop premature flowers or otherwise distinguishable organs until the actual flowering stage at the age of 21

weeks. From these eight, there were four females, three males, and one plant bearing both male and female flowers (hermaphrodite). It does seem, however, that plants bearing well-formed female flowers, on several successive node, usually turn out to be females.

Preflowering

In the week or two prior to flowering and throughout flowering, many common marijuana varieties follow two general growth patterns which depend on gender. With these varieties, you can tell gender by the spacing between the leaves (internodes). For the female, the emphasis is on compact growth. Each new leaf grows closer to the last, until the top of the plant is obscured by tightly knit leaves. The male elongates just prior to showing flowers. New growth is spaced well apart and raises the male to a taller stature. This may be the first time the male shows its classic tall, loosely arranged profile.

{Figure 79. Premature flowers are found on the main stem next to the leaf spurs. Upper left: Early female flower without stigmas. Lower left: Undifferentiated (indistinguishable). Centre: Early male flower. Upper and lower right: Well-formed female flowers on successive nodes usually indicate a female.}

17.5 Sinsemilla

Sinsemilla ((The word "sinsemilla" comes from the Spanish, and means without seeds. It is also spelled "sansimilla.")) is any marijuana consisting of seedless female flower buds. Sinsemilla is not a variety of marijuana; it is the seedless condition that results when the female flowers are not fertilised with pollen.

In the United States, most sinsemilla comes in the form of Thai sticks that are imported from Southeast Asia and Japan. Thai sticks are made up of seedless buds wrapped around a sliver of bamboo or a long wooden matchstick. The buds, which may be on one or more stems, are secured with a hemp fibre wound around the stick. A growing amount of fine sinsemilla now comes from domestic sources, such as Hawaii and California. The grass is usually boxed or bagged with pure buds that are manicured (extraneous leaf removed). Infrequently sinsemilla comes from Mexico and, rarely, from Colombia.

Sinsemilla has a reputation as high-potency marijuana, with a sweet taste and mild smoke. It doesn't have the harsh, gagging qualities of the usual Colombian and Mexican grasses. These qualities, however, have nothing to do with sinsemilla as such. The potency of any grass depends primarily on the variety and development of the plant, and the taste and mildness of the smoke depend on the condition of the plant when harvested and the cure. Heavily seeded grass can be as mild and sweet-smoking as sinsemilla when it is properly handled.

When buying grass, remember that sinsemilla indicates a conscientious effort on the grower's part to bring you the best possible product. Sinsemilla is almost pure smoking material with no wasted weight in seeds. An ounce of sinsemilla has about twice as much smoking material as a typical seeded ounce. Also, any marijuana that is fresh, with intact buds, indicated less

deterioration of cannabinoids. {Figure 80. Thai Sticks.}

Sinsemilla is becoming a preferred form of grass with homegrowers, many of whom believe that a seedless female is more potent than a seeded one, reasoning that the plant's energy goes to the production of resin rather than seed. There seem to be no scientific studies on this point. Many experienced growers believe the difference is small, perhaps 10 percent.

From observing the resin glands on the bracts, one sees that they continue to develop in size after pollination. Any difference from the unseeded state is not apparent. Whether pollination does in fact hamper or lessen resin production or potency is questionable, but the effect on the plant as a whole can be dramatic. Usually when the female is well-pollinated, growth noticeably slows, and the plant enters the last phase of life, which is seed set. Seed set is a period of incubation, in which the seeds grow and reach their mature state. New growth forms more slowly and lack the vitality of the bloom before pollination. The plant's reaction to pollination is relative. The more thoroughly pollinated the female is, the more pronounced the change in rhythm from vigorous to incubation. A plant on which only a few flowers have been fertilised continues to actively form flowers as sinsemilla.

Not all plants react alike to pollination. When the weather is good and the plant vigorous, even a well-seeded plant may bloom a second or third time before the rate of growth starts a final decline.

To put this in perspective, the main advantage to growing sinsemilla is that the plant remains in a flowering state for a longer period of time. Flowers may rapidly form for four to ten weeks. The flower buds develop larger and more thickly along the stems, yielding more top-quality grass (more buds) than in the seeded condition.

Anyone can grow sinsemilla. Simply remove the male plants before they release pollen. Given a normal spring planting, males usually flower in August and September, but may begin to flower as early as mid-July. Under artificial lights, males sometimes flower after only three months, and before the grower has shortened the photoperiod. Even though the females are not flowering, remove the males from the room before any flowers open. Indoor, the pollen will collect as dust and can fertilise the females weeks later.

Male flowers mature quickly, in about one to two weeks after the immature buds are first visible. Check each plant about twice a week to make sure you harvest all the males before any shed pollen. If you can't visit your garden consistently, then thin the garden, using the preceding section on "Sexing" as a guide. Even though you may not get all the males, the females will be more lightly seeded. Actually, even in carefully watched gardens, the females may have a few seeds. Pollination may come from an occasional male flower on a basically female plant, or a female may reverse and form male flowers. And pollen may come from a neighbour's garden, a problem that is becoming more common. But in practical terms, an occasional seed makes no difference. The female can form thousands of flowers, and when only a few are pollinated, there is little impact on the plant's growth.

Chapter 18 PROPAGATION AND BREEDING

18.2 Producing Seeds

Marijuana is naturally prolific. It has been estimated that a single male plant can produce over 500 million pollen grains⁴¹. A large female plant can bear tens of thousands of seeds. In nature, pollen is carried from the male flowers to the stigmas of the female flowers by air currents or the wind. Indoors or out, if the plants are simply left on their own, most gardens produce many more seeds than are needed for the next crop.

Seeds usually become viable within two weeks after pollination, although they may not have developed good colour by this time. The colour can take several more weeks to develop, particularly indoors or late in the year, when the light is not as strong. Once seeds are plump, well-formed, and of a mature size, most of them will be viable. When seeds have also developed good colour, their viability should be over 90 percent.

Pollination may also be carried out artificially. Pollen can be collected and transferred to the female flowers with a cotton swab or artist's brush, or shaken directly over the flowers. Store pollen in a clean, open container and keep in a dry area at moderate temperature. Remove any flowers or vegetative matter from the pollen, because they encourage fungal attack.

One advantage of artificial pollination is that only the flowers on certain plants need be pollinated. This allows you to harvest most of your grass as sinsemilla, while developing seed on part of the plant. If you have only a few plants, pollinate a single branch, or perhaps only a few lower buds, in order to leave the most potent buds seedless.

A good way to insure a thorough pollination, and to avoid contaminating other females, is to loosely tie a transparent bag containing pollen directly over individual buds, branches, or whole plants. Shake the bag to distribute the pollen and carefully remove it from several hours to a few days later.

To avoid contaminating a sinsemilla crop, you must remove any males from the garden before their flowers open. Males in pots can simply be moved to another area or room if you want to keep them growing. Male plants can complete development even in low light; so they do not need artificial light. Otherwise, the best procedure is to harvest the males intact by cutting them at their base after some flowers have formed distinct (but unopened) buds. Hang the whole plants upside down in a sheltered area where there is moderate light and where temperatures and humidity are not extreme. Place clean plates or sheet plastic beneath the plants to catch falling pollen. Generally there is enough stored water in the plant for the unopened flowers to mature and drop pollen. Well-formed flowers may open the next day. Usually all the flowers that are going to open will do so within two weeks.

Pollen gradually loses viability with time, but pollen that is about three

weeks old generally has sufficient viability for good seed production. However, the age of the pollen may influence the sex ratio of the next generation.

For instance, in a 1961 study with hemp plants 97, the percentage of females in the next generation was 20 percent higher than in the control plants (natural pollination) when pollen 14 to 17 days old was used. A small increase in female-to-male ratios also occurred when pollen was fresh (six hours or less). The age of the stigmas appeared not to affect the sex ratio.

18.3 Producing Female Seeds

If it were possible to know which seeds are female and which are male, marijuana growing would be even simpler than it is. There is not practical way to discern the gender of a seed - but there is a simpler procedure for producing seeds that will all grow into female plants.

To produce female seeds, the plants are fertilised with pollen with male flowers that appear on a basically female plant. Such flowers appear on intersexes, reversed females, and hermaphrodites (see section 17). Female plants have an XX complement of sex chromosomes; therefore, the pollen from the male flowers that form on female plants can only carry an X chromosome. All seeds produced from flowers fertilised with this "female" pollen will thus have an XX pair of sex chromosomes, which is the female genotype.

Although the male Cannabis plant can produce female flowers, it cannot produce seed; so there is no chance of mistakenly producing seed on a male plant. It is possible to use pollen from an intersexual plant that is basically male (XY); the resulting crop of seeds will have the normal 1:1 ratio of males to females. For this reason, choose a plant that is distinctly female as a pollen source. A female plant with a few random male-flower clusters, or a female plant that has reversed sex are both good pollen sources. The seed bearer can be any female, female intersex, or reversed-female plant.

In most crops, careful inspection of all the females usually reveals a few male flowers. And often, when females are left flowering for an extended period of time, some male flowers will develop. If no male flowers form, you can help to induce male flowers on female plants by severe pruning. One such procedure is to take the bulk of the harvest, but to leave behind some green leaves to maintain growth (as described in the section on "Double Harvests" in section 20). Most of the plants will continue to form female flowers, but male flowers are also likely to form. At times, the plants may not grow particularly well, and may in fact form distorted and twisted leaves, but they will produce viable seeds as long as some stigmas were white when pollinated. (Remember, it only takes a few fertile buds to produce hundreds of seeds.) Pollinate the female flowers by hand as soon as pollen becomes available.

{Figure 82. A solitary male flower on a female plant provides "female" pollen. (Also see Figure 84 for a female reversing sex.)}

{Figure 83. Growth may not be vigorous, but seeds will form if stigmas are white when pollinated.}

Under artificial lights, turn the light cycle down to eight hours after cutting the plants back. The short cycle helps to induce male flowers on female plants.

Male-free seed can also be produced by pollen from a natural hermaphrodites. The progeny, however, may inherit the hermaphroditic trait, resulting in a crop with some hermaphrodites as well as females. This could be a problem if you want to grow sinsemilla the next crop.

18.4 Breeding

Breeding Cannabis is done simply by selecting certain plants to be the pollinators and the seeds bearers. Characteristics such as fast growth, early maturation, and high potency might be the reasons for choosing one plant over another. Selection can be by means of the male plants, the females, or both. A simple procedure would be to harvest all male plants, sample each for potency, and use the most potent plant for the pollen source. At harvest, compare the seeded females for potency, and use seeds from the most potent plant for the pollen source. At harvest, compare the seeded females for potency, and use seeds from the most potent plant for the following generation.

There are two basic approaches to breeding. One is inbreeding, and the other is outbreeding. Inbreeding involves starting with a single variety and crossing individuals to produce seeds. In this way, certain desirable characteristics that the parents have in common will probably be perpetuated by the offspring.

Certain variants with unusual characteristics, such as three leaves to a node instead of the usual two leaves, can be inbred continuously until all progeny carry the trait. One problem with inbreeding is that other desirable characteristics may be lost as the new population becomes more homogeneous. Inbreeding plants indoors seems to lead in a loss in potency by the fourth generation. (Preceding generations were considered comparable to the original imported grass.)

Outbreeding is crossing two different varieties. Offspring from parents of two different varieties are called hybrids. Cannabis hybrids exhibit a common phenomenon on plants called "hybrid vigour." For reasons not wholly understood, hybrids are often healthier, larger, and more vigorous than either of their parents. {Figure 84. Upper left: An old female reversing to male flowering. Lower left: Three leaves to a node (trifoliate). Upper right: A plant with three leaves to a node alternating with one leaf on next node. Lower right: Three-leafed plants sometimes split into two growing shoots.}

A reference to cannabinoid content of hybrids from crosses between chemotypes was made in a 1972 study by the Canadian Department of Agriculture: "The ratio of THC to CBD in hybrids was approximately intermediate between the parents ... there was also occasionally a small but significant deviation toward one of the parents - not necessarily the one with the higher or lower ratio of THC to CBD." 51 This means that a cross between a midwestern weedy hemp (type III) and a fine Mexican marijuana (type I) would yield offspring with intermediate amounts of THC and CBD, and

which hence would be considered type II plants.

Homegrowers have mentioned that inbreeding plants often led to a decrease in potency after several generations. Outbreeding maintained potency, and sometimes (some growers claimed) led to increases in potency.

One area in which breeding can be useful for homegrowers is the breeding of early-maturing plants for northern farmers. Farmers in the north should always plant several varieties of marijuana. Mexican varieties generally are the fastest to mature. Individual plants that mature early and are also satisfactorily potent are used for the seed source in next year's crop. This crop should also mature early. Some growers cross plants from homegrown seed with plants from imported seed each year. This assures a maintenance of high-potency stock.

Potency Changes Over Generations

It is well-established that plants of the P1 generation (parentals, or the first homegrown plants from imported seed) maintain their chemical characteristics. (For example, type I plants yield type I progeny whose cannabinoids are about equal both quantitatively and qualitatively to those in their native grown parents.) This fact is shown by Table 25.

In the study 66 from which Table 25 has been adapted, individual plants within varieties differed by more than four times in CBD content and by more than three times in THC content. The researchers also noted that illicit marijuana samples contained proportionately less leaf material and proportionately more stem and seed material than samples grown in Mississippi. (Mississippi samples may be more dilute.) New Hampshire and Panama samples were nearly equal in terms of the sum of THC plus CBN.

One of the questions that persists in marijuana lore is what effect if any a change in latitude has on the plant chemotype over a period of generations. Non-drug types of Cannabis usually originate above 30 degrees latitude in temperate areas. Drug types of Cannabis usually originate in tropical or semitropical areas below the 30-degree parallel. Whether this is due entirely to cultural practices is questionable. More likely, the environment (natural selection) is the prime force, and cultural practices reinforce rather than determine chemotype.

Cannabis is notorious for its adaptability. Historically, there are many statements that the drug type of Cannabis will revert to the "fibre" type when planted in temperate areas, whereas the fibre type will revert to the drug type after several generations in a tropical area. That a change in chemotype is actually caused by transfer between tropical and temperate areas has not been verified scientifically. (Such studies are ongoing in Europe.) If such changes occur, it is also not known whether the change is quantitative (the plant produces less total cannabinoids) or whether it is qualitative (succeeding generations, for example, change from being high in THC and low in CBD to being high in CBD and low in THC).

We believe that qualitative changes can occur within a few generations, but can only guess what environmental factor(s) might be responsible for such a change. Probably the change has more to do with adaptation of general growth

and developmental characteristics than with particular advantages that production of either CBD or THC may bestow upon the plants.

The reason we suspect a change in chemotype is that these changes occur rapidly in evolutionary terms, in a matter of several generations. This rapidity implies that some very strong selective pressure are acting on the plant populations. Also, changes in the chemotype seem to occur globally, which implies that the selective pressures responsible are globally uniform rather than local phenomena. Such globally uniform pressures might be light intensity, daylength, ambient temperatures, and the length of the growing season. For example, in populations adapting to temperate areas, those plants that are able to grow well under relatively lower light intensity and cooler temperatures, and which are able to complete development in a relatively short growing season, would be favoured over siblings with more tropical characteristics.

Adaption acts on populations by means of whole organisms which are reacting to a total environment. Shifts in the chemotype of the population are probably linked genetically to the strong selective pressures exerted on the populations by the need to adapt general growth and maturation to either northern (temperate) or southern (tropical) conditions. {From the northern hemisphere.}

18.5 Cuttings

Marijuana growing often transcends the usual relationship between plant and growers. You may find yourself particularly attached to one of your plants. Cuttings offer you a way to continue the relationship long beyond the normal lifespan of one plant.

To take a cutting, use scissors or a knife to clip an active shoot about four to six inches below the tip. Cannabis does not root easily compared to other soft-stemmed plants. Cuttings can be rooted directly in vermiculite, Jiffy-MIX, a light soil, or in a glass of water. The cutting is ready to plant when roots are about an inch long, in about three to four weeks. A transplant compound such as Rootone can be used to encourage root growth and prevent fungi from forming.

Keep the mixture consistently moist but not too saturated. Roots need oxygen as well as water in order to grow. Change the water daily if the cutting are in a glass of water. Cuttings root best in moderate light, not in intense light (HID's) or direct sunlight. The best light is fluorescent set on constant light (24 hour photoperiod).

{Picture. Comparing rooting mediums. Left to right: One, roots both in and removed from rockwool cube; two, perlite; three and four, perlite vermiculture mixture; five, vermiculite; not shown: cuttings died in peat-pellets. Best rooting was in perlite-vermiculite mixture. Pure vermiculite also worked well.}

Cuttings taken from the same plant are genetically identical and are clones. Clones eliminate genetic differences between individuals, and hence are particularly useful in scientific experiments. By using clones, one can attribute variations between individuals specifically to outside factors.

This would be particularly useful when testing, for example, the affect of fertilisers on potency. In the 1980's, scientists finally began to use this useful tool in Cannabis experiments.

18.6 Grafting

One of the most persistent myths in marijuana lore concerns grafting Cannabis to its closest relative. Humulus, the hops plant of beer-making fame. The myth is that a hops scion (shoot or top portion of the stem) grafted to a marijuana stock (lower stem and root) will contain the active ingredients of marijuana. The beauty of such a graft is that it would be difficult to identify as marijuana and, possible, the plant would not be covered under marijuana statutes. Unfortunately, the myth is false. It is possible to successfully graft Cannabis with Humulus, but the hops portion will not contain any cannabinoids.

In 1975, the research team of Crombie and Crombie grafted hops scions on Cannabis stocks from both hemp and marijuana (Thailand) plants 205. Cannabis scions were also grafted to hops stocks. In both cases, the Cannabis portion of the graft continued to produce its characteristic amounts of cannabinoids when compared to ungrafted controls, but the hops portions of the grafts contained no cannabinoids. This experiment was well-designed and carried out. Sophisticated methods were used for detecting THC, THCV, CBD, CBC, CBN, and CBG. Yet none of these were detected in the hops portions.

The grafting myth grew out of work by H.E. Warmke, which was carried out for the government during the early 1940's in an attempt to develop hemp strains that would not contain the "undesirable" drug 58. The testing procedure for the active ingredients was crude. Small animals, such as the water flea Daphnia, were immersed in water with various concentration of acetone extracts from hemp. The strength of the drug was estimated by the number of animals killed in a given period of time. As stated by Warmke, "The Daphnia assay is not specific for the marijuana drug ... once measures any and all toxic substances in hemp (or hop) leaves that are extracted with acetone, whether or not these have specific marijuana activity." Clearly it was other compounds, not cannabinoids, that were detected in these grafting experiments.

Unfortunately, this myth has caused some growers to waste a lot of time and effort in raising a worthless stash of hops leaves. It has also leg growers to some false conclusions about the plant. For instance, if the hops scion contains cannabinoids, the reasonable assumption is that the cannabinoids are being produced in the Cannabis part and translocated to the hops scion, or that the Cannabis root or stem is responsible for producing the cannabinoids precursors.

From this assumption, growers also get the idea that the resin is flowing in the plant. The myth has bolstered the ideas that cutting, splitting, or bending the stem will send the resin up the plant or prevent the resin from going down the plant. As explained in our discussion of resin glands in section 2, these ideas are erroneous. Only a small percentage of the cannabinoids are present in the internal tissues (laticiferous cells) of the plant. Almost all the cannabinoids are contained and manufactured in the resin glands, which cover the outer surfaces of the above-ground plant

parts. Cannabinoids remain in the resin glands and are not translocated to other plant parts.

We have heard several claims that leaves from hops grafted on marijuana were psychoactive. Only one such case claimed to be first hand, and we never did see or smoke the material. We doubt these claims. Hops plants do have resin glands similar to those on marijuana, and many of the substances that make up the resin are common to both plants. But of several species and many varieties of hops tested with modern techniques for detecting cannabinoids, no cannabinoids have ever been detected 212.

The commercially valuable component of hops is lupulin, a mildly psychoactive substance used to make beer. To our knowledge, no other known psychoactive substances has been isolated from hops. But since these grafting claims persist, perhaps pot-heads should take a closer look at the hops plant.

Most growers who have tried grafting Cannabis and Humulus are unsuccessful. Compared to many plants, Cannabis does not take grafts easily. Most of the standard grafting techniques you've probably seen for grafting Cannabis simply don't work. For example, at the University of Mississippi, researchers failed to get one successful graft from the sixty that were attempted between Cannabis and Humulus. A method that works about 40 percent of the time is as follows. (Adapted from 205)

Start the hops plants one to two weeks before the marijuana plants. Plant the seeds within six inches of each other or start them in separate six-inch pots. The plants are ready to graft when the seedling are strong (about five and four weeks respectively) but their stem has not lost their soft texture. Make a diagonal incision about halfway through each stem at approximate the same levels (hops is a vine). Insert the cut portions into each other. Seal the graft with cellulose tape, wound string, or other standard grafting materials. In about two weeks, the graft will have taken. Then cut away the unwanted Cannabis top and the hops bottom to complete the graft. Good luck, but don't expect to get high from the hops leaves. {Smoking any plant's leaves will give a short, slight buzz.}

18.7 Polyploids

H.R. Warmke also experimented with breeding programs during the war years. Polyploid Cannabis plants were produced by treatment with the alkaloid colchicine. Colchicine interferes with normal mitosis, the process in which cells are replicated. During replication, the normal doubling of chromosomes occurs, but colchicine prevents normal separation of the chromosomes into two cells. The cell then is left twice (or more then) the normal chromosome count.

Warmke's experiments concluded that polyploids contained higher concentrations of the "active ingredient." However, the procedure for measuring that ingredient was much the same is described for grafting, with probably similar shortcomings.

Polyploid Cannabis has been found to be larger, with larger leaves and flowers. Recent experience has shown that polyploids are not necessarily

higher in potency. Usually they are about equal to diploid siblings.

Colchicine is a highly poisonous substance. The simplest and safest way to induce polyploids is to soak seeds in a solution of colchicine derived from bulbs of winter or autumn crocus (*Colchicum*). Mash the bulbs and add an equal part of water. Strain through filter paper (or paper towels). Soak seeds in the solution and plant when they start to germinate. Cultivate as usual.

Only some of the seeds will become polyploid. Polyploid sprouts generally have thicker stems, and the leaves are often unusually shaped, with uneven-sized blades. Leaves also may contain more than the usual number of blades. As the plant grows, leaves should return to normal form, but continue to be larger and with more blades.

If no polyploids sprout, use less water in preparing the solution.

Colchicine is also a prescribed drug for treatment of gout and is taken in pill form. These usually contain .6 mg per tablet. Use 10 tablets per ounce of water, and soak the seeds as described above.

Colchicine is also sold by mail-order firms which advertise in magazines such as *Head* or *High Times*.

Because colchicine is a poison, it should be handled carefully. It is not known if plants from seeds treated with colchicine will contain a harmful amount of colchicine when plants are grown. Harm is unlikely, because the uptake by the seed is so small, and because the colchicine would be further diluted during growth, as well as diminished by smoking. But we cannot guarantee that you can safely smoke colchicine-treated plants.

Chapter 19
EFFECTS OF THE ENVIRONMENT ON POTENCY

This chapter deals only with the influence of the environment on the potency of your crop. Differences or changes in potency can also result from inherent differences between plants, such as in their variety or growth stage, from chemical degradation of the harvested marijuana, and from genetic processes that take place over several generations of plantings ((For discussion of these other causes of differences in potency, see the following sections: "Cannabis Chemotypes" in section 2; "Inherent Variations" in section 3; "Breeding" in section 18; "Potency and Decomposition" in section 20; and "Storage" in section 21.))

We have emphasised the heredity is the most important factor that determines potency. Potent marijuana grows from seeds of potent marijuana. A healthy, mature plant bears an abundance of flowers, guaranteeing you a potent harvest.

Some researchers have investigated the impact of the environment on relative potency, since this question is of interest to officials concerned with marijuana control as well as to marijuana growers. Their primary goal has

been to discover the gross effects of different environments rather than to single out the effects of any particular factor. A consensus is that the impact of environment on potency is small relative to that of the plant's heredity. Nevertheless, where scientists have commented on this question, the common denominator for higher potency has been stress.

19.2 Stress

Stress is anything that detracts from the plant's health or vigour. Environmental factors such as competition from other plants, low water availability, and poor soil conditions are examples of stress factors.

In many marijuana-growing cultures, farmers have practices that are stress-related; splitting the base, severe pruning, bending or contorting the stem, and water deprivation are common examples. Of course, the fact that marijuana-growing cultures have such practices does not mean that these practices actually increase potency, or that this is, or ever was, their intent. This original meaning may well have been forgotten centuries ago. For instance, cultivation of sinsemilla has been practiced for centuries, not for potency, but because the seedless product is easier to process or smoke.

There does seem to be some underlying relationship between stress and higher potency. Stress factors may slow growth in general, but at the same time, may not slow the synthesis of cannabinoids. Potency may be affected in much the same way by growth factors that are not considered stressful. As described previously, marijuana plants grow more compactly and have smaller leaves under conditions of relatively warm temperatures, or strong sunlight, or a dry atmosphere; they grow taller and have larger leaves when grown under cool temperatures, moderate light, or a humid atmosphere. Higher relative potency seems to correlate with conditions which favour compact development of the plant and its parts.

The rate of cannabinoids synthesis relative to photosynthesis may be affected in ways not apparent. Sunlight, for instance, is a growth factor. In almost all cases, the more sunlight the plants receive, the faster and larger they will grow. Yet plants grown with intense sunlight seem to maximise potency. Intense sunlight can raise plants' internal temperatures to levels that interfere with the photosynthesis cycle. Absorption of light energy and conversion to biochemical energy continues unimpeded, but the synthesis of sugars is impeded. (Under a midday sun, this phenomenon has been observed in other field crops. (206)) In marijuana, cannabinoids synthesis may continue unaffected at these higher temperatures. This might account, in part, for the slightly higher potency of plants grown in tropical zones.

The subject of potency is mired in confusion and mystery, largely because of fertiliser and soil ads, marijuana-growing books, and individuals who promise ways of increasing potency or growing super grass. There are no magic formulas or secrets to divulge that will make or break the potency of your crop. We have tried to play down this type of thinking throughout this book. Choice of seed, and a harvest of well-developed buds, far outweigh any other factors in determining potency.

We know of no one who has demonstrated that manipulation of any particular environmental factor leads to higher potency. This lack of demonstration probably exists for two reasons: (1) environmental effects on potency are relatively small compared to the effects of inheritable traits, and hence are not easy to discern; and (2) "increased potency" is difficult to prove ((Most scientific experiments are observations, and test effects or compare results rather than try to prove something.)) The variations in potency within any variety, and within each plant, require stringent methods of sampling for comparative tests. And since potency also changes with time, meaningful comparisons can be difficult to make. Scientific papers reflect this difficulty.

An experiment on potency must account for inherent variations in potency before environmental effects can be analysed. Samples would need to be equivalent in terms of variety, growth stage and development, sex, plant part, and the position of the part on the plant. A simple way to do this would be to harvest females when each reached full bloom and then compare the uppermost buds from each plant.

Most of the research on potency done to date either has not reported sampling techniques or did not account for certain inherent variations. In the extreme case, all vegetative matter from one plant was mixed together, and the THC concentration in a sample of this matter was compared with that in a similar sample of mixed marijuana from another plant. Such practices can give misleading results. Consider the fact that an unhealthy plant will have dropped many of its lower, less-potent leaves. A healthy plant has more leaf overall and retains more of its lower leaves. There is a good chance that the unhealthy plant will test higher in average THC content, because proportionately shoots, which are relatively more potent. Such a sampling error could create the impression that stress is positively correlated with potency.

Marijuana scientists have recognised the need for testing equivalent samples and for setting standards for testing. In 1974, the English scientist John Fairburn (68) published a number of well-controlled experiments concerning potency and light. This is a hopeful sign that more meaningful experiments will be forthcoming.

We have said that the common denominator for increasing potency is stress. Let's put that in perspective.

You cannot go wrong if you grow the largest and healthiest plants possible. Our experience has been that the most potent plants are more often the healthiest and most vigorous in the garden.

Factors that limit growth rate are probably related to potency, and if growth rate is relatively slower, cannabinoids concentrations may be higher. Plants whose average yield is six ounces may be slightly more potent than plants whose average yield is eight ounces. Factors related to potency affect growth rate rather than ruin the plant's health. When a plant is so traumatised that it is barely surviving, potency as well as growth rate declines.

Obviously, if the growth rate is slower, the harvest will be smaller. Any

difference in potency due to stress is quite small, but the difference in yield can make the difference between harvesting an ounce and harvesting several pounds (ie., don't get carried away with the practice of stressing the plants). If you wish to stress the plant, wait until it is firmly established and growing well.

Outdoors, don't stress the plant until at least the middle of its life. You want the plant to be large enough to bear a good harvest of buds. Water deprivation is a good method of limiting growth outdoors. However, wilted plants must be watered, or they will die.

Competition from other weeds has been correlated with higher potency in two recent studies (71,74). You might prefer not to weed your patch after the seedling stage. (Initially, weeding is necessary because indigenous weeds generally outgrow marijuana seedlings.)

Another safe way of applying stress is to remove all large leaves from the plant once it has begun to flower.

Indoors, the plants are already in a delicate state. We advise indoor growers to grow the largest and healthiest plants possible for best results.

19.3 Nutrients

Most growers show a keen interest in fertilising, since it is one factor over which they have some control. Most growers also feel that nutrients, which play such an important part in plant growth, probably have a relationship to the potency, and this is a reasonable assumption. In marijuana lore, potency is sometimes attributed to particular soil types (for instance, red dirt, which is iron-rich) or to presence or lack of certain nutrients (for examples, nitrogen or potassium deficiency).

The relationship of potency to soil conditions, in particular the nutrient content, has been looked at recently by several research groups. In two such studies, (71,74) the cannabinoid content of naturalised weedy hemp stands in the Midwest was examined. Variations in potency were then correlated to soil properties, such as N, P, and K content. The two papers came to similar conclusions. First, stands growing in areas where they were under stress tended to produce less biomass (yield) but were more potent overall. Second, when nutrients or other growth factors, such as height and weight of plants or root size, were correlated with potency, potency was almost always correlated positively with positive growth factors. That is, higher potency occurred when the plants were growing with adequate or high amounts of nutrients present, not when nutrients were inadequate.

What appears to be a contradiction (stress leads to higher potency, or good growing condition lead to higher potency) may be explainable in terms of what these experiments actually measured.

A basic assumption in these studies was that all the plants were relatively homogeneous genetically, since they may have originated from a single stock of hemp grown during World War II. Assuming this is true, then variations between stands would be due to differences in local environmental factors. However, since environmental condition differed locally for separate stands,

one cannot tell whether variations in potency between stands are due to present environmental factors (phenotypic responses) or reflect thirty years of adaption by each stand to its local environment (genotypic shifts).

It may be that positive growth factors are associated with higher potency in phenotypes (plants now growing), whereas stress leads to higher potency in succeeding generations, because of selective pressure. It is interesting that both papers reported strong positive correlations between higher potency and competition from other weeds, since competition between plants does exert strong selective pressures.

The following list of possible effects of nutrients on potency has been adapted from these four studies. (63,71,74,231)

Nitrogen

Nitrogen was positively correlated with higher potency. Once controversy in marijuana lore is whether a nitrogen deficiency during flowering increases potency. We have grown plants with N deficiencies, and they seemed no more potent than those grown with high amounts of nitrogen available. However, the N-deficient plants did produce a much smaller harvest.

Phosphorus

P has been correlated positively with higher potency in all studies that have examined this factor. Phosphorus is necessary for good flower development and seed production. Give the plants a steady supply of phosphorus throughout growth and in particular during flowering.

Potassium

K has been correlated both positively and negatively with potency. More often, it has been found to be negatively correlated. As discussed previously, plants that show some potassium deficiencies may grow well; so you may choose not to treat minor symptoms of K deficiency often grows vigorously with little harm other than the spotting and the loss of some lower leaves. It should not be necessary to fertilise with potassium during flowering unless deficiency symptoms are severe and the plant has ceased growing.

Calcium

Abundant Ca levels have been consistently correlated with higher potency.

Magnesium

Mg has been negatively correlated with potency. However, this may have been due to the interaction of Ca and Mg, and may reflect Ca's strong positive correlation to potency, rather than the negative effects of Mg per se. Plants that show Mg deficiencies must be fertilised, or they will quickly lose most of their leaves and barely remain alive.

Chapter 20 HARVESTING

Figure 30 is a hypothetical plot of the increase in potency of a male plant and a female during the course of their growth. (Potency is measured by the percentage by weight of THC in a dried sample of the uppermost leaves or growing shoots until flowers appear.) It shows that generally potency increases as the plant develops. Cues such as phyllotaxy changes and rate of growth are helpful indicators to changes in development and the chronological age of the plant has little significance.

The development of the cannabinoids, resin glands, and, in practical terms, the potency in the living plant is not clearly understood. We believe that, for the most part, potency does not increase steadily throughout the entire plant. Rather, each plant part reaches a point of maximum potency as it individually develops. A leaf that is formed when the plant is four weeks old does not increase in potency during the rest of the season. To say that potency is increasing means that the leaves that are now forming are more potent than those previously formed.

We also believe that cannabinoid formation is very fast as each plant part forms. Once matured (for example, when a leaf is fully expanded), cannabinoids are decomposing. This is one reason why the potency can decrease as well as increase during growth, especially late in the season, after the flowers have formed. The practical aspects of these points are detailed in the following sections.

20.2 Harvesting During Growth: Leaves and Growing Shoots

Leaves

We have emphasized that you should harvest grass during the course of the season. One reason is to assure yourself a return for your efforts. It is a sad commentary on our times that the greatest danger in growing marijuana outdoors is that the plants may be ripped off. On a more positive note, vegetative shoots and leaves can be surprisingly potent and should be sampled.

The potency of each new set of leaves is higher than the last pair until a plateau is reached, usually during the middle of vegetative growth. Thereafter potency of new leaves stays about the same as in those preceding. Often there is a noticeable decline in potency just prior to flowering. Leaves that form during flowering are usually more potent than those formed during the vegetative plateau. Leaves that form after the bloom are less potent.

Of course, not all varieties or individual plants will follow this rhythm. Faster-developing plants may reach the plateau sooner, and slower plants later. Potency of plants that have a longer life cycle may stay at the vegetative plateau for several months. Some plants do not seem to experience any drop in potency before flowering. Potency of these plants continues to increase gradually after the initial quick increase during early vegetative growth.

Whenever you harvest green leaves during growth, you should always take the uppermost leaves, since these are the most potent. Also, the smaller leaves that form on the branches are more potent than the large leaves on the main stem. These large stem leaves (fan, shade, or sun leaves) are often the first leaves that growers pick. But these are the least potent of all leaves, and they may not get you high at all. As long as these leaves are healthy and green, let them stay on the plant for the plant's growth. Many growers simply use these leaves for mulch or compost as they die.

Don't think that you should harvest each leaf as soon as it appears; this procedure would seriously affect normal growth and result in a small harvest of buds. The potency of individual leaves does not increase during the course of the season, but the decrease in potency is not great. Some of the loss in potency may even be made up for by the loss in tissue weight that a leaf experiences as it dies. Many growers prefer to harvest leaves during growth only after they lose colour, preferring the taste of the smoke to that of green leaves.

Leaves should always be harvested if they die; with indoor gardens, remove any leaves that show signs of insects or other pests.

Do keep yourself supplied with grass (that is the reason you are growing the plant); just don't overdo it. The main harvest is made up of buds, and you want a large, healthy plant that can support vigorous flowering. The larger and healthier a plant is, the more leaf you can harvest without seriously affecting the plant.

Growing Shoots

You may prefer not to clip the growing shoot of the main stem. This forms the largest and most potent cola by harvest time. Plants grown close together usually are not clipped, so that the plants may grow as tall as possible. Where there is much space between plants, the main shoot is clipped to encourage the plant to develop its branches, which fill the available space.

The potency of growing shoots follows the rhythm described for new leaves. However, growing shoots can be the most potent parts of the harvest when picked at the right time. Shoots sometimes reach a very high peak of potency during the middle of vegetative growth. Outdoor gardens should be sampled from mid-June through July, since this is the period in which shoots usually reach their peak.

Potency also fluctuates according to local weather conditions. Try to harvest after a period of clear, sunny weather. Potency may decline for several days after a period of cloudy weather or heavy rainfall. After a heavy rain, harvest the shoots a week or two later, since the shoots often peak in potency during a burst of fast growth.

Growing shoots can be harvested from each plant at least twice during growth. The first clipping may not give you much worthwhile grass, but it is done when the plants are young (roughly six weeks old) to force the plant to develop several growing shoots which are harvested about six to eight weeks later. The main shoot is clipped, leaving about four or five nodes below the

cut. Two shoots should start to grow from each node, the strongest at the top of the plant and the weakest at the bottom. (This difference is more pronounced under artificial light, since the light is strongest on the top of the plants.) Each plant should produce at least six strong growing shoots after this first clipping. The yield from growing shoots can be considerable (especially during the summer marijuana drought) and will probably keep you supplied until the main harvest.

A third harvest of shoot can be made later if the plants have a long growing season or are indoors. You don't want to clip shoots from the plants just prior to or during flowering, since doing so cuts down on the harvest of buds. Each plant should have at least twelve growing shoots after being clipped twice previously. You might harvest only a few shoots from each plant if the time for flowering is near.

20.3 Male Plants

Male plants usually do not have the dramatic increase in potency during flowering that the females do. Male flowers take about two weeks to mature, from the time they are first visible as tiny knob-like buds. New flowers continue to appear for several weeks.

When male flowers open and are about to release pollen, they reach their maximum potency. Since all flowers do not mature at the same time, for maximum potency the plants should be harvested after the first few flowers have opened.

Male flowers actually make up little of the total weight of the harvest, and few new leaves form once flowering begins. There is no significant loss in either potency or yield if the male is harvested before its flowers open. Once male flowers appear, there is little change in their potency. Also, once the flowers do open and release pollen, they shortly fall from the plant and are lost to the harvest.

Males should therefore be harvested before any flowers open unless you want the females to produce seeds. In a small garden, male flower clusters can be individually harvested as they mature. Most growers treat male flowers more as a novelty. Potency of male flowers is quite variable, and seldom are they as good as the female flowers. To remove male plants, cut them near the base of the stem. Don't rip them up by the roots if they are near females that will be left to grow.

Male plants normally begin to lose their vigour after the initial bloom. When the weather is mild, or the plants are indoors, they can be encouraged to bloom a second and sometimes a third time before they finally die.

20.4 Harvesting Female Buds

The decision of when to harvest females can be simplified by understanding that you want to pick the buds after they have developed fully, but before degradation processes begin to lower potency. There are two criteria you can use to tell when the plants have reached full bloom. The first is recognising the rhythm, with which the plants are blooming. A second is the condition of the flowers as judged by the health of the stigmas and the

colour of the resin.

Sinsemilla

Since sinsemilla flowers are not pollinated, the flowering period may last for many weeks. The most common rhythm for sinsemilla is that plants go through a stage of rapid bud formation, and the plants do indeed bloom. This bloom often lasts four to five weeks. The bloom ends when the rate at which new flowers form noticeably declines. At this time you should be able to sense that the bloom is completed. Buds are at their peak potency about one week after flower formation slows. This is the time to harvest. True, the plant may continue to grow slowly, but the main harvest is ready and should be taken.

With sinsemilla, some marijuana varieties have an extended bloom that may last more than two months. With this rhythm, the rate at which the buds form is drawn out, and progresses at a slower but steadier pace. The point at which the bloom is essentially over may not be as obvious as in the first case. Here, use the condition of the buds to make your decision. Stigmas wither first at the base of the buds (older flowers). Those stigmas at the top of the buds (younger) will still be white and healthy, although their tips are often brown. Harvest the plants when about half the stigmas in the buds have withered. The coating of resin glands should still be clear or white, with only a few golden or browned gland heads.

A third type of flowering rhythm is sometimes seen on plants from Thai seed. Flower buds bloom and ripen at different times. These plants also have an extended flowering stage that can last for over two months. You may choose to harvest individual buds, colas, or branches as they ripen.

Seeds

If your primary interest is seeds, the plant should be harvested after the seeds have developed their mature colour. Mature seeds can be seen splitting their sheaths or bracts. When enough seeds have ripened, the plants should be harvested. If the plants are left in the ground and die, many of the seeds will fall from the plant.

For most growers, potency will be of primary interest, seeds only a secondary. With seeded marijuana, flowering is initially rapid until the plant is well-pollinated. If pollination occurs early in flowering, the plants often bloom for another week or two. Generally, you want the plants to flower for at least four weeks before picking, and usually longer, about six to seven weeks.

With seeded marijuana, the bloom is of shorter duration than with sinsemilla. Once growth slows, wait another two to three weeks before harvesting. All the seeds may not be matured, particularly at the top of the bud. But potency of the buds should be about maximum at this time.

20.5 Weather

Because of such variables as variety and growing conditions, there can be so much variation in the ripening process that no one criterion for judging

when maximum potency is reached will be reliable for all cases.

Warm, sunny weather encourages rapid flowering and a long period of receptivity by the stigmas. Cool, rainy weather can wither the stigmas and dampen the vigour of the bloom.

If brief frost or long, cool rain has withered the stigmas, use the plants' growth as a guideline, because ultimately this is the most important criterion. You want the buds to reach a mature size, and to ripen for about another week. You do not want the buds to be left on the plant longer than necessary.

Ideally, harvesting should follow a period of warm, sunny weather. In northern and mountainous parts of the country, many tropical varieties will not flower until late in the season, when the weather has cooled and night-time frosts are threatening. Most mature plants can withstand mild frosts and continue to grow well if daytime temperatures are mild. In this case, let the plants mature, since formation of the buds is more important than the weather in determining potency. Watch the plants carefully, and harvest when the buds reach mature size. Marijuana killed by frost may smoke harshly, but potency does not seem affected. Well-formed buds should be picked if heavy rains are expected. Cannabinoids are not water-soluble, but gland heads will be washed away.

Barring a catastrophe, such as a long frost, death to Cannabis is usually not sudden. The plants will continue to grow, and may in fact rejuvenate the next year if the stalks are left in the ground. But after the main bloom, the growth that follows is usually much less vigorous and sometimes forms abnormally. Leaves at this time are simplified, and have one blade. Later leaves are smaller, and tend to have entire margins (no serrations). Sometimes they are twisted or misshaped, as are the flowers that form along with them. This slow growth that follows the initial bloom will contribute little to the weight of the harvest. Additionally, this post-bloom growth is much less potent than the original bloom. Resin glands on these plant parts are feeble and poorly developed. When this abnormal growth forms, the time for harvesting is past. {See Figure 83.}

When a plant seems to persist in growing, and you are not sure bloom is past, the best procedure to follow is to try for a double harvest.

Double Harvests

Most marijuana plants take at least five months to reach maturity. Once the plant has reached maturity, it is forming its most potent marijuana, and should not be cut down completely. You can often induce the females to flower a second (and sometimes a third) time, especially if the plants are indoors or if the weather is expected to stay mild for several more weeks.

To encourage a second bloom, first take the bulk of the harvest: all but the smallest buds, and most of the leaf. Some green leaves should be left on the plant to maintain the plant's growth. After harvesting, give the plants a thorough watering, and water with a soluble, complete fertiliser that provides a good supply of both N and P. This will encourage new growth and continued flowering.

Indoors, the best procedure is to treat the plants like a hedge. Cut all the plants back to equal heights, about two to three feet tall. Remove most of the grass, but again leave a few green leaves on the plant. Don't remove lower branches even if they are leafless, since these will sprout again. Lower the light system to the tops of the plants, and maintain the daily cycle at about 12 hours. The second crop of buds will be ready for harvest in four to eight weeks. With this system, the plants appear like dense hedges of buds. If the second crop of buds forms quickly, you should try for a third crop. Continue to fertilise the plants regularly, and watch for signs of magnesium deficiencies, which often show up when the plants have been growing for an extended time.

Double and triple harvests are one of the benefits of indoor growing. Although plants are relatively small indoors, the original harvest of buds can be triples in the next four months.

20.6 Potency and Decomposition

We have said that when buds are picked too late, the potency may decline because of decomposition of the cannabinoids, especially THC.

In section 21, Tables 26-29 give measured rates of decomposition of the major cannabinoids due to exposure to light and air. Light rapidly decomposes THC into unknown products (possibly polymers (122,164)). Light also converts CBD to CBS and CBC to CBL. Air (oxygen) slowly converts THC to the less active CBN. Conversion to CBN is hastened by higher temperatures.

Degradative processes do not occur as quickly in the living plant as when the cannabinoids are purified or in solution, as is shown by the data in Tables 27-30 in section 21 {Tables on disk only}. Resin glands seem to function well in storing the cannabinoids in dried plant material. However, the rates of decomposition in Tables 27 and 28 are for samples exposed to north light and a maximum of 80F temperatures. Temperature would be higher, and light stronger, under full sunlight.

Studies with fresh plant material usually show negligible CBN content in fresh marijuana from immature plants. When mature buds are tested, their CBN content is generally equal to at least five percent of their THC content. When growing temperatures are higher, such as in the tropics, CBN content can account for more than 20 percent of the original THC. Even if we assume a low figure, such as five percent conversion of THC to CBN, there is actually a much greater decline in THC content because of the simultaneous degradation of THC by light.

When the slow rate at which THC oxidises to CBN is considered, five percent decomposition in a period of less than two months represents considerable exposure of the THC to air, and most of this exposure occurs in the last critical weeks when the resin glands begin to degenerate. Plates 8 and 11-13 show the condition of the resin glands on several different kinds of marijuana.

Stalked glands that cover the female flower bracts sometimes rupture or secrete cannabinoids through pores in the glands head. Secretion is not a

continuous flow, but more of an emptying of the glands' contents. At this time, gland heads may dehisce. Also, because of their abundance and raised positions, resin glands on the female bracts are exposed to strong sunlight and possible physical damage. These conditions may explain the significant decline in potency of buds that are overripe.

Leaves are also affected by decomposition of the cannabinoids, but not as quickly or seriously as the buds, probably because the resin glands on the leaves are most numerous on the undersurface, where they are somewhat protected from light. These glands rarely rupture or secrete cannabinoids. Often they are intact, clear, and apparently unchanged for many weeks on the living plant.

As the plates show, one can, with the naked eye, see the glands change colour, from colourless or white to golden, and then to reddish or brown. THC is colourless. If the colour changes of the resin do indicate decomposition of THC, then decomposition in the stalked glands that cover the buds can be considerable.

We have smoked buds that seemed to lose about half their potency when left on the plant for an additional three weeks. Colour changes are after the fact. If many of the glands are beginning to brown, the grass should be harvested.

20.7 Timing the Harvest

Many growers will disagree with us on when the best time is to harvest the buds (female plants). When the plants are left in the ground, and are alive but past the main bloom, the resinous qualities of the plant may become more apparent. The bracts and tiny leaves may swell in size, and the leaves feel thicker. The coating of resin glands will change colour. Leaves often yellow and fall from the plant. Much of the green colour in the flowering buds may also be lost. Harvests of these buds more closely resembles commercial Colombian grass than typical homegrown. The resin content of the dried buds may be higher, and the grass will smoke more harshly than if the buds were younger when picked. You may prefer these qualities in your grass, and some growers insist this grass is stonier. We feel that the grass will give you the highest high when it is picked as described previously. Smoking is a personal experience, and you should try different approaches and come to your own conclusions.

The first time you grow marijuana is largely a learning experience. Most growers can't wait to start their second crop, because they are certain that they'll improve on both the quantity and the quality of their crop, and this is usually true. The wise grower will not put all his proverbial eggs in one basket. It is a good idea to monitor potency by taking samples every few days when harvest time is drawing near, just as such monitoring is for deciding when to harvest growing shoots during vegetative growth.

In any garden, some of the plants will mature sooner than others. Use the plant(s) that is earliest to mature to decide at what point in its development the plant reaches maximum potency. This finding then serves as a guide for harvesting the rest of the plants.

Try to use buds from approximately the same position on the plant each time

you sample. Take only enough to make a joint or two. The more you standardise your testing (and this includes your smoking evaluation), the more accurate your results may be.

20.8 Final Harvesting

The time of harvest is a time of joy. It is also a time for caution. Unless the safety of your garden is assured, you will want to harvest quickly, quietly and as efficiently as possible. Ideally, each plant is harvested as it matures, but some of you will have to harvest all at once.

It is best to take cardboard boxes or large, sturdy bags to carry the harvest. You want to harvest the plants with as little crushing or damage to the flowers as possible.

Bring a strong knife, heavy shears, or clippers for cutting the stalks. The quickest way to harvest is to cut each plant at its base. Once the plants are on the ground, cut the stalks into manageable lengths for boxing or bagging. Separate large branches as needed for packing.

The bagged or boxed material should be moved to the curing or drying area as soon as possible. If you let the plants sit in the trunk of a car or in plastic bags, they will start to ferment and smell in less than a day.

Chapter 21 AFTER THE HARVEST

Once the marijuana plant is harvested, it ceases to produce cannabinoids and resins, and the main changes in potency that occur are degradative. However, when the material is handled carefully, dried or cured properly, and then stored well, little degradation will occur. During drying or curing, the resin content may seem to increase, as the plant's tissues shrink away from their resinous coating.

More than 70 percent of the fresh weight of the plant is water. Drying is done to evaporate most of this water, so the marijuana will burn evenly and smoke smoothly. Additionally, the cannabinoids in fresh plant material are mostly in the acid forms, which are not psychoactive. The acid cannabinoids decarboxylate (they lose the gas, carbon dioxide) during the drying or curing processes, which convert them to their psychoactive neutral forms. Decarboxylation is complete if the marijuana is actually smoked. For this reason, no special procedures are needed to decarboxylate the marijuana unless it will be eaten. In that case, the recipe should include a period of dry heating. The heat converts the cannabinoids to their psychoactive neutral forms, and also melts the sharp-pointed cystolith hairs that cover leaves, stems and petioles. Cystolith hairs can cause stomach pains if you eat uncooked marijuana or chew on raw marijuana, which we strongly advise you not to do.

Commercial marijuana is usually composed of just the flower tops (colas), which have been stripped, manicured, cured, and dried. Homegrowers often do not cure their crop before drying, and if the smoke is smooth, there is no

reason not to dry it directly. But harsh-smoking marijuana can be cured so that the smoke is smoother. Curing has little effect on potency when done properly.

21.2 Stripping

Stripping, the removal of large leaves, is usually done soon after harvesting. Fan leaves are stripped because they are much less potent than the colas that they cover, and do not cure as well as the prime material. In commercial growing areas, the fan leaves are often stripped in the field and form a green manure. But fan leaves are sometimes quite potent, especially if they are recent growth. The lower leaves are usually weak, but they can be used in cooking or concentrated in an extract.

The easiest time to strip fan leaves is after they have wilted, because they are easier to pull off when they are limp than when they are turgid. Wilting takes place in less than an hour if the plants are in a well-ventilated space. Plants placed in a plastic bag in a cool area may take a day or more to wilt.

Some growers leave the fan leaves on until the plants have dried. After the buds are removed, they strip the remaining leaves by running their (gloved) hands from the base of stems and branches toward their tips. The fan leaves disintegrate into shake.

21.3 Grading and Manicuring

Grading and manicuring are important steps in preparing fine grass. Grading is done by separating the plants according to variety, sex, and the particular stash uniform, and the quality of the better grades is not diluted. Plant parts are usually graded as follows: main top colas, small side colas, immature buds, leaves accompanying flowers, and fan and stray leaves. This is important, because the differences in potency will be considerable. For instance, the buds on a Colombian homegrown will be top quality, but the lower leaves will be more like a low-grade commercial Mexican.

Manicuring is done to remove the extraneous leaf from the colas. First the large fan leaves are stripped. The exposed colas are then trimmed with scissors to remove the ends of leaves that stick out from the colas. Plants should be manicured and (usually) graded before drying, since dried material crumbles into shake when handled. Also, leaves dry much more quickly than buds, and different plant parts cure at their own rates.

Male flowers are often treated as a novelty by growers, who make individually rolled sticks from them, as follows. Hang the plants upside down; the leaves will wilt and hang down, covering the male flower clusters. Then roll each cluster within its leaves between the palms of your hands, to compress the cluster into a joint-shaped mass. Dry the "stick" in a warm dark place. Rolling the grass ruptures many of the glands; so dried sticks should be stored carefully until each is used.

Hashish

When you handle your crop, you may notice a resin build-up on your hands and the tools you are using. This resin can be collected by rubbing and scraping it into a ball. It makes a quality hash that is several times as concentrated as the grass.

Small quantities of hash can be made by rubbing resinous plant parts across a thin, fine mesh screen. The resin is then scraped off the screen and rolled into finger shapes. Hash can also be made by thrashing fresh plants over a mesh screen inside an enclosed box whose floor is lined with sheet plastic. A box about one yard square is a suitable size. On one side of the box a hole is made large enough for the colas to be shaken by hand. In this way, the resin glands are knocked loose, but are contained by the box and settle on the plastic.

Plastic or paper should be placed beneath the marijuana during manicuring, grading, or drying. Besides fallen grass, a considerable amount of glands and fine shake can be caught and compressed to a hash-like mass.

21.4 Curing

Curing is a process employed to naturally enhance the bouquet, flavour, and texture of marijuana. Curing does not lower potency when done correctly, although poor curing methods often result in some loss of THC.

Curing is not an essential procedure, and many growers prefer the "natural" flavour of uncured grass. Sweet sinsemilla buds usually are not cured.

Curing is most successful on plants which have "ripened" and are beginning to lose chlorophyll. It is less successful on growing tips and other vigorous parts which are immature. These parts may only lose some chlorophyll.

Curing proceeds while the leaf is still alive, for until it dries, many of the leaf's life processes continue. Since the leaf's ability to produce sugars is thwarted, it breaks down stored starch to simple sugars, which are used for food. This gives the grass a sweet or earthy aroma and taste. At the same time, many of the complex proteins and pigments, such as chlorophyll, are broken down in enzymatic processes. This changes the colour of the leaf from green to various shades of yellow, brown, tan, or red, depending primarily on the variety, but also on growing environment and cure technique. The destruction of chlorophyll eliminates the minty taste that is commonly associated with green homegrown.

There are several methods of curing, most of which were originally designed to cure large quantities of tobacco. Some of them can be modified by the home grower to use for small marijuana harvests as well as large harvests. The methods used to cure marijuana are the air, flue, sweat, sun, and water cures.

Air Curing

Air curing is a technique developed in the United States for curing pipe and cigar tobacco. It was originally done in specially constructed barns made with ventilator slats which could be sealed; a small shed or metal building

can easily be adapted for this use. However, this method of curing works only when there is enough material to keep the air saturated with moisture.

Wires are strung across the barn, and the marijuana plants or plant parts are hung from them, using string, wire twists, or the crooks of branches. The plants material should be closely spaced, but there should be enough room between branches (a few inches) so that air circulates freely. The building is kept unventilated until all the material loses some chlorophyll (green colour). This loss occurs rapidly during warm sunny weather because heat builds up, which hastens the cure. In wet or overcast weather, the temperature in the chamber will be cooler, and the process will proceed more slowly. If these conditions last for more than a day or two, unwanted mould may grow on the plants. The best way to prevent mould from forming is to raise the temperature to 90F by using a heater.

After the leaves have lost their deep green and become pale, the ventilator or windows are opened slightly, so that the temperature and humidity are lowered and the curing process is slowed. The process then continues until all traces of chlorophyll are eliminated. The entire process may take six weeks. Then the ventilators are opened, and an exhaust fan installed if necessary, to dry the material to the point that it can be smoked but still is moist, that is, bends rather than crumbles or powders when rubbed between thumb and forefinger.

Flue Curing

Flue curing differs from air curing in that the process is speeded up by using an external source of heat, and the air circulation is more closely regulated. This method can be used with small quantities of material in a small, airtight curing box constructed for the purpose. Large quantities can be hung in a room or barn as described in Air Curing.

A simple way to control the temperature when curing or drying small amounts of marijuana is to place the material to be cured in a watertight box (or a bottle) with ventilation holes on the top. Place the box in a water-filled container, such as a pot, fish-tank, or bathtub. The curing box contains air and will float. The water surrounding the box is maintained at the correct temperature by means of a stove or hotplate, fish-tank or water-bed heater, or any inexpensive immersible heater. Temperature of the water is monitored.

With the marijuana loosely packed, maintain water temperature at 90 degrees. After several days, the green tissue turns a pale yellow-green or murky colour, indicating yellow or brown pigments. Then increase temperature, to about 100 degrees, until all traces of green disappear. Raise the temperature once again, this time to 115 degrees, until a full, ripe colour develops. Also increase ventilation at this time, so that the marijuana dries. Plants dried at high temperature tend to be brittle; so lower the temperature before drying is completed. This last phase of drying can be done at room temperature, out of the water bath. The whole process takes a week or less.

Marijuana cured by this technique turns a deep brown colour. Immature material may retain some chlorophyll and have a slight greenish cast. Taste is rich yet mild.

Sweat Curing

Sweat curing is the technique most widely used in Colombia. Long branches containing colas are layered in piles about 18 inches high and a minimum of two feet square, more often about ten by fifteen feet. Sweat curing actually incorporates the fermenting process. Within a few hours the leaves begin to heat up from the microbial action in the same way that a compost pile ferments. Then change in colour is very rapid; watch the pile carefully, so that it does not overheat and rot the colas. Each day unpack the piles, and remove the colas that have turned colour. Within four or five days, all the colas will have turned colour. They are then dried. One way to prevent rot while using this method is to place cotton sheets, rags, or paper towels between each double layer of colas. The towels absorb some of the moisture and slow down the process.

Sweat curing can be modified for use with as little marijuana as two large plants. Pack the marijuana tightly in a heavy paper sack (or several layers of paper bags), and place it in the sun. The light is converted to heat and helps support the sweat.

Another variation of the sweat process occurs when fresh undried marijuana is bricked. The bricks are placed in piles, and they cure while being transported.

A simple procedure for a slow sweat cure is to roll fresh marijuana in plastic bags. Each week, open the bag for about an hour to evaporate some water. In about six weeks, the ammonia smell will dissipate somewhat, and the grass should be dried. This cure works well with small quantities of mediocre grass, since it concentrates the material.

Sun Curing

A quick way to cure small quantities of marijuana is to loosely fill a plastic bag or glass jar, or place a layer between glass or plastic sheets, and expose the material to the sun. Within a few hours the sun begins to bleach it. Turn the marijuana every few hours, so that all parts are exposed to the sun. An even cure is achieved in one to two days {(see Plate 16)}. Some degradation of THC may occur using this method.

Water Cure

Unlike other curing methods, the water cure is performed after the marijuana is dried. Powder and small pieces are most often used, but the cure also works with whole colas. The material is piled loosely in a glass or ceramic pot which is filled with luke-warm water. (When hot water is used, some of the THC is released in oils, which escape and float to the top of the water.) Within a few hours many of the non-psychoactive water-soluble substances dissolve. An occasional gentle stirring speeds the process. The water is changed and the process repeated. Then the grass is dried again for smoking.

THC is not water-soluble; so it remains on the plant when it is soaked. By eliminating water-soluble substances (pigments, proteins, sugars, and some

resins), which may make up 25 percent of the plant material by weight, this cure may increase the concentration of THC by up to a third.

Marijuana cured by this method has a dark, almost black colour, and looks twisted and curled, something like tea leaves. The water cure is frequently used to cure dried fan leaves and poor-quality grass.

21.5 Drying

Living marijuana leaves are 80 percent water; colas are about 70 percent water. Marijuana dried for smoking contains only eight to 10 percent water, or about 10 percent of the original amount. There are several methods used to evaporate water; these have little effect on potency, but can affect the taste, bouquet, and smoothness of the smoke. Generally, the slower the dry, the smoother the taste. Excess drying and drying methods that use heat will evaporate some of the volatile oils that give each grass its unique taste and aroma.

Grasses which are dried as part of the curing process usually have a smooth, mild taste, because of the elimination of chlorophyll and various proteins. Cured marijuana may also be a little sweeter than when first picked, because the curing converts some of the plant's starch to simple sugars.

Some grasses are tasty and smooth-smoking when they are dried without curing, especially fresh homegrown buds which retain their volatile oils and sugar. Many homegrowers have acquired a taste for "natural" uncured grass, with its minty chlorophyll flavour; such marijuana is dried directly after harvesting. {Figure 89, Male plants drying on a tree. Cheesecloth holds loose leaf for drying.}

Slow Drying

Slow drying is probably the method most commonly used to dry marijuana. Because of the slowness of the dry, a slight cure takes place, eliminating the bite sometimes associated with quickly dried grass.

There are many variations of the technique, but most commonly whole plants or separated colas are suspended upside down from a drawn string or from pegs on a wall in a cool dark room, closet, or other enclosed space. A large number of plants may take a week or two to dry. The drying time for small numbers of plants can be increased (for a slight cure) by placing the plants in large, open paper sacks that have ventilation holes cut in their sides. The drying room should have no heavy drafts, but mould may form on the plants if the air is stagnant. If weather is rainy or the air humid, increase ventilation and watch for any mould. Plants should be dried quickly under moderate heat if any mould appears.

Many experienced growers prefer slow drying to curing. There is little chance of error with this method, and buds usually smoke smooth and develop a pliable consistency. Slow-dried ripe buds retain their delicious, sweet aroma and taste.

Fast Drying

The fast dry-method produces a harsher smoke than slow drying, but it is often the most convenient method to use. The plants are suspended in the same way as for slow drying, but the temperature in the drying area is increased to between 90 and 115 degrees, often by means of electric or gas heater. The drying area is kept well-ventilated with a fan. As the plants dry, they are removed from the drying area. By this method, plants in a tightly packed room can be dried in less than four days, but the exhaust will contain the deliciously pungent odour of drying marijuana.

Indoor growers often hang plants to dry over radiators or stream pipes. Leaves are dried by placing them on a tray over a radiator or on top of the light fixture.

Marijuana that is fast-dried retains its original green colour and minty taste.

Oven Drying

Oven drying is often used by gardeners to sample their crop. Small quantities of material can be quickly dried by being placed in a 150 to 200 oven for about 10 minutes. Larger quantities can be dried in trays that contain a single layer of material or in a dehydrator. Oven-dried and dehydrator-dried marijuana usually has a harsh taste and bite, and loses much of its bouquet. The method is often used to dry marijuana which has been cured and dried but is too moist to smoke, or to dry marijuana which is to be used for cooking or extractions. It is an adequate method for obtaining dry material for testing and emergencies, but the main harvest should not be dried in this way. Oven drying works best with leaves. When leaves are dried together with buds or shoots, remove the material from the oven periodically, to separate the faster-drying leaf material (before it burns) from the slower drying buds. One way to do this is to place all the material on a wire screen over a tray. Every few minutes rub the material across the screen. Dried material falls unto the tray and is removed from the oven. Repeat until all the material has dried.

Oven curing works well when closely watched. Dried marijuana that is left in the oven will lose potency quickly. Any time the marijuana begins to char, most of the potency will already have been lost. This should not be a problem unless you are careless, or allow the temperature to go above 200 degrees.

Sun Drying

Some growers dry their crops right in the field. There are many methods of sun drying. In Oregon, some growers break the main stem about two feet from the ground. The leaves and buds dry gradually, since they are still partly attached to the plant. Other growers spread burlap and cover it with plants left to dry. Fan leaves are left on the plants to protect the drying buds from the sun. The grass is manicured after drying. Growers in Arizona shade drying plants with cheesecloth.

Sun-dried marijuana usually has a taste similar to that of oven-dried. Often the sun bleaches it slightly but also destroy some of the delicate bouquet. Prolonged exposure to the sun will decrease potency, although there is no

noticeable loss if drying is done quickly.

Dry Ice

Many homegrowers have written to us that the dry-ice cure increases the potency of marijuana considerably, and we would be remiss not to mention it.

Dry ice is frozen carbon dioxide. When it melts (sublimates), it turns from a solid directly into a gas. This gas absorbs some moisture from the frozen marijuana and partially dries it.

There are many variations of the dry-ice method. Fresh or partially dried material is usually used, although some enthusiasts claim that the cure also works with dried material. The marijuana is placed in a coffee can or similar container with a lid, along with at least an equal volume of dry ice. Puncture the lid so that the gas can escape as it evaporates. Place the can in a freezer to prolong the evaporation process. When the dry ice is gone, the grass is dried, but still moist.

Some growers claim that simply freezing the grass increases potency. They often freeze fan leaves or other less-potent material for a couple of months before smoking it. This is said to work only with fresh (wet or dried) grass.

21.6 Fermentation

When vegetation dries, the individual cells which maintained life processes die. But marijuana can still be conditioned by means of fermentation. Fermentation is the process in which microbes and plant enzymes break down complex chemicals into simpler ones, mainly starch and sugars into alcohol and simple acids. In the process chlorophyll is destroyed, giving the material a more ripened appearance. If the fermentation is stopped early, the marijuana has a sweeter taste because of the sugars which the ferment produced.

Fermentation occurs when the moisture content of the marijuana is raised above 15 percent and the temperature is above 60 degrees. The more tightly packed the material, that faster the ferment proceeds. The rate of ferment is controlled primarily by varying the moisture content, but each batch proceeds at its own rate because of differences between plants in nitrogen content. (Nitrogen is necessary to maintain fermenting bacteria.) The process is delicate; should the ferment proceed too rapidly, the marijuana may be converted to compost. Watch the fermentation closely. After the desired colour or flavour (from a dried sample) is reached, dry the grass quickly to stop the process.

During fermentation, flavourings can be added to give the marijuana a spicy aroma. Such spices as cinnamon, cloves, ginger, mace, sage, or vanilla are placed between the fermenting material. Orange, lemon, or lime peels are also used. About half an ounce of spice or four ounces of peel are used for each cubic foot of material to be fermented. The spices are wrapped in cloth sachets. The citrus peels are strung. They can be placed between the layers of marijuana.

There are two types of fermentations: self-generating and forced. They are best used with leaves or immature plants.

Self-Generating Fermentation

Self-generating fermentation proceeds rapidly only when there is enough material to make a heap at least one cubic yard large. When smaller quantities are used, too much of the heat generated by the bacteria is dissipated, so that the process is slow and is more properly considered aging.

Place the material in a large container or in a pile with a tarpaulin placed over it, and lightly spray it with a mister if it is dry. Let the pile heat up for a few days, and then break it down. If it is repacked, the marijuana will develop a dull matte appearance and lose its sugars. IF the process is allowed to proceed even further, the marijuana will disintegrate.

Forced Fermentation

Forced fermentation can be used with small quantities of material. It requires an enclosed chamber in which heat and humidity can be regulated.

Pack the marijuana loosely in a kiln or other chamber, and raise the temperature to 135 degrees. Maintain humidity at 75 percent. Check the progress of the ferment periodically. Within a week the ferment should be completed. During this ferment there is a release of ammonia compounds, resulting in some foul odours, but upon completion of the ferment and drying, the marijuana should smoke sweet and mellow.

21.7 Storage

THC is degraded by both heat and light. Table 26 shows results of an experiment conducted at the University of Mississippi, in which marijuana was stored under varying temperature conditions¹⁷¹. These results indicate that marijuana stored at room temperature (72) or below, and in darkness for up to two years will lose only an insignificant amount of its original potency; whereas marijuana stored in darkness at 97 or above will lose almost all its potency within two years.

In another experiment,¹⁶⁴ Fairbairn stored dried marijuana at different temperatures in both light and dark conditions. The samples in light were exposed to a north-facing windows (no direct sunlight). The results are shown in Table 27.

Fairbairn also performed an experiment to discover the effect of air on THC¹⁶⁴. Freshly prepared Cannabis resin was stored as a loose powder, a compressed powder, and an unbroken lump for one year at 68 degrees F (about room temperature). Samples were stored under two conditions: in light and air, and in darkness and air. The results are shown in Table 28.

Fairbairn experimented further with pure cannabinoids and extracts of marijuana dissolved in petroleum ether, chloroform, and ethanol (alcohol)¹⁶⁵. The results, in Tables 29 and 30, show that the THC and CBD in solution are much more unstable than when they are left in marijuana,

especially if they are held by the plant in undamaged glands, where they are protected from exposure to air and, to some degree, light. Crude extracts seem more stable than highly refined cannabinoids, especially CBD, which is very unstable in refined solutions.

Extract makers and purchasers should limit the exposure of the solution to light and heat as well as to air. Oils and extracts should be kept refrigerated in opaque, sealed containers. Notice that THC is almost completely degraded in a few weeks when it is held in solution and exposed to light. Red oil, hash oil, and honey oil must be stored in light-tight containers to preserve potency.

From the tables, you can see that light is the primary factor that causes decomposition of THC. The decomposition products are unknown, but are suspected to be polymers or resins. We also do not know whether the rate of decomposition would be faster in direct sunlight.

Air (oxygen) acts much more slowly to convert THC to CBN. Decomposition of THC to CBN is not significant unless temperatures are in the nineties or higher. However, such high temperatures can occur in grass that is packed before it is properly dried. The moisture that is left supports microbial activity, which heats the grass internally, as occurs during certain types of curing. Potency of cured grass is not lowered significantly when the cure is done properly and when the buds are left intact during the process.

The figures for powdered and compressed grass in Table 28 show that both light and air cause rapid decomposition when the resin is exposed through breaking of the resin glands. Intact resin glands appear to function well in storing the cannabinoids. For this reason, it is important to handle fresh and dried grass carefully, in order not to crush the material and thus break the glands, especially in the buds, which have a cover of raised resin glands. Most well-prepared marijuana will have intact, well-preserved buds.

The best place to store marijuana is in a dark container in a refrigerator or freezer. Cannabis should be stored uncleaned, so that the glands containing the THC are not damaged, since damage causes their precious contents to be exposed to light and air. Marijuana should be cleaned only when it is about to be smoked.

Many growers place a fresh lemon, orange, or lime peel in with each lid of stored grass. The peel helps to retain moisture, which keeps the buds pliable, and also gives the grass a pleasant bouquet.

Most growers take well-earned pride in the quality of the marijuana that they grow. By supplying yourself with an herb which may play an important role in your life, you gain a feeling of self-sufficiency that can be infectious.

Since your homegrown is well-tended and fresh, it has a sweet flavourful taste, far superior to that of commercial grass. And there need be no fear of contamination from herbicides, pesticides, adulterants, or other foreign matter. By growing your own, you come to the pleasant realisation that you are free from the vagaries and paranoia of the marijuana market - not to mention how little a home garden costs. All of these feelings can add up to a

very heady experience.

In a time of quiet contemplation, you might also reflect on the experiences that brought you this wondrous herb from a tiny seed. There is a tradition of mutual nurture and support between humanity and this plant that goes back 10,000 years.

You are now part of this continuing tradition.

As you probably realised while reading this book, some of the practical information came to us through letters from growers. We appreciate these letters and will continue to refer to them when we update and improve future editions of the Marijuana Grower's Guide. We would also like to hear ideas, criticisms, and feedback from our readers. Other research material and copies of professional research are also welcome.

Wishing you a Happy Harvest,
Mel Frank
Ed Rosenthal

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Marijuana Botany

An Advanced Study: The Propagation and Breeding of Distinctive

by Robert Connell Clarke

Chapter 1 - Sinsemilla Life Cycle of Cannabis

Cannabis is a tall, erect, annual herb. Provided with an open sunny environment, light well-drained soil, and a warm season. Exposed river banks, meadows, and agricultural lands are ideal habitats for Cannabis since the female plant. A cross with a cutting from a male plant of Mexican origin results in hybrid seed which

Seeds are planted in the spring and usually germinate in 3 to 7 days. The seedling emerges from the soil with a stem that is narrowed to the base and rounded or blunt to the tip. The hypocotyl ranges from 1 to 10 centimeters. The first pair of oppositely oriented single leaflets each with a distinct petiole (leaf stem) rotated one-quarter turn. The second pair of leaves having 3 leaflets, the third 5 and so on up to 11 leaflets. Occasionally

If a plant is not crowded, limbs will grow from small buds (located at the intersection of petioles) and the plant develops a dense network of limbs and extensive fine roots to increase floral production. Under favorable conditions Cannabis can

Cannabis shows a dual response to daylength; during the first two to three months of growth it responds to long days and complete its life cycle.

LIFE CYCLE OF CANNABIS I Juvenile Stage

Cannabis flowers when exposed to a critical daylength which varies with the strain. Critical daylengths for long day strains have no critical daylength. Most strains have an absolute requirement of inductive photoperiod for the formation of undifferentiated primordia (unformed flowers) only.

The time taken to form primordia varies with the length of the inductive photoperiod. Given 10 hours of inductive photoperiods of less than 8 hours per day do not seem to accelerate primordia formation.

Cannabis is a dioecious plant, which means that the male and female flowers develop on separate plants. The flowering organs varies greatly between males and females: the male flowers hang in long, loose, pendulous clusters between small leaves.

Note: Female Cannabis flowers and plants will be referred to as pistillate and male flowers and plants as staminate. This complex aberrant sexuality easier to understand.

The first sign of flowering in Cannabis is the appearance of undifferentiated flower primordia along the stem. In Cannabis are indistinguishable except for general trends in shape.

When the primordia first appear they are undifferentiated sexually, but soon the males can be identified by the appearance of stamens. The females are recognized by the enlargement of a symmetrical tubular calyx (floral segment) which bears the stamens (pollen-catching appendages) though initial male flowers often mature and shed viable pollen. In Cannabis the male primordia.

Cultivators wait until actual flowers form to positively determine the sex of Cannabis

The female plants tend to be shorter and have more branches than the male. Female plants are less

leaves along the extended flowering limbs.

*The term pistil has developed a special meaning with respect to Cannabis which differs slightly from the general knowledge of plant anatomy but has an intense interest in the reproduction of Cannabis. The precise definition of style and stigma. The informal sense is used throughout the book since it has become common practice.

The female flowers appear as two long white, yellow, or pink pistils protruding from the fold of a bract borne in pairs at the nodes one on each side of the petiole behind the stipule of bracts (reduced leaf). Each contains, the ovary.

In male flowers, five petals (approximately 5 millimeters, or 3/16 inch, long) make up the calyx and emerge, consisting of slender anthers (pollen sacs), splitting upwards from the tip and suspended by nearly spherical slightly yellow, and 25 to 30 microns (μ) in diameter. The surface is smooth and even.

Before the start of flowering, the phyllotaxy (leaf arrangement) reverses and the number of leaflets becomes decussate (opposite) to alternate (staggered) and usually remains alternate throughout the floral period.

The differences in flowering patterns of male and female plants are expressed in many ways. Soon after viable flowers are formed if little or no fertilization occurs. Compared with pistillate plants, staminate flowers. Staminate plants tend to flower up to one month earlier than pistillate plants; however, pistillate plants may flower earlier than staminate plants.

Many factors contribute to determining the sexuality of a flowering Cannabis plant. Under average conditions, a ratio of staminate and pure pistillate plants with a few hermaphrodites (both sexes on the same plant). It has been shown to depart greatly from the expected one-to-one staminate to pistillate ratio.

Just prior to dehiscence, the pollen nucleus divides to produce a small reproductive cell accompanied by a vegetative cell. Minutes after contact with a pistil. As the pollen tube grows the vegetative cell remains in the pollen tube. Two gametes (sex cells) as it travels the length of the pollen tube.

Pollination of the pistillate flower results in the loss of the paired pistils and a swelling of the tubular ovary. The seed is matured and drops from the plant, leaving the dry calyx attached to the stem. This combination approach 100% viability, but this decreases with age.

The hard mature seed is partially surrounded by the calyx and is variously patterned in grey, brown, and black. It is 1 to 2 millimeters (1/16 to 1/8 inch) in maximum diameter.

Careful closed pollinations of a few selected limbs yield hundreds of seeds of known parentage, with some seedless and continue to mature on the plant. As the unfertilized calyxes swell, the glandular trichomes dry, and sampled. The preceding simplified life cycle of sinsemilla Cannabis exemplifies the process.

Chapter 2 - Propagation of Cannabis

Make the most of the Indian Hemp Seed and sow it every where.

Err:508

Sexual versus Asexual Propagation

Cannabis can be propagated either sexually or asexually. Seeds are the result of sexual propagation, which allows for genetic variation among seedlings and offspring with characteristics differing from those of the parents. Vegetative propagation allows for the replication of the parental plant without genetic variation. Asexual propagation, in theory, allows for the replication of the parental plant without genetic variation.

When the difference between sexual and asexual propagation is well understood then the proper selection of clones can be made. The chromosomes present in each cell, collectively known as the genotype of that individual. The expression of these genes is the phenotype. The function of propagation is to preserve special genotypes by choosing the proper traits.

If two clones from a pistillate Cannabis plant are placed in differing environments, shade and sun, the clone grown in shade will mature late, while the clone grown in full sun will remain short and bushy and mature much earlier.

Sexual Propagation

Sexual propagation requires the union of staminate pollen and pistillate ovule, the formation of viable gametes through meiotic divisions (meiosis) in which the 10 chromosome pairs fail to replicate, so that each of the two daughter cells contains only 10 chromosomes. The diploid condition is restored upon fertilization resulting in diploid (2n) offspring. If either parent is heterozygous for a trait or neither parent and considerable variation in offspring is to be expected. Traits may be controlled by a single gene.

The terms homozygous and heterozygous are useful in describing the genotype of a particular plant. If a plant has two identical alleles for a trait (homologous chromosomes), the plant is homozygous and will "breed true" for that trait if selfed. If the plant is heterozygous, the parent will be transmitted to the offspring, which will resemble each other and the parent. If the parent is heterozygous, the resultant offspring may not possess the parental traits and will most probably differ from each other.

To minimize variation in seedlings and ensure preservation of desirable parental traits in offspring, vegetative propagation will be thoroughly explained here.

The Life Cycle and Sinsemilla Cultivation

A wild Cannabis plant grows from seed to a seedling, to a prefloral juvenile, to either pollen- or seed-producing plants. Sinsemilla cultivation interferes with the natural cycle and blocks the pathways of inheritance. Fiber crops are usually harvested before the plants mature, which eliminates pollination and subsequent seed production. In the case of cultivated Cannabis crops, sinsemilla is a product.

Modern fiber or hemp farmers use commercially produced high fiber content strains of even maturity. In these plots where phenotypes can be recorded and controlled crosses can be made. A farmer may self a plant, but the offspring will not all resemble the parent crop and desirable characteristics may be lost.

Growers of seeded marijuana for smoking or hashish production collect vast quantities of seeds that are produced by freely pollinated plants. Sinsemilla marijuana is grown by removing all the staminate plants from the field.

Various theories have arisen to explain the unusually potent psychoactive properties of unfertilized Cannabis. One theory is that the plant is unable to reproduce, and many theories are both twisted and romantic. What actually happens when a plant is unfertilized (a class of aromatic organic compounds) levels remains a mystery. The psychoactive compound in Cannabis does not have enough time to accumulate. Hormonal changes that occur during the life cycle of the plant, the exact nature of these changes is unknown but probably involves imbalance in the enzymatic system that produces resin. Increased resin production. Sinsemilla plants continue to produce new floral clusters until late in the season, the calyx is fertilized. If this is the case, then sinsemilla may be higher in THC because of unfertilized flowers. That once again the farmer has interfered with the life cycle and no naturally fertilized seeds have been produced.

The careful propagator, however, can produce as many seeds of pure types as needed for future generations. The seeds are isolated while pollen is carefully collected and applied to only selected flowers of the pistillate parent.

Many cultivators overlook the staminate plant, considering it useless if not detrimental. But the staminate plant is essential for breeding, but they must be allowed to mature, uninhibited, until their phenotypes can be determined.

Biology of Pollination

Pollination is the event of pollen landing on a stigmatic surface such as the pistil, and fertilization.

Pollination begins with dehiscence (release of pollen) from staminate flowers. Millions of pollen grains are released. When the pistil is ripe, the pollen grain will germinate and send out a long pollen tube much as a seed pushes through soil. The pollen tube grows through the style to the ovule. When the pollen tube reaches the ovule, the staminate haploid nucleus fuses with the pistillate haploid nucleus. This contact with the stigmatic surface (pistil); fertilization may take up to two days in cooler temperatures. If the plant is properly watered, seed will form and sexual reproduction is complete. It is crucial that no part of the plant be stressed. If the plant is not properly watered, it will fail to germinate, the pollen tube will die prior to fertilization, or the embryo will be aborted.

Controlled versus Random Pollinations

The seeds with which most cultivators begin represent varied genotypes even when they originate from a single parent. Imported shipments are the result of totally random pollinations among many genotypes. If eliminated by a late flowering staminate plant or a hermaphrodite, adversely affecting the genotype of the parent, favorable phenotypes by controlled breeding may begin. Only one or two individuals out of many may be selected to improve, it may even degenerate through natural and accidental selection of unfavorable traits. The genotype of future offspring.

Data Collection

Keeping accurate notes and records is a key to successful plant-breeding. Crosses among ten parents is a task to attempt to remember the significance of each little number and colored tag associated with the cross. Data about crosses, phenotypes, and growth conditions in a system with one number corresponding to each cross.

The single most important task in the proper collection of data is to establish undeniable credibility. Data constitute the data needed to reproduce that strain. Data is always written down; memory is not a reliable record. Data is parent and recorded as follows: "seed of pistillate parent X pollen or staminate parent." Also the date and location of the parent and voucher specimens for later characterization and analysis.

Pollination Techniques

Controlled hand pollination consists of two basic steps: collecting pollen from the anthers of the staminate parent and transferring it to the pistil of the pistillate parent. The process is controlled so that no pollen escapes to cause random pollinations. Since Cannabis is a wind-pollinated plant, light penetration and air circulation for the pollen and seeds to develop without suffocating. Paper materials tend to collect transpired water and rot the flowers. Light-colored opaque or translucent materials tend to create a greenhouse effect, heating the flowers inside and killing the pollen. Pollination bags are made of nylon oven bags (for observation windows) with silicon glue. Breathable synthetic fabrics such as paper or plastic. Conditions inside the enclosures must remain suitable for pollen-tube growth and fertilization. It is important to avoid pollen transfer. Controlled "free" pollinations may also be made if only one pollen parent is allowed to pollinate the plants. If the selected staminate parent drops pollen when there are only a few primordial flowers on the pistillate parent, seedless. Early fertilization might also help fix the sex of the pistillate plant, helping to prevent hermaphroditism. Each limb to be re-pollinated, so avoiding confusion. Hermaphrodite or monoecious plants may be used to preserve a selected trait. Selfed hermaphrodites usually give rise to hermaphrodite offspring.

Pollen may be collected in several ways. If the propagator has an isolated area where staminate plants are growing, endangering the remainder of the population, then direct collection may be used. A small vial, glass or plastic, is dislodged by tapping the anthers. Pollen may also be collected by placing whole limbs or clusters of flowers in a bag, some of the anthers as they dry, and this may be scraped up and stored for a short time in a cool, dry place.

or more fresh, dry soda crackers or a cup of dry white rice. The sealed container is stored in the refrigerator.

Any breeze may interfere with collection and cause contamination with pollen from neighboring plants. Hands used for collection, including hands, must be cleaned before continuing to the next pollen source.

Staminate flowers will often open several hours before the onset of pollen release. If flowers are covered with a carefully sealed paper cover allows air circulation, facilitates the release of pollen, and prevents mold.

Both of the previously described methods of pollen collection are susceptible to gusts of wind, which can interfere with collection. Therefore, a method has been designed so that controlled pollen collection and application can be done with ease. For convenience, the pollen parents mature under the same conditions as the seed parents, thus making the process easier.

The first step in collecting pollen is, of course, the selection of a staminate or pollen parent. Healthy staminate flowers often brings a feeling of panic ("stamenoia") to the cultivator of seedless Cannabis, and when the flowers open and pollen is released. During this period the selected pollen plants are carefully watched. The remaining staminate plants that are unsuitable for breeding are destroyed and the pollen parent is kept.

As the first flowers begin to swell, they are removed prior to pollen release and destroyed. Tossing the plant to see the floral condition and more ripe flowers appear than can be easily controlled, limbs with the most ripe flowers develop. If there are ten prospective seed parents, pollen from twenty limbs on the pollen parent plant are removed to prevent stray pollinations. Large leaves are left on the remainder of the plant. Limbs removed from the pollen parent are saved for later analysis and phenotype characterization.

The pollination enclosures are secured and the plant is checked for any shoots where flowers might be. A stretchable seal such as a rubber band, elastic, or plastic plant tie-tape to ensure a tight seal and the bags may be supported; the bags will also remain cooler if they are shaded. Hands are always washed after handling the plants.

Enclosures for collecting and applying pollen and preventing stray pollination are simple in design. Popcorn bags or bakery bags provide a convenient shape for covering the limb tip. The thinner the bag, the better. Most available bags are made with water soluble glue and may come apart after rain. Paper bags tear easily. Bags of Gore-Tex cloth or vegetable parchment will not tear when wet. Paper bags are used for the first two days after the enclosure was secured, and any useful notes. Room is left to add the date of pollen collection.

Pollen release is fairly rapid inside the bags, and after two days to a week the limbs may be removed. To monitor the progress of pollen release, a flashlight is held behind the bag at night and the silhouettes of the flowers are observed. When flowering is at its peak and many flowers have just opened, collection is completed, and the limbs are removed. If the limbs remain on the plant too long, most of the pollen will be dropped inside the bag where heat and moisture will cause the pollen to open after the limbs are collected. The bags are collected early in the morning before the sun has become moist, it will germinate and spoil, therefore dry storage is imperative.

After the staminate limbs have dried and pollen release has stopped, the bags are shaken vigorously to release the pollen. This could promote mold growth, and the pollen bags are resealed. The bags may be stored as they are or used for hand application. Before storing pollen, any other plant parts present are removed with a screen.

Now a pistillate plant is chosen as the seed parent. A pistillate flower cluster is ripe for fertilization when the calyxes are a sign that the reproductive peak has long passed. Cannabis plants can be successfully bred when seeds is achieved by pollinating in the peak floral stage. At this time, the seed plant is covered with a paper bag. The receptive time for fertilization, still early in the seed plant's life, with plenty of time remaining for the plant to heat up in the bags as much as buds in the hot sun, and this will help protect the sensitive pistils. For each seed parent and two clusters of pistillate flowers for each bag, there are four opportunities for fertilization and embryo development. Since interfering with any part of this cycle precludes seed production.

Before the pollen bags are used, the seed parent information is added to the pollen parent data. In addition, for each of the selected pistillate clusters, a tag containing the same information is made and attached to the plant.

has time to grow before sunrise. After removing most of the shade leaves from the tips of the limb two inverted limb tips, taking care not to release any pollen, and tied securely with an expandable pollination. Fresh bags are sometimes used, either charged with pollen prior to being placed over accidental pollination with injection is higher.

If only a small quantity of pollen is available it may be used more sparingly by diluting with a neutral one is needed for fertilization. Diluted pollen will go further and still produce high fertilization helps retard the growth of molds in the maturing, seeded, floral clusters.

The bags may remain on the seed parent for sometime; seeds usually begin to develop within a few days after the bags are removed and sterilizes or destroys the bags. This way there is little chance of stray pollination. An along with many of the unpollinated pistils. In particularly cool or overcast conditions a week may be needed for pollinations. As soon as the bag is removed, the calyxes begin to swell with seed, indicating successful and nonviable seeds. Seeds develop fastest in

warm weather and take usually from two to four weeks to mature completely. In cold weather seeds begin to dry up and the dark shiny perianth (seed coat) can be seen protruding from the drying calyx. This parentage used to study and improve Cannabis genetics.

Seed Selection

Nearly every cultivated Cannabis plant, no matter what its future, began as a germinating seed; a seed that was either extracted from imported shipments of marijuana. Very little true control can be exercised in seed selection. This is not possible for most cultivators or researchers and they usually rely on imported seeds. The problems affect the genetic purity and predictability of collected seed.

- 1 - If a Cannabis sample is heavily seeded, then the majority of the male plants (and some late maturing staminate and hermaphrodite plants) will contribute to the seeds in any batch. At least the pistillate or seed parent is the same for all those seeds, though the pollen may be from many sources.
- 2 - In very lightly seeded or nearly sinsemilla Cannabis, pollination has largely been prevented from pollen from hermaphrodite plants that went undetected by the farmer, or by random cross-pollination and this may not be desirable.
- 3 - Most domestic Cannabis strains are random hybrids. This is the result of limited selection and the remainder of the crop.

When selecting seeds, the propagator will frequently look for seed plants that have been carefully selected. The following guidelines are followed:

- 1 - The dried seeded flower clusters are free of staminate flowers that might have caused cross-pollination.
- 2 - The flowering clusters are tested for desirable traits and seeds selected from the best clusters.
- 3 - Healthy, robust seeds are selected. Large, dark seeds are best; smaller, paler seeds are less desirable.
- 4 - If accurate information is not available about the pollen parent, then selection proceeds from the main stems occur in the earliest pistillate flowers to appear and must have been pollinated by the desired parent. By contrast, mature seeds selected from the tips of floral clusters, often surrounded by immature staminate or hermaphrodite pollen parents, and their seeds should mature under the influence of the later-maturing pollen parents, and their seeds should mature under the influence of the later-maturing pollen parents. If seeds are collected from the same parentage, the pollinations represent fewer different gene pools and will produce more uniform offspring.
- 5 - Seeds are collected from strains that best suit the locality; these usually come from single parentage.

6 - Pure strain seeds are selected from crosses between parents of the same origin.

7 - Hybrid seeds are selected from crosses between pure strain parents of different origin

8 - Seeds from hybrid plants, or seeds resulting from pollination by hybrid plants, are available

Seed stocks are graded by the amount of control exerted by the collector in selecting the parents. contamination.

Grade #2 - Seed parent is known but several known staminate or hermaphrodite pollen parents are

Grade #4 - Neither parent is known, but the seeds are collected from one floral cluster, so the pistil

Grade #5 - Parentage is unknown but origin is certain, such as seeds collected from the bottom of

Grade #6 - Parentage and origin are unknown.

Asexual Propagation

Asexual propagation (cloning) allows the preservation of genotype because only normal cell division occurs. Chromosomes in the nucleus of each cell. This is known as the diploid (2n) condition where 2n = 2n. Each cell migrates to each daughter cell, which now has a genotype identical to the mother cell. Consequently, all clones have the same genotype as the mother plant and will, for all practical purposes, develop identical

In Cannabis, mitosis takes place in the shoot apex (meristem), root tip meristems, and the meristems of vegetative stems and be multiplied. Asexual propagation techniques such as cuttage, layerage, and division of root systems are produced from even a single cell, because every cell of the plant possesses the genetic information

Asexual propagation produces clones which perpetuate the unique characteristics of the parent plant and multiplied by cloning. Propagation of nearly identical populations of all-pistillate, fast growing clones. All the members of that clone equally.

The concept of clone does not mean that all members of the clone will necessarily appear identical. Members of the clone will develop differently under varying environmental conditions. These influences may slowly decline due to poor selection of clone material or the constant pressure of disease or other factors that occur during selection for vigorous growth. However, if parental strains are maintained by inbreeding, a mutation gene will permanently affect the genotype of the clone. If this mutated portion is cloned or reproduced, the mutation is therefore noticed immediately. Mutations may be induced artificially (but without much predictability).

The genetic uniformity provided by clones offers a control for experiments designed to quantify the differences resulting from sexual propagation. However, clonal uniformity can also invite serious problems. If one member of the clone is sure to be affected and the entire population may be lost. Since no genetic diversity exists in a sexually propagated population.

In propagation by cuttage or layerage it is only necessary for a new root system to form, since the stem has the capability of producing adventitious roots. In fact, every vegetative cell in the plant contains the genetic information to systemic roots which appear along the developing root system originating in the embryo. In humans, roots appear along limbs where they droop and touch the ground.

Rooting

A knowledge of the internal structure of the stem is helpful in understanding the origin of adventitious

The development of adventitious roots can be broken down into three stages: (1) the initiation of meristematic cells into root primordia, and (3) the emergence and growth of new roots by rupturing the epidermis.

As the root initials divide, the groups of cells take on the appearance of a small root tip. A vascular cylinder emerges from the epidermis of the stem. Initiation of root growth usually begins within a week on the surface of the stem adjacent to the areas of root initiation. This tissue has no influence on root formation.

The physiological basis for root initiation is well understood and allows many advantageous modifications. Auxins are considered the most important hormone responsible for the control of root initiation and the rate of root formation. Auxins are also involved in growth, root formation, lateral bud inhibition, floral maturation, fruit development, and determination of sex. In addition to rooting do not occur. Auxins seem to affect most related plant species in the same way.

Many synthetic compounds have been shown to have auxin activity and are commercially available. Indoleacetic acid has been isolated from plants. Naturally occurring auxin is formed mainly in the stem. The concentrations of auxins in rooting solutions will force travel up the vascular tissue. Knowledge of auxin activity was gained by Thimann and Went that auxins promote adventitious root formation in stem cuttings. Since auxin levels are associated with the formation of root initials. Further research by Warmke and Went showed that high auxin levels promoting root growth and low levels favoring shoots.

Cytokinins are chemical compounds that stimulate cell growth. In stem cuttings, cytokinins suppress root formation. A balance of the two may be responsible for regulating normal plant growth. Skoog discusses the use of cytokinins in tissue culture. This may provide a handy source of undifferentiated material for cellular cloning.

Although Cannabis cuttings and layers root easily, variations in rootability exist and old stems may root more easily. Cuttings (1/8 to 1/2 inch) in diameter, root most easily. Weak, unhealthy plants are avoided, along with large, woody stems. Firmness is a sign of high carbohydrate levels in stems but may be confused with older wood. The cut ends of a bundle of cuttings are immersed in a weak solution of iodine in potassium iodide. Cuttings with high carbohydrate content seem to root more poorly than cuttings with medium to low nitrogen content. The cuttings are selected that have ceased elongating and are beginning radial growth. For rooting, sections are selected that have ceased elongating and are beginning radial growth. Cuttings with higher nitrogen levels. It is unknown whether sex influences rooting, but cuttings from vegetative plants root more favorably. A favorable balance (low nitrogen-to-high carbohydrate) is achieved in several ways:

- 1 - Reduction of the nitrogen supply will slow shoot growth and allow time for carbohydrate accumulation. Withholding nitrogenous fertilizer, and allowing stock plants to grow in full sun light. Crowding plants together will also reduce nitrogen levels.
- 2 - Portions of the plant that are most likely to root are selected. Lower branches that have high carbohydrate levels are selected. You move away from the tip of the limb, so cuttings are not made too short.
- 3 - Etiolation is the growth of stem tissue in total darkness to increase the possibility of root formation. As the plant grows in darkness, carbohydrate levels increase, vascular tissue is diminished, auxin levels rise, and undifferentiated tissue becomes available. Whole plants can be subjected to etiolation, but usually single limbs are selected. Cuttings are made several weeks prior to rooting. The etiolated end may then be unwrapped and inserted into the rooting medium.
- 4 - Girdling a stem by cutting the phloem with a knife or crushing it with a twisted wire removes the carbohydrate components of root initiation above the girdle.

Making Cuttings

Cuttings of relatively young vegetative limbs 10 to 45 centimeters (4 to 18 inches) are made with a sharp knife. It is essential that the cuttings be placed in water as soon as they are removed or a bubble of air (embolism) will form in the vascular tissue. If cuttings are exposed to the air they are cut again before being placed in water.

The medium should be warm and moist before cuttings are removed from the parental plant. Rows are spaced 10 centimeters (4 inches) between each hole. The cuttings are removed from the water, the end of the shoot is kept at least 10 centimeters (4 inches) from the bottom of the medium. During the first few days the cuttings are checked frequently to make sure every thing is working properly. The

Hardening-off

The cuttings usually develop a good root system and will be ready to transplant in three to six weeks. They are removed and transplanted to a sheltered spot such as a greenhouse until they begin to grow and the hardening-off process begins. Young roots are very tender and great care is necessary to avoid damage. The proper time of the year for the cuttings to grow and mature properly (near harvest time, for example) is chosen to increase daylength. Alternatively they may be induced to flower indoors under artificial conditions.

After shoots are selected and prepared for cloning, they are treated and placed in the rooting medium. It has been discovered that the application of synthetic auxins such as NAA increase the rate of root production and are more effective than one alone. IAA and NAA are often combined with a small percentage of certain phytohormones. Solutions are made up as needed. Treatments with vitamin B1 (thiamine) seem to help roots grow on their own reserves. A complete complement of nutrients in the rooting medium and conditions conducive to rooting are also favorable to the growth of fungus. "Cap tan" is a long-lasting fungicide. It is applied to the end of the cutting in the powder before placing it in the rooting medium.

Oxygen and Rooting

The initiation and growth of roots depends upon atmospheric oxygen. If oxygen levels are low, shoot growth is retarded in the rooting medium. In addition to natural aeration from the atmosphere, rooting media may be enriched with oxygen. A threshold for damage by excess oxygenation has been determined, although excessive oxygenation is usually confined to the surface of the medium, whereas with adequate oxygen levels, roots will tend to grow throughout the medium.

Oxygen enrichment of rooting media is fairly simple. Since shoot cuttings must be constantly wet, water culture systems achieve this automatically because they deliver a fine mist (high in dissolved oxygen) to the cuttings. This can be accomplished by installing an aerator in the main water line so that atmospheric oxygen can be bubbled into the water. Aeration is a convenient way to add oxygen to water as it also adds carbon dioxide from the atmosphere. This can be done with pin holes, or through a porous stone such as those used to aerate aquariums.

Rooting Media

Water is a common medium for rooting. It is inexpensive, disperses nutrients evenly, and allows for a submerged stem, delaying etiolation and slowing root growth. Water also promotes the growth of algae. In a nutrient solution, roots will appear in great profusion at the base of the stem, while in a poorly aerated or pure water, the solution might be replaced regularly with tap water, which should contain sufficient oxygen. In a nutrient solution does become concentrated by evaporation, and this is watched. Pure water is used to dilute the solution.

Soil Treatment

Solid media provide anchors for cuttings, plenty of darkness to promote etiolation and root growth. Vermiculite and perlite are often used but the soil must be carefully sterilized to prevent the growth of harmful bacteria. An oven set at "low," approximately 82°C (180°F), for thirty minutes. This kills most harmful bacteria and fungi. It also destroys nutrients and organic complexes and the formation of toxic compounds. Large amounts of soil may be used in a better rooting mix. Formaldehyde is an excellent fungicide and kills some weed seeds, nematodes, and insects. It is applied until each cubic foot of soil absorbs 2-4 quarts of solution. Small containers are sealed with plastic and allowed to dry for two weeks or until the odor of formaldehyde is no longer present. The treated soil is dried and cultivators use them only outside with appropriate protection for themselves.

It is usually much simpler and safer to use an artificial sterile medium for rooting. Vermiculite and perlite (due to their neutral pH and low alkalinity). No sterilization is needed because both products are manufactured at high heat and conditions that promote the greatest root growth. This results from increased air circulation around the larger particles. The nutrient material is supplied by these artificial media. Solutions are checked for pH and corrected to neutral.

Layering

Layering is a process in which roots develop on a stem while it remains attached to, and nutritionally supported by, the parent plant. Layering differs from cutting because rooting occurs while the stem is still attached to the parent. Water and mineral nutrients are supplied by the parent plant because only a small amount of photosynthates (products of photosynthesis) from the shoot tip. This causes the accumulation of auxin at the point of attachment. In this manner, the propagator can overcome the problem of keeping a severed cutting dry up and die, may be rooted by layering. Layering can be very time-consuming and is less practical for a small-scale propagator a high-success alternative which also requires less equipment than cutting.

Techniques of Layering

Almost all layering techniques rely on the principle of etiolation. Both soil layering and air layering techniques often use fungicides prove beneficial, and they are usually applied as a spray or powder. Root formation on

Soil Layering

Soil layering may be performed in several ways. The most common is known as tip layering. A long and small shoots where the rooting is to take place. A narrow trench, 6 inches to a foot long and 2 inches deep, is dug and staked, and buried with a small mound of soil. The buried section of stem may be girdled by cutting a ring around the stem to promote rooting. It may also be treated with growth regulators at this time.

Serpentine layering may be used to create multiple layers along one long limb. Several stripped sections of stem are placed in a trench to form a set of roots to allow shoots to develop. The soil surrounding the stem is kept moist at all times and the lateral shoot buds rotting from constant contact with the moist soil surface. Tip layers and serpentine layers may be removed with a sharp razor or clippers after four to six weeks. If the roots have formed, the layers may be removed and the clones may be rooted under the same conditions as the parent, and less time is needed for the clone to root.

In air layering, roots form on the aerial portions of stems that have been girdled, treated with growth regulators, and wrapped in a moist medium. The Chinese technique of gootee uses a ball of clay or soil plastered around a girdled stem. The gootee is wrapped in a wick to the wrapped gootee; this way the gootee remains moist.

The single most difficult problem with air layers is the tendency for them to dry out quickly. Relative humidity and sun. Many wraps have been tried, but the best seems to be clear polyethylene plastic sheeting. They may also be used outside as long as they are kept moist and don't freeze. Air layering is often used to propagate many individuals.

Making an Air Layer

A recently sexed young limb 3-10 mm (1/8 to 3/8 inch) in diameter is selected. The site of the layer is marked and the stem is splinted by positioning a 30 centimeter (12 inch) stick of approximately the same diameter. The stem is wrapped with elastic plant-tie tape. This enables the propagator to handle the stem more confidently. An old, dry stem is cut. After girdling, the stem is sprayed or dusted with a fungicide and growth regulator, surrounded by a layer of moist moss (4-6 mil). The film is tied securely at each end, tightly enough to make a waterproof seal but not so tight that the moss dries out. Outside of the medium and rooting will be slowed. Plastic florist's tape or electrician's tape works well. The moss may be remoistened periodically. Unwrapping each layer is impractical and would disturb the roots, so the stem is checked regularly by injecting water until it squirts out and then very lightly tapping the stem. Rooting begins within two weeks and roots are removed, carefully unwrapped, and transplanted with the moss and the splint intact. The layer is

system. It is then placed in the open. In hot weather, large leaves are removed from the shoot before

Layers develop fastest just after sexual differentiation. Many layers may be made of staminate plants. To flower profusely, the layers will be rooted and may be cut and removed to an isolated area. Layers

Layers often seem rejuvenated when they are removed from the parent plant and begin to be supported under the same conditions. Layers removed from old or seeded parents will continue to produce root off-season seed production.

Grafting

Intergeneric grafts between Cannabis and Humulus (hops) have fascinated researchers and cultivators. Much drug is produced as leaves from intact hemp plants, even though leaves from intact hop plants are commonly transported across the graft to the Humulus tops. Later research by Crombie and Crombie (1975) on grafts between Cannabis and Humulus, Detailed chromatographic analysis was performed on both factors critical to cannabinoid formation across the grafts."

Grafting of Cannabis is very simple. Several seedlings can be grafted together into one to produce a bushy plant in the same container, placing the stock (root plant) for the cross in the center of the rest of the stock stem and one of the scion (shoot) seedlings at the same level. The cut portions are slipped from an adjacent seedling may be grafted to the stock higher up the stem. After two weeks, the graft is maintained in a mild environment at all times. As the graft takes, and the plant begins to grow, the

Pruning

Pruning techniques are commonly used by Cannabis cultivators to limit the size of their plants and the method is meristem pruning or stem tip removal. In this case the growing tip of the main stalk or pair of axial growing tips begins to elongate and form two new limbs. The growth energy of one stem

Auxin produced in the tip meristem travels down the stem and inhibits branching. When the meristem and strings can be kept short and bushy by meristem pruning. Removing meristems also removes the growing tip. Pruning during the early part of the growth cycle will have little effect on flowering, but plants that are pruned later happens because the meristematic tissue responsible for sensing change has been removed and they continue to grow and develop without interference from pruning. If late maturation of Cannabis is desired, then extra time and strain is needed to pollinate a late-maturing pistil late plant. The staminate plant is kept immature and allowed to develop flowers and release pollen.

Other techniques are available for limiting the size and shape of a developing Cannabis plant with limited space. In cases where space is available only along a fence or garden row. Posts 1 to 2 meters (3 to 6 feet) long are placed at 18 to 24 inches intervals, much like a wire fence or grape trellis. Trellises are ideally oriented on an east-west axis and they are gradually bent and attached to the wire. The plant continues to grow upward at the stem until they are 15 to 30 centimeters (6 to 12 inches) long. The plant grows and sprouts under the wire when they are 15 to 30 centimeters (6 to 12 inches) long. The plant grows and sprouts until the floral clusters are allowed to grow upward in a row from the wire where they receive maximum light. Cultivators feel that trellised plants, with increased sun exposure and meristems intact, produce a bushy pattern that limits the ultimate size and yield of the plant.

Another method of trellising is used when light exposure is especially crucial, as with artificial light. Poultry netting which is suspended on a frame 30 to 60 centimeters (12 to 24 inches) from the soil. The plant grows through the netting almost immediately, and the meristems are pushed back down under the netting frame evenly. Once again, when the plant begins to flower, the floral clusters are allowed to grow upward since the flat beds of floral clusters could be mechanically harvested. Since no meristematic tissues are removed from the floral clusters, since they are growing from a plane perpendicular to the direction of light.

Sometimes limbs are also tied down, or crimped and bent to limit height and promote axial growth.

the roof or walls and burn or rot from the intense heat and condensation of water on the inside of at least 60 centimeters (24 inches) beneath the roof of the green house. Tying plants over allows moisture to accumulate as well as inhibiting the flow of auxin down the stem from the tip. Once again, as with meristem removal,

Limbing is another common method of pruning Cannabis plants. Many small limbs will usually grow. If these atrophied lower limbs are removed, the plant can devote more of its floral energies to the remaining ones. Removing entire limbs constitutes a shock to the growing plant, possibly limiting its ultimate size. Removing leaves, meristems, and flowers; this probably results in less metabolic imbalance than if only flow metabolism of the total plant. In large plants, many limbs near the central stalk also become shaded and drop from exterior margins.

Leafing is one of the most misunderstood techniques of drug Cannabis cultivation. In the mind of some growers, removing leaves from a plant, and therefore the flowering clusters will be smaller. It is felt that by removing the leaves, substances synthesized in the leaves during the long noninductive days of summer, may be stored in the older parts of the plant. The plant will proceed to flower, and maturation will be accelerated. Large leaves shade the inner portions of the plant.

In actuality, few if any of the theories behind leafing give any indication of validity. Indeed, leafing Cannabis plants is a waste of time. Large leaves serve as photosynthetic factories for the production of sugars and other nutrients. They produce foods that will be used during the floral development of the plant. Premature removal causes the plant to carry on photosynthesis they turn chlorotic (yellow) and fall to the ground. In humid areas care must be taken to prevent mold. Large leaves break down substances, such as chlorophylls, and translocates the molecular components to a non-flowering stage, and this trend continues until senescence. It is more efficient for the plant to reuse the energy during flowering. During flowering this energy is needed to form floral clusters and ripen seeds.

Removing large amounts of leaves may interfere with the metabolic balance of the plant. If this metabolic balance is disrupted, inhibitors are removed, the intended effect of accelerating flowering will probably be counteracted. If there is not enough food energy produced in the leaves, the small internal floral clusters will probably abort.

If leaves must be removed, the petiole is cut so that at least an inch remains attached to the stalk. Care is taken to see that the shriveling petiole does not invite fungus attack.

It should be remembered that, regardless of strain or environmental conditions, the plant strives to reproduce as fast as possible. Although the purpose of leafing is to speed maturation, disturbing the plant's natural growth cycle will probably result in a smaller yield.

Cannabis grows largest when provided with plentiful nutrients, sunlight, and water and left alone to mature. The most productive combinations and adaptations of propagation techniques exist, based on the timely maturation of those products sought by the cultivator, without sacrificing seed or clone production.

Chapter 3 Breeding of Cannabis

The greatest service which can be rendered to any country is to add a useful plant to its culture.

Err:508

Genetics

Although it is possible to breed Cannabis with limited success without any knowledge of the laws of inheritance, the results are usually disappointing.

breeders who have mastered a working knowledge of genetics.

As we know already, all information transmitted from generation to generation must be contained in a seed form, and a new generation is begun. Both pollen and ovules are known as gametes, which through reduction division have identical sets of genes ($2n$) in every cell except the gametes, which through reduction division have

In Cannabis, the haploid (n) number of chromosomes is 10 and the diploid ($2n$) number of chromosomes is 20 in the plant.

If cross-pollination of two plants with a shared genetic trait (or self-pollination of a hermaphrodite) results in a strain (i.e., the line of offspring derived from common ancestors) that is true-breeding, or breeds true, for a trait, then the offspring will also breed true for that trait. For example, if two plants with traits of sweet aroma and early maturation are crossed, the offspring may breed true for these traits, while offspring vary in size and shape. The genes that influence the expression of that trait. For example, in a strain that breeds true for webbed leaves, we signify with the letter w . Since each gamete carries one-half (n) of the genetic complement of the parent, the gametes of the parent like both parents, are w . In turn, the offspring also breed true for webbed leaves because they have

On the other hand, when a cross produces offspring that do not breed true (i.e., the offspring do not breed true for one or more traits), it can also segregate for one or more traits; this is often seen. For example, if two plants with compound-pinnate leaves are crossed, the offspring may not breed true for this trait. To continue our system of notation we will refer to the gametes of plants with compound-pinnate leaves as W and lower-case w and upper-case W notation instead of w for webbed and possibly P for pinnate.) Since two plants which produce two types of offspring must have genetically different parents.

Observation of many populations in which offspring differed in appearance from their parents led to the discovery of these crosses? Can we use these rules to predict the outcome of future crosses?

Assume that we separate two true-breeding populations of Cannabis, one with webbed leaves and one with compound-pinnate leaves. All gametes produced by the compound-pinnate individuals will have W genes for

If we make a cross with one parent from each of the true-breeding strains, we will find that 100% of the offspring have compound-pinnate leaves (phenotype.) What happened to the genes for webbed leaves contained in the webbed leaf parent? The expression of the w gene. We term the W gene the dominant gene and say that the trait of compound-pinnate leaves in Cannabis has compound-pinnate leaves. It must be remembered, however, that many useful traits are recessive; the segregating hybrid condition wW or Ww is called heterozygous. When we cross two heterozygous plants, the F₂ generation shows a ratio of approximately 3:1, three compound pinnate to one webbed, the expected ratios, especially in small samples.

In this case, compound-pinnate leaf is dominant over webbed leaf, so whenever the genes w and W are homozygous for W so only 25% are fixed for W . The w trait is only expressed in the F₂ generation offspring. If compound-pinnate showed incomplete dominance over webbed, the genotypes in this cross would be 1 compound-pinnate :2 intermediate :1 webbed.

The explanation for the predictable ratios of offspring is simple and brings us to Mendel's first law of inheritance.

I. Each of the genes in a related pair segregate from each other during gamete formation.

A common technique used to deduce the genotype of the parents is the back-cross. This involves crossing the F₁ generation to one of the parental phenotypes. If the ratio of phenotypes is 1:1 (one heterozygous to one homozygous) it proves that the parents were

The 1:1 ratio observed when back-crossing F₁ to P₁ and the 1:2:1 ratio observed in F₁ to F₁ crosses prove that the genes are segregating. The astute breeder uses these ratios to determine the genotype of the parental plants.

This simple example may be extended to include the inheritance of two or more unrelated traits. For example, tall (T)/t (short) and M (early maturation)/ m (late maturation). This is termed a polyhybrid inheritance.

II. Unrelated pairs of genes are inherited independently of each other.

If complete dominance is assumed for both pairs of genes, then the 16 possible F₂ genotypes would result in 6 F₂ phenotypes in a 6:3:3:2:1:1 ratio. Thus, we see that a cross with complete dominance is complete. This ratio may differ, depending on the dominance conditions present in the F₂ generation; these phenotypes differ from both parents and grand parents. This phenomenon is called epistasis.

A polyhybrid back-cross with two unrelated gene pairs exhibits a 1:1 ratio of phenotypes. If the P₁ homozygous-recessive yields the homozygous-recessive phenotype short/late 25% of the time, the homozygous dominant phenotype tall/early 25% of the time. Again, the back-cross proves that the F₁ generation contains at least one each of both recessive genes or one each of both dominant genes, though the phenotypes are not necessarily the same.

So far we have discussed inheritance of traits controlled by discrete pairs of unrelated genes. However, the same but phenotype ratios may be altered. Consider a hypothetical example where 2 genes are present alone, only the leaves of the plant (under the proper environmental stimulus) will be green through out its life cycle despite environmental conditions. If both are present, however, the leaves will be purple. We assume for now that this may be a desirable trait in Cannabis flowers. What breeding techniques would you use to produce a plant with purple leaves?

First, two homozygous true-breeding ~1 types are crossed and the phenotype ratio of the F₁ generation is 1:1.

The phenotypes of the F₂ progeny show a slightly altered phenotype ratio of 9:3:4 instead of 9:3:3:1. If the plant has purple pigmentation in leaves or calyxes, then an even more distorted phenotype ratio of 9:7 will be observed.

Two gene pairs may interact in varying ways to produce varying phenotype ratios. Such interactions are called epistasis.

Summary of Essential Points of Breeding

- 1 - The genotypes of plants are controlled by genes which are passed on unchanged from parent to offspring.
- 2 - Genes occur in pairs, one from the gamete of the staminate parent and one from the gamete of the pistillate parent.
- 3 - When the members of a gene pair differ in their effect upon phenotype, the plant is termed heterozygous.
- 4 - When the members of a pair of genes are equal in their effect upon phenotype, then the plant is termed homozygous.
- 5 - Pairs of genes controlling different phenotypic traits are (usually) inherited independently of each other.
- 6 - Dominance relations and gene interaction can alter the phenotypic ratios of the F₁, F₂, and back-cross generations.

Polyploidy

Polyploidy is the condition of multiple sets of chromosomes within one cell. Cannabis has 20 chromosomes and are termed polyploids. It is believed that the haploid condition of 10 chromosomes has been shown to occur naturally in Cannabis; however, it may be induced artificially with colchicine. Colchicine inhibits chromosome segregation to daughter cells and cell wall formation, resulting in larger than average cells. Colchicine raised drug levels in Cannabis. It is unfortunate that Warmke was unaware of the actual techniques of bioassay using killifish and small freshwater crustaceans are far from conclusive. He was able to produce strains (in their ability to kill small aquatic organisms). The aim of his research was to "produce a Cannabis without any apparent increase in fiber quality or yield."

Warmke's work with polyploids shed light on the nature of sexual determination in Cannabis. He also discovered that the presence of a single set of chromosomes is necessary for the plant to be fertile.

with low potency parents.

More recent research by A. I. Zhatov (1979) with fiber Cannabis showed that some economically valuable strains are more sensitive to changes in environment. Vegetative growth cycles are extended by up to 30-40% and the formation of floral clusters is delayed. It would be difficult to determine if cannabinoid levels had been raised or not. Production is promoted by plentiful light and warm temperatures. Greenhouses and artificial lighting are used.

The height of tetraploid (4n) Cannabis in these experiments often exceeded the height of the original diploid gross phenotype. Increased height and vigorous growth, as a rule, vanish in subsequent generations. Frequent tests are performed to determine if ploidy is changing.

Triploid (3n) strains were formed with great difficulty by crossing artificially created tetraploids (4n) with diploids (2n).

De Pasquale et al. (1979) conducted experiments with Cannabis which was treated with 0.25% aneuploid. The plants possessed slightly larger leaves than the controls. Anomalies in leaf growth occurred in 20% and 30% of the plants without anomalies, and in the second group (0.50%) cannabinoid levels were highest in plants with anomalies (30-33%) and CBN (39-65%). CBD (cannabidiol) and CBN (cannabinol) are cannabinoids involved in the biosynthesis of THC. Colchicine or the resulting polyploidy interferes with cannabinoid biogenesis to favor THC. In treatment with colchicine without deformed lamina a few cells are tetraploid and the remainder are triploid or diploid.

The transformation of diploid plants to the tetraploid level inevitably results in the formation of a few triploid plants which are inferior to polyploids in every economic respect. Aneuploid Cannabis is characterized by extremely small seeds. Plants do not have such small seeds and average 14-19 grams (1/2-2/3 ounce) per 1,000 (Zhatov 1979).

Once again, little emphasis has been placed on the relationship between flower or resin production and ploidy. More Cannabis is needed.

Colchicine is sold by laboratory supply houses, and breeders have used it to induce polyploidy in Cannabis. Many cultivators have started polyploid strains with colchicine. Except for changes in leaf shape and phyllotaxy, polyploid strains have been examined to determine if they are actually polyploid or if they were merely treated with colchicine. The entire plant growing from a colchicine-treated seed could be polyploid and if any colchicine exists in the plant. In other words, if 100 of the survivors. On the other hand, if 1,000 viable treated seeds give rise to 3 seedlings, the character of the seedlings determine if the offspring are actually polyploid by microscopic examination.

The work of Menzel (1964) presents us with a crude map of the chromosomes of Cannabis, Chromosome 1 is the longest and ends in a knob and a dark chromomere 1 micron from the knob. Chromosome 7 is extremely short and dense. Colchicine has received recent media attention as a dangerous poison and while the possibility of bodily harm exists and this is multiplied when breeders inexperienced in handling toxic substances use colchicine. Mapping will enable us to picture the location of the genes influencing the phenotype of Cannabis. For each trait the number of genes in control will be known, which chromosomes carry them.

Breeding

All of the Cannabis grown in North America today originated in foreign lands. The diligence of our ancestors worked to create native strains with localized characteristics of resistance to pests, diseases, and a way of protecting a species. There is hardly a plant more flexible than Cannabis. As climate, disease, and the generation of seeds. Through the importation in recent times of fiber and drug Cannabis, a vast population of strains (to the environment), while domestic drug strains (from imported seeds) have, unfortunately, hybridized.

Changes in agricultural techniques brought on by technological pressure, greed, and full-scale era of hybridization containing poorly selected seeds are appearing in North America and elsewhere, the result of attention to the environment with long standing cultural patterns, may contain genes not found in the newer commercial varieties. The increasing popularity of Cannabis and the requirements of agricultural technology will call for

Limitation of genetic diversity is certain to result from concerted inbreeding for uniformity. Should due to potentially resistant diverse genotypes having been dropped from the population. If this ge the ravaged population. There may also be currently unrecognized favorable traits which could be recombining existing genetic variety, but only nature can create variety in the gene pool itself, th

This does not mean that importation of seed and selective hybridization are always detrimental. In rapid search for improvements must not jeopardize the pool of original genetic information on wh are often inadequate, poorly selected and badly maintained. Indeed, the United Nations Cannabis

Several steps must be taken to preserve our vanishing genetic resources, and action must be imn

Seeds and pollen should be collected directly from reliable and knowledgeable sources. Gove known; consequently, mixed bales of randomly pollinated marijuana are not suitable seed so responsible for carrying on the breeding traditions that have produced the sample. Accurate i Since Cannabis seeds do not remain viable forever, even under the best storage conditions, s to their original niche and allowed to reproduce freely to minimize natural and artificial select until the viability of further generations is confirmed, and to provide parental material for con understanding the genotypes contained in the collection. Favorable traits of each strain shoul It is possible that in the future, Cannabis cultivation for resale, or even personal use, may be should the patenting of Cannabis strains become a reality. Favorable traits must be carefully integrated into existing strains.

The task outlined above is not an easy one, given the current legal restrictions on the collection o genetics of this interesting plant.

Even if a grower has no desire to attempt crop improvement, successful strains have to be protec drug strains will degenerate and lose potency as they acclimatize to the new conditions. Let me ci

A grower in northern latitudes selected an ideal spot to grow a crop and prepared the soil well. Se domestic. Nearly all of the staminate plants were removed as they matured and a nearly seedless were kept for the following season, These seeds produced even bigger and better plants than the the second season, but there were many good individuals. Seed collection and cultivation the four grower collected seed from the best plants each year and grew them under the same conditions.

This example illustrates the unconscious selection for undesirable traits. The hypothetical cultivat resulted from random hybrid pollinations by early-flowering or overlooked staminate plants and b pass on tendencies toward premature maturation, retarded maturation, or hermaphroditism. Howe condition is called hybrid vigor and results from the hybrid crossing of two diverse gene pools. The particularly large and vigorous plants. This increased vigor due to recombination of dominant gen (usually recessive) genes may form pairs and express their characteristics in the F2 offspring. Hyk again accounted for a few seeds and these were collected. This selection draws on a huge gene p plants that are acclimatized to their new conditions instead of the drug-producing conditions of th parental types, and random pollinations will again increase the numbers of acclimatized individua next F2 generation. This effect is compounded from generation to generation and finally results in

With some care the breeder can avoid these hidden dangers of unconscious selection. Definite go characteristics does a strain exhibit that are unfavorable and should be bred out? Answers to the successful breeder also becomes aware of the most minute differences and similarities in phenoty simplified explanation of the time-tested principles of plant breeding shows how this works in prac

Selection is the first and most important step in the breeding of any plant. The work of the great b of flower, fruit, and vegetable crops was the result of his meticulous selection of parents from hur

Bear in mind that in the production of any new plant, selection plays the all-important part. First, over a series of years the plants which are approaching nearest the ideal, and rejecting all others.

Luther Burbank (in James, 1964)

Proper selection of prospective parents is only possible if the breeder is familiar with the variable characteristics and established goals for improving these characteristics by selective breeding. A detailed list of variables against it, are found at the end of this chapter. By selecting against unfavorable traits while selecting for desirable ones, the breeder can gradually improve the stock.

The most important part of Burbank's message on selection tells breeders to choose the plants "with care" and to reject the undesirable parents. Any staminate plant that survives detection and roguing (removal) is not to be used in the next generation. Pollination must be controlled so that only the pollen- and seed-parents that have been selected are used.

Selection is greatly improved if one has a large sample to choose from! The best plant picked from a sample of 100,000. Burbank often made his initial selections of parents from samples of up to 100,000 plants of one strain to allow a significant selection. A Cannabis breeder's goals are restricted by the amount of space available. Another technique used by breeders since the time of Burbank is to make early selections. Seedlings are raised as a hundred 10-centimeter (4-inch) sprouts or six-teen 30-centimeter (12-inch) seedlings or one (one) plant per square foot that as many as 10,000 sprouts can be screened in the space required by each mature plant, providing thousands of individuals, even of such common strains as those from Colombia or Mexico, may be screened. This does not mean that rare strains are not valuable, but careful selection is even more important under such a condition which results in great seedling diversity. Distinctive plants are not hard to discover if the breeder is familiar with the characteristics of the parents.

Traits considered desirable when breeding Cannabis often involve the yield and quality of the final product. It is possible to select or breed it. Early seedling selection, therefore, only works for the most basic traits. Early traits often give clues to mature phenotypic expression, and criteria for effective early selection are different for pulp or fiber production, while seedlings of short internode length and compound branching may not be judged until long after the parents are gone, so many crosses are made early and selected for later.

Hybridization is the process of mixing differing gene pools to produce offspring of great genetic variability. In cultivation, breeders take over to produce specific, controlled hybrids. This process is also known as hybrid vigor. Some characteristics from each parent.

Large amounts of hybrid seed are most easily produced by planting two strains side by side, removing the weaker plants developed for the production of large amounts of hybrid seed without the labor of thinning; however, the vigor of the strengths. Because of this, the most vigorous, healthy plants are always used for hybrid crosses.

Also, sports (plants or parts of plants carrying and expressing spontaneous mutations) most easily produce hybrid vigor results, because dominant genes tend to carry valuable traits and the differing dominant genes are expressed in healthy individuals. To increase hybrid vigor in offspring, parents of different geographic origins are used.

Occasionally hybrid offspring will prove inferior to both parents, but the first generation may still be used. The first generation (F1) hybrids are therefore inbred to allow recessive genes to recombine and express themselves. To produce an F2 generation by crossing or self-pollinating F1 offspring. Since most domestic Cannabis strains are inbreeding domestic hybrid strains. In this way the breeding of the F1 hybrids has already been accomplished. From the F2 hybrid generation selections can be made for parents which are used for the next generation. (For example, P1 high-THC X P1 low-THC yields F1 hybrids of intermediate THC content. Selection of F2 offspring yields extra-high THC as well as extra-low THC phenotypes.)

Also, as a result of gene recombination, F1 hybrids are not true-breeding and must be reproduced each successive years of cultivation, After initial field tests, undesirable hybrid seeds are destroyed and the original parental genes are preserved.

Back-crossing is another technique used to produce offspring with reinforced parental characteristics.

desired trait. Once again this provides a chance for recombination and possible expression of the an annual, so special care is taken to save parental stock for back-crossing the following year. In addition to saving particular parents, a successful breeder always saves many characteristic can be grown and selected for back-crossing at a later time.

Several types of breeding are summarized as follows:

- 1 - Crossing two varieties having outstanding qualities (hybridization).
- 2 - Crossing individuals from the F1 generation or selfing F1 individuals to realize the possibilities
- 3 - Back crossing to establish original parental types.
- 4 - Crossing two similar true-breeding (homozygous) varieties to preserve a mutual trait and restore

It should be noted that a hybrid plant is not usually hybrid for all characteristics nor does a true-breeding strain express only a few traits. The strain may be true-breeding for only a few traits, hybrid for the rest. Monohybrid crossing can only produce a plant that is an expression of some gene already present in the total gene pool. But the possibilities of recombination are nearly limitless.

The most common use of hybridization is to cross two outstanding varieties. Hybrids can be produced by crossing two parents that share only the characteristic of high psycho activity and differ in nearly every other characteristic. These two parents may share only the characteristic of high psycho activity and differ in nearly every other characteristic. In the F1 offspring the breeder selects individuals that express the best characteristics of the parents. As an example, if a Thai pollen parent and a Thai seed parent are selected from both parents while other desirable characteristics can be selected from both parents. Size and sweet floral aroma are selected from the Thai pollen parent. Many of the F1 offspring express the best characteristics of both parents and are crossed among themselves. The F2 generation is a great source of variation and recessive expressions. Now the process of inbreeding begins, using the desirable F2 parents.

If possible, two or more separate lines are started, never allowing them to interbreed. In this case the two lines are kept separate. The two seed parents result in two lines of inheritance with slightly differing genetics, but both lines are kept separate.

If two inbred strains are crossed, F1 hybrids will be less variable than if two hybrid strains are crossed. Further independent selection and inbreeding of the best plants for several generations from any parents in the strain will give rise to seedlings which all exhibit the selected traits. Success is achieved when the selected traits are fixed in the strain.

When lack of vigor interferes with selecting phenotypes for size and hardiness, the two strains are crossed with breeding for the selected traits unless two different gene systems control the same trait in the strain. The goal has been reached! The goal has been reached!

Wind pollination and dioecious sexuality favor a heterozygous gene pool in Cannabis. Through anthesis and selfing are needed to create true-breeding strains. Establishing pure strains enables the breeder to make hybrid strains. Commercial strains of seeds could be developed that would have to be purchased each year. Results of breeding, since it would be nearly impossible to reproduce the parents from F2 seeds.

At this time it seems unlikely that a plant patent would be awarded for a pure-breeding strain of Cannabis. The cost of space, and money to produce pure and hybrid strains of Cannabis will apply for patents. It may be possible to combine to control the quality and quantity of "drug" Cannabis?

Acclimatization

Much of the breeding effort of North American cultivators is concerned with acclimatizing high-THC strains. Irregularly flowering strains like those of Thailand have difficulty maturing in many parts of North America.

To develop an early-maturing and rapidly flowering strain, a breeder may hybridize as in the previous section. Alternatively, a pure cross is made between two or more Thai plants that most closely approach the

variety of a pure Thai strain. This strain may still mature considerably later than is ideal for the particular criteria such as high THC content, these may be used to develop another pure Thai strain of high yield. To produce an F1 generation containing early-maturing, high-THC strains of pure Thai genetics, in other words,

Crosses made without a clear goal in mind lead to strains that acclimatize while losing many favorable traits. That original imported Cannabis genetics be preserved intact to protect the species from loss of genetic diversity to a pest or disease, and it may only be possible to breed for this gene by back-crossing existing strains.

Once pure breeding lines have been established, plant breeders classify and statistically analyze the results. Mendel to formulate the basic laws of inheritance and aid the modern breeder in predicting the results of crosses.

- 1 - Two pure lines of Cannabis that differ in a particular trait are located.
- 2 - These two pure-breeding lines are crossed to produce an F1 generation.
- 3 - The F1 generation is inbred.
- 4 - The offspring of the F1 and F2 generations are classified with regard to the trait being studied.
- 5 - The results are analyzed statistically.
- 6 - The results are compared to known patterns of inheritance so the nature of the genes involved can be determined.

Fixing Traits

Fixing traits (producing homozygous offspring) in Cannabis strains is more difficult than it is in many other plants. In this case one plant acts as both mother and father. However, if a trait is required to fix the trait. If this is not possible, the unique individual may be crossed with a similar one from the F2 generation, but this is very difficult.

If a trait is needed for development of a dioecious strain it might first be discovered in a monoecious strain from the monoecious population and these individuals crossed to breed out monoecism in subsequent generations.

Galoch (1978) indicated that gibberellic acid (GA3) promoted stamen production while indoleacetic acid (IAA) promoted pistillate production. These hormones have many useful applications. Most importantly, if only one parent expressing a desirable trait can be found, a cutting from the desirable plant, and this cutting used to mate with it. This is most easily accomplished by misting the cutting with IAA solution each day for five consecutive days. Within two weeks staminate flowers may appear. Pollen from the staminate parent may be used to pollinate pistillate since the breeder is selfing for pistillate sexuality. Staminate parents reversed to pistillate by the application of IAA.

If entire crops could be manipulated early in life to produce all pistillate or staminate plants, seed production would be greatly simplified.

Sex reversal for breeding can also be accomplished by mutilation and by photoperiod alteration. A cutting from a staminate plant may be used to produce a pistillate plant. New growth will appear within a few days, and several flowers of reversed sex may appear. Short day light cycles (6-8 hour photoperiod) can also cause sex reversal. However, this process takes longer than mutilation.

Genotype and Phenotype Ratios

It must be remembered, in attempting to fix favorable characteristics, that a monohybrid cross gives a 3:1 phenotypic ratio. A dihybrid cross gives a 16:1 phenotypic ratio.

Phenotype and genotype ratios are probabilistic. If recessive genes are desired for three traits it is better to raise hundreds of offspring, choosing only the best homozygous recessive individuals for each trait.

predicted ratios until many more have been phenotypically characterized and grouped than the theoretical ratios.

The genotype of each individual is expressed by a mosaic of thousands of subtle overlapping traits. If the characteristic being selected is one trait or the blending of several traits and whether these have been proven to breed true. Breeding goals can still be established. The selfing of F1 hybrids will often give characteristics of the original parents of the F1 hybrid are not known. It is in the following generations that most nearly approach the ideal described by the breeding goals, the variety can be continuously improved in one line whose seeds reproduce the favorable parental traits. Inbreeding strains also allows weak vigor. After five or six generations, strains become amazingly uniform. Vigor is occasionally restored by outcrossing.

Parental plants are selected which most nearly approach the ideal. If a desirable trait is not expressed, it is not primarily the result of environment and cultivation. Acquired traits are not hereditary and are not passed on. In addition to the specific traits chosen as the aims of breeding, parents are selected which possess vigor. Observing the outcome of many crosses, although wild traits often tend to be dominant. This is often enough, regardless of dominance.

Now, after further simplifying this wonderful system of inheritance, there are additional exceptions. A dominant gene is needed to express this trait. This is known as gene interaction. No particular genetic attribute is transferred in groups instead of assorting independently. This is known as gene linkage, These genes are linked together so one trait cannot be inherited without another. At times, traits are associated with the X and Y sex chromosomes. Crossing over is the exchanging of entire pieces of genetic material between chromosomes. This will be independently inherited. All of these processes can cause crosses to deviate from the expected results. The more a breeder attempts the higher are the chances of success.

Variate, isolate, intermate, evaluate, multiply, and disseminate are the key words in plant improvement. Parents are selected and isolated. Intermating of the select parents results in offspring which must be evaluated. Improved offspring are multiplied and disseminated for commercial use. Further evaluation in the field is a part of the balanced system of plant improvement.

The basic nature of Cannabis makes it challenging to

breed. Wind pollination and dioecious sexuality, which

account for the great adaptability in Cannabis, cause many

problems in breeding, but none of these are insurmountable. Developing a knowledge and feel for Cannabis is indelibly fixed by repetition.

The first set of traits concerns Cannabis plants as a whole while the remainder concern the quality of the plants. Following this order, basic and then specific selections of favorable characteristics

List of Favorable Traits of Cannabis

in Which Variation Occurs

1. General Traits

- a) Size and Yield
- b) Vigor
- c) Adaptability
- d) Hardiness
- e) Disease and Pest Resistance

- f) Maturation
- g) Root Production
- h) Branching
- i) Sex
- 2. Seedling Traits
- 3. Leaf Traits
- 4. Fiber Traits
- 5. Floral Traits
 - a) Shape
 - b) Form
 - c) Calyx Size
 - d) Color
 - e) Cannabinoid Level
 - f) Taste and Aroma
 - g) Persistence of Aromatic Principles and Cannabinoids
 - h) Trichome Type
 - i) Resin Quantity and Quality
 - j) Resin Tenacity
 - k) Drying and Curing Rate
 - l) Ease of Manicuring
 - m) Seed Characteristics
 - n) Maturation
 - o) Flowering
 - p) Ripening
 - q) Cannabinoid Profile
- 6. Gross Phenotypes of Cannabis Strains
 - 1. General Traits
 - a) Size and Yield - The size of an individual Cannabis plant is determined by environment and irrigation. These environmental factors influence the phenotypic image of genotype.

including size. Grown under the same conditions, particularly large and small individuals may be subject to genetic control, as it is in many higher plants, such as dwarfism in corn (Shull and Mather 1909). Hybrid vigor, however, will influence the size of offspring and average size each year. Hybrid vigor, however, will influence the size of offspring and accounts for much of the success of Cannabis cultivators in raising large plants. Tetraploid individuals really yield more than diploid due to increased chromosome count. Tetraploidy is determined by the overall production of fiber, seed, or resin and selective breeding may be closely related, and it may be impossible to breed for one without the other (Gardner and Harbeck 1978). Yield plants, staminate or pistillate, are not finally selected until the plants are dried after harvest when the yield can be measured.

b) Vigor - Large size is often also a sign of healthy vigorous growth. A plant that grows faster during the growing season than a sluggish, slow-growing plant. Parents are always selected for vigor. Weaknesses in overall growth and development are bred out of the population with vigor.

c) Adaptability - It is important for a plant with a wide distribution such as Cannabis sativa. It is the most genotypically diverse and phenotypically plastic plants on earth; as a result of its wide distribution, agricultural circumstances also dictate that Cannabis must be grown under a great variety of conditions.

Plants to be selected for adaptability are cloned and grown in several locations. The most adaptable strain. Adaptability is really just another term for hardiness under varying conditions.

d) Hardiness - The hardiness of a plant is its overall resistance to heat and frost, drought, and other conditions lead to the death of the rest of a large population. The surviving few are bred and destroyed the majority of the population. Breeding these survivors, subjecting them to the same conditions, result in a pure-breeding strain with increased resistance to drought, frost, or extreme conditions.

e) Disease and Pest Resistance - In much the same way as for hardiness a strain of Cannabis infected by damping-off disease and nearly all of them die, the remaining few will be bred and subjected to subsequent generations by crossing these surviving plants. Subsequent crossing will result in a resistant strain.

Resistance to pest attack works in much the same way. It is common to find strains of Cannabis that are untouched. Cannabinoid and terpenoid resins are most probably responsible for resistance against insect attack in the form of resin-secreting glandular trichomes, which cover the plant. They are disagreeable, rarely attack mature Cannabis flowers. However, they may strip the trichomes from the flowers. Non-glandular cannabinoids and other compounds produce resistance of seedlings and vegetative juvenile plants to pest infestation. With the exception of mite, aphid,- or white fly infestation. These problems are often so severe that growers must be vigilant. Spores, so negligence can rapidly lead to epidemic disaster. Selection and breeding for resistance to pest attack is a reality.

f) Maturation - Control of the maturation of Cannabis is very important no matter what the maximum fiber content of the crop be reached early and that all of the individual plants mature at the same time. The even maturation of both pollen and seed parents to ensure even setting and harvest. Plants that mature early and late are lost while others are still ripening. An understanding of floral maturation is the key to successful breeding. Changes in cannabinoid and terpenoid production and serve as visual keys to maturity.

A Cannabis plant may mature either early or late, be fast or slow to flower, and ripen at different rates.

Breeding for early or late maturation is certainly a reality; it is also possible to breed for early-maturing plants give rise to early-maturing offspring, crosses between late-maturing plants give rise to offspring of intermediate maturation. This seems to indicate that maturation is a quantitative trait but probably results from incomplete dominance and a combination of genes for maturation. The sum of these genes produces a certain phenotype for maturation. All Cannabis plants have a certain maturation rate.

these traits and achieve results more nearly approaching the goal of timely matu

g) Root Production - The size and shape of Cannabis root systems vary greatly. A pattern and final size and shape of the roots vary considerably. Some plants sen rain. Most Cannabis plants, however, produce a poor taproot which rarely extenc plants. These fine lateral roots offer the plant additional support but their primar support a large plant. Most lateral roots grow near the surface of the soil where t may prove beneficial for the production of large rain- and wind-resistant strains. certain alkaloids have been discovered in the roots of Cannabis that might have levels in the roots to be used in the commercial production of pharmaceuticals.

As with many traits, it is difficult to make selections for root types until the paren

h) Branching - The branching pattern of a Cannabis plant is determined by the fr a tall, thin plant with slender limbs made up of long internodes and nodes with li limbs of short internodes and highly branched nodes (Hindu Kush hashish strains or resin production. Tall, thin plants with long internodes and no branching are b branching is best adapted to floral production. Branching structure is selected th growers in temperate zones with short seasons. Some breeders select tall, limbe the weight of water without bending.

i) Sex - Attempts to breed offspring of only one sexual type have led to more mis Schaffner (1928) showed that pure sexual type and hermaphrodite conditions ar hermaphrodites. Since then it has generally been assumed by researchers and b result in a population of all pistillate offspring. This is not the case. In most cases for the production of Cannabis other than fiber hemp. This is not to say that ther of some pollen from predominantly pistillate hermaphrodites, along with the con shift in sexual ratio in domestic populations of sinsemilla drug Cannabis. It is con hermaphrodites are not uncommon in these populations.

However, a cross can be made which will produce nearly all pistillate or staminate pistillate plant is selected as the seed-parent it is possible to produce an F1, and pollen-parent is one which has grown as a pure pistillate plant and at the end of If pollen from these few staminate flowers forming on a pistillate plant is applied only a few pistillate hermaphrodites. This will also be the case if the selected pis hermaphrodite gives rise to more hermaphrodites, but a selfed pistillate plant th should give rise to nearly all pistillate offspring. The F1 offspring may have a slig used to produce F2 seed. A monoecious strain produces 95+% plants with many plants. A plant from a dioecious strain with a few inter sexual flowers is a pistilla one of degree, determined by genetics and environment.

Crosses may also be performed to produce nearly all staminate offspring. This is pistillate flowers due to environmental stress, or selfing the latter plant. It is reac enough to produce pistillate flowers, and when this does happen the number of s hermaphrodite, it may produce only a few staminate flowers, but each of these r flowers, producing a seed. This is another reason that natural Cannabis populatio can be produced by hormone sprays, mutilation, and altered light cycles. These :

Drug strains are selected for strong dioecious tendencies. Some breeders select believe this reduces the chances of pistillate plants turning hermaphrodite later i

2. Seedling Traits

Seedling traits can be very useful in the efficient and purposeful selection of future p grown for initial selection, as less space is required to raise small seedlings than mat

emergence of the embryo from the soil. Early selection for vigor, hardiness, resistance to frost, and height. Leaf type, height, and branching are other criteria for early selection. These early selection criteria are important for plant improvement.

Whorled phyllotaxy is associated with subsequent anomalies in the growth cycle (i.e. phyllotaxy may be sex-linked).

3. Leaf Traits

Leaf traits vary greatly from strain to strain. In addition to these regularly occurring variations, leaf shape is correlated with other traits in Cannabis. Broad leaflets might be associated with other desirable traits. In this case, early selection of seedlings by leaflet shape could determine the characteristics of the strain. As are general leaf characteristics. A breeder may wish to develop a unique leaf shape.

A peculiar leaf mutation was reported from an F1-Colombian plant in which two leaves meet at the intersection of the leaflet array and the petiole attachment, on the adaxial (top) side of the leaf. It is unknown if this mutation is hereditary.

From Afghanistan, another example has been observed with several small floral clusters.

4. Fiber Traits

More advanced breeding has occurred in fiber strains than any other type of Cannabis. This has resulted in improved fiber quality as regards length, strength, and suppleness. Extensive breeding has been done of fiber Cannabis. Tall limbless strains that are monoecious are most desirable. Monoecious plants will become brittle before the pistillate plants are ready for harvest. The fiber strains have a longer vegetative period and as a result grow taller and yield more fiber.

5. Floral Traits

Many individual traits determine the floral characteristics of Cannabis. This section will discuss the characteristics of staminate floral clusters. Pistillate flowering clusters are the seed-producing organs of pistillate plants.

a) Shape - The basic shape of a floral cluster is determined by the internode length. In some strains, internodes are short along a long floral axis and there are short internodes within a long stretched floral axis with long internodes between well-branched individual floral clusters.

The shape of a floral cluster is also determined by the general growth habit of the plant. A creeper phenotype plant will curve upwards at the end, and floral clusters from this type of plant will be curved. In winter, many strains begin to stretch and cease calyx production in preparation for the next year. There is a wide variation in floral clusters. Some plants have tight clusters of staminate calyxes and some have long, exposed, leafless branches (Thailand).

b) Form - The form of a floral cluster is determined by the numbers and relative positions of calyx-to-leaf ratio of 1-to-4. It is obvious that strains with a high calyx-to-leaf ratio are advantageous in characterizing plants as future parents of drug strains. At this point, many strains include stems, occasional seeds, calyxes, inner leaves subtending calyx pairs (small leaflets). The ratios (by dry weight) of these various portions vary by strain, degree of maturity, and the degree of maturity reached is subject to climatic limits as well as to the strain. In floral form it is often difficult to breed Cannabis for floral characteristics. A thorough knowledge of floral clusters from acquired traits. Chapter IV, Maturation and Harvesting of Cannabis. The following traits are described from fully mature floral clusters (peak floral stage).

c) Calyx Size - Mature calyxes range in size from 2 to 12 millimeters (1/16 to 3/8 inch).

cluster is best expressed as the average length of the mature viable calyxes. Cal colors. At this time, the calyx is relatively straight and has not begun to swell with large calyxes is often as important in determining the psychoactivity of a strain psychoactive strains, and they are often characterized by large calyxes and seeds.

Calyx size appears to be an inherited trait in Cannabis. Completely acclimatized strains retain that size when inbred.

Initial selection of large seeds increases the chance that offspring will be of the line of which may set seed. This phenomenon is most pronounced in strains from Thailand.

d) Color - The perception and interpretation of color in Cannabis floral clusters is subjective. A strain that is metallic green any more than a red strain resembles a fire engine. Cannabis floral clusters include various shades. The intense green of chlorophyll usually masks the color pigments also contained in the tissues are unmasked and allowed to show through other than green. This color modification is usually triggered by seasonal change that expression of color is controlled by environment alone and is not an inherited metabolic potential to produce anthocyanin pigments coupled with a responsive gene. This also means that a strain could have the genes for expression of purple color pigmentation or chlorophyll breakdown. Colombian and Hindu Kush strains often show purple coloration at maturation. Color changes will be discussed in more detail in Chapter IV-Maturation.

Carotenoid pigments are largely responsible for the yellow, orange, red, and brown colors. As the masking green chlorophyll color fades upon maturation. Gold strains are those that are closer to reddish brown in color, although certain carotenoid and anthocyanin pigments are also present in old floral clusters. Red color in pressed, imported tops is often a result of massive purple coloration.

Several different portions of floral cluster anatomy may change colors, and it is possible to have a strain that is purple at the top and green at the bottom.

The petioles, adaxial (top) surfaces, and abaxial (bottom) surfaces of leaves, as well as the calyxes, are removed during manicuring, the color expressed by the calyxes and leaves are only considered to be truly purple or gold if the calyxes maintain those colors. Purple coloration is often the result of phosphorus deficiency but in most situations results from uncharacteristic excesses of phosphorus. Pistils in Hindu Kush strains are quite often magenta or purple, as in most strains. Purple coloration usually indicates that pistillate plants are phosphorus deficient.

e) Cannabinoid Level - Breeding Cannabis for cannabinoid level has been accomplished. Davidson (1943-44) showed that they could significantly raise or lower the cannabinoid content of chemotypes based on the relative amounts of THC and CBD. Recent research has shown that the offspring of cannabinoid content intermediate between the two parents. Beutler (1979) crossed *C. sativa* (THC) X *C. ruderalis* (Russia-low THC) and found that they fell into two groups into two groups controlled by more than one gene. Also the F1 hybrids of lower THC (resembling the *C. ruderalis* parent). More research is needed to learn if THC production in Cannabis is associated with a single gene. According to Small (1979) the cannabinoid ratios of strains grown in northern climates are genetically controlled, and the levels of the total cannabinoid content of Cannabis may be blended by careful breeding to produce hybrids of varying psychoactivity. It is an indication that unconscious breeding with undesirable low-THC parents could rapidly reduce the THC content of fiber strains are of little if any use in breeding drug strains.

Breeding for cannabinoid content and the eventual characterization of varying high-THC strains is a complex task. A chromatographic analysis system would allow the selection of specific strains. It presents a problem when breeding for cannabinoid content. Staminate plants usually produce large quantities, and they are rarely allowed to reach full maturity for fear of seeding the ground. This is done by leaving a series of from three to five numbered bags of leaves and tops of various strains.

steady repeating crowd of marijuana smokers. The bag completely consumed for impossible for one person to objectively select the most psychoactive staminate unstructured panel evaluation which averages the opinions of unbiased testers v staminate parent.

It is difficult to say how many genes might control THC-acid synthesis. Genetic controlling each individual reaction. It is generally accepted that drug strains have accumulation. Fiber strains lack this enzyme activity, so CBD-acid accumulation is also sensitive to changes in heat and light.

It is supposed that variations in the type of high associated with different strains ingredient which is acted upon synergistically by small amounts of CBN, CBD, and potentiate or suppress the effect of THC. We know that cannabinoid levels may be offspring. Therefore, cannabinoid levels are in part determined by genes. To achieve particular cannabinoid contents, an accurate and easy method is needed for measurement is certainly complex.

f) Taste and Aroma - Taste and aroma are closely linked.

As our senses for differentiating taste and aroma are connected, so are the source components of the resin secreted by glandular trichomes on the surface of the cannabis trichomes rupture and the aromatic terpenes are exposed to the air. There is often polymerization (joining together in a chain) of many of the smaller molecules of Cannabis resins age and mature, both while the plant is growing and while curing ammonia gas and other gaseous products given off by the curing, fermentation and

A combination of at least twenty aromatic terpenes (103 are known to occur in Cannabis) aromatic compound may be influenced by many genes; therefore, it is a complex: the genetic control of aroma, Each strain, however, has several characteristic aromas parents in aroma. Many times breeders complain that their strain has lost the desired aroma that is hereditary and often true-breeding. The cultivator with preservation it. This is good insurance in case the aroma is lost in the offspring by segregation

The aromas of fresh or dried clusters are sampled and compared in such a way that a piece of unscented writing paper at room temperature (above 650). A light squeeze trichome head. When sampling, never squeeze a floral cluster directly, as the resin floral cluster, avoids confusion during sampling, and contains the aromas as a gland

Taste is easily sampled by loosely rolling dried floral clusters in a cigarette paper

Taste in Cannabis is divided into three categories according to usage: the taste of being lighted; the taste of the smoke from burning Cannabis; and the taste of Cannabis

The terpenes contained in a taste of unlighted Cannabis are the same as those of generally tastes bitter due to the vegetative plant tissues, but the resin is characterized determined by the burning tissues and vaporizing terpenes. These terpenes may

Biosynthetic relationships between terpenes and cannabinoids have been firmly suspected that changes in aromatic terpene levels parallel changes in cannabinoid breeder will be better able to make field selections of prospective high-THC parents

g) Persistence of Aromatic Principles and Cannabinoids - Cannabis resins deteriorate hardly noticeable. Since fresh Cannabis is only available once a year in temperate Packageability and shelf life are important considerations in the breeding of fresh

h) Trichome Type - Several types of trichomes are present on the epidermal surface: bulbous, capitate sessile, and capitate stalked types. Of these, the capitate stalked type is a logical goal for breeders. Plants with a high density of capitate stalked trichomes are a logical goal for breeders with a small hand lens (10X to 50X). Recent research by V. P. Soroka (1979) concerns calyxes and the various cannabinoid contents of the floral clusters. In other words,

i) Resin Quantity and Quality - Resin production by the glandular trichomes varies from strain to strain. Resin heads may darken and become more resinous that are transparent amber instead of clear and colorless, and these are only when the plant is actively carrying out resin biosynthesis. When biosynthesis ceases, resin hardens, and the conditions inside the resin head, and this may prove to be another important factor.

j) Resin Tenacity - For years strains have been bred for hashish production. Hashish is a high resin production that gives up its precious covering of resin heads with only a little effort to facilitate hashish production. Strains that are bred for use as marijuana would be bred for low resin production.

k) Drying and Curing Rate - The rate and extent to which Cannabis dries is generally more rapidly and completely than others. It is assumed that resin has a role in preventing water from being secreted to coat and seal the surface of the calyxes and leaves. Resin is secreted by the trichome holding the resin away from the surface of the leaves. There it would dry and seal the surface. It seems that an alternate reason must be found for the great variation in drying and curing rates.

1) Ease of Manicuring - One of the most time-consuming aspects of commercial marijuana production is the removal of the larger leaves from the floral clusters. These larger outer leaves are not nearly as important as the inner leaves. Strains with fewer leaves obviously require less time to manicure. There is a marked size difference between very large outer leaves and tiny, resinous inner leaves.

m) Seed Characteristics - Seeds may be bred for many characteristics including : size, shape, color, and weight. Cannabis-seed cake is a fine feed for ranch animals. Higher-protein varieties may be desirable for certain uses.

n) Maturation - Cannabis strains differ greatly as to when they mature and how long they take to mature. Some strains, such as Colombian and Thai, are stubborn in maturing; however, a particular strain may produce some early, average, or late in maturing; however, a particular strain may produce some early, average, or late in maturing; however, a particular strain may produce some early, average, or late in maturing. On the one hand, developed strains that mature in four weeks, outdoors under temperature control, and others that take four months in their protected environment. Early maturation is extremely advantageous. Early-maturing plants are selected as parents for future early-maturing strains.

o) Flowering - Once a plant matures and begins to bear flowers it may reach peak production in several months. The rate at which a strain flowers is independent of the rate at which it matures. Some strains mature floral clusters in only a few weeks.

p) Ripening - Ripening of Cannabis flowers is the final step in their maturation process. Some strains will form and only after a period of apparent hesitation will the flowers begin to ripen. Some strains, such as those from Thailand, are known to ripen a few floral clusters at a time. Possibly Cannabis strains could be bred that are true everbearing.

q) Cannabinoid Profile - It is supposed that variations in the type of high associated with Cannabis are due to variations in the primary psychoactive ingredient which is acted upon synergistically by small amounts of other ingredients. It is used to establish cannabinoid phenotypes and that these phenotypes are passed on to offspring. It is used to accurately characterize highs from various individuals and establish criteria for breeding. It is used to measure cannabinoid levels in prospective parents.

Various combinations of these traits are possible and inevitable. The traits that vary from strain to strain are most easily accomplished by concentrating on the major phenotypes and breeding for the desired ideals.

6. Gross Phenotypes of Cannabis Strains

The gross phenotype or general growth form is determined by size, root production, gross phenotypes although there tend to be occasional rare examples of almost every phenotype. Hybrid crosses between imported pure varieties were the beginning of new variety are exhibited in various combinations by the F1 offspring. Nearly all of the offspring are saying a lot, but this F1 hybrid generation is far from true-breeding and the subsequent imported parental varieties, and will also exhibit recessive traits not apparent in either traits in subsequent generations. Enough of the original F1 hybrid seeds are produced.

Phenotypes and Characteristics

of Imported Strains

Following is a list of gross phenotypes and characteristics for many imported strains of Cannabis.

1. Fiber Strain Gross Phenotypes (hemp types)
2. Drug Strain Gross Phenotypes
 - a) Colombia - highland, lowland (marijuana)
 - b) Congo - (marijuana)
 - c) Hindu Kush - Afghanistan and Pakistan (hashish)
 - d) Southern India - (ganja marijuana)
 - e) Jamaica - Caribbean hybrids
 - f) Kenya - Kisumu (dagga marijuana)
 - g) Lebanon - (hashish)
 - h) Malawi, Africa - Lake Nyasa (dagga marijuana)
 - i) Mexico - Michoacan, Oaxaca, Guerrero (marijuana)
 - j) Morocco - Rif mountains (kif marijuana and hashish)
 - h) Nepal - wild (ganja marijuana and hashish)
 - 1) Russian - ruderalis (uncultivated)
 - m) South Africa - (dagga marijuana)
 - n) Southeast Asia - Cambodia, Laos, Thailand, Vietnam (ganja marijuana)
3. Hybrid Drug Phenotypes
 - a) Creeper Phenotype
 - b) Huge Upright Phenotype

In general the F1 and F2 pure-bred offspring of these imported varieties are more similar to each

However, it should be remembered that these are average. Gross phenotypes and recessive variation and stress will alter the gross phenotype. Also, the protective environment of a greenhouse tends

strains for breeding.

1. Fiber Strain Gross Phenotypes Fiber strains are characterized as tall, rapidly maturing, limit farmers to facilitate forming long fibers through even growth and maturation. Monoecious strain interferes with fiber production. Most varieties of fiber Cannabis originate in the northern temperate growing areas and offered commercially over the last fifty years in both Europe and America. They are early flowering, and low in cannabinoid production. They represent an escaped race of Cannabis sativa.

2. Drug Strain Gross Phenotypes Drug strains are characterized by Delta1-THC as the primary cannabinoid. They are derived from selective breeding for high potency or natural selection in niches where Delta1-THC biosynthesis is high. a) Colombia - (0 to 10 north latitude)

Colombian Cannabis originally could be divided into two basic strains: one from the lowland coastal region and one from inland from Santa Marta. More recently, new areas of cultivation in the interior plateau of the primary areas of commercial export Cannabis cultivation. Until recent years high quality Cannabis was introduced to Colombia just over 100 years ago, and its cultivation is deeply rooted in tradition. The production of "la mona amarilla" or gold buds is achieved by girdling or removing a section of the stem to produce plant products. Over several days the leaves dry up and fall off as the flowers slowly die (Partridge 1973). Trade names such as "punta roja" (red tips [pistils]), "Cali Hills," "chocoma" (location of cultivation).

In response to an incredible demand by America for Cannabis, and the fairly effective control by Paraquat, Colombian farmers have geared up their operations. Most of the marijuana smuggling to the United States domestic cultivation also originate in Colombia. Cannabis agri-business has squeezed out small farmers. The fine marijuana of Colombia was often seedless, but commercial Cannabis is now produced in large scale commercial agriculture and few of the small farmers remain. It is thought that some high quality Colombian strains are now highly prized by breeders. In the heyday of "Colombian" Cannabis, it was characterized by stringy, brown, fibrous floral clusters of sedative narcotic high. Now high quality Cannabis is characterized by a more sedative effect. Many of the unfavorable characteristics of imported Colombian Cannabis still contain genes favoring vigorous growth and high THC production. Colombian strains are often cured using curing and storage techniques. Domestic Colombian strains usually lack CBD and CBN. The majority of commercial strains.

Colombian strains appear as relatively highly branched conical plants with a long upright stem and slender leaflets (7-11) in a nearly complete to overlapping circular array of varying shades of green. They may fail to mature flowers in colder climates. These strains favor the long equatorial growth habit of low latitudes. Because of the horizontal branching pattern of Colombian strains and their long internodes, they tend to the central stalk. The small flowers tend to produce small, round, dark, mottled, and brittle buds. This may be caused by the synergistic effect of THC with higher levels of CBN. The buds, when dried, resembling compost heaps, may form CBN as a degradation product of THC. Colombian Cannabis is native to North America.

b) Congo - (5 north to 5 south latitude)

Most seeds are collected from shipments of commercial grade seeded floral clusters appropriate for seed production.

c) Hindu Kush Range - Cannabis indica (Afghanistan and Pakistan) - (30 to 37 north latitude)

This strain from the foothills (up to 3,200 meters [10,000 feet]) of the Hindu Kush range is characterized by a high THC content hashish. In these areas hashish is usually made from the resins covering the pistil late in the flowering stage. The plants are screened and collecting the dusty resins that fall off the plants. Adulteration and pressing up the resins is common. Cannabis indica. Early maturation and the belief by clandestine cultivators that this strain is the best for hashish.

throughout domestic populations of "drug" Cannabis. Names such as "hash plant" and "s Chitral, and Kandahar in Afghanistan and Pakistan.

This strain is characterized by short, broad plants with thick, brittle woody stems and they usually grow in an upright fashion until they are nearly as tall as the central stalk and form very wide, coarsely serrated leaflets in a circular array. The lower leaf surface is often like a maple leaf. Floral clusters are dense and appear along the entire length of the primary inner leaves associated with the calyxes are usually liberally encrusted with resin. Early rapid acclimatization to northern temperate latitudes and selection for hashish production. The staminate and pistillate individuals and continues throughout the life of the plant. Sweet psychoactivity.

Short stature, early maturation, and high resin production make Hindu Kush strains very desirable. This strain seems to be dominant for these desirable characteristics and they seem readily to hybridize with late-maturing, tall, sweet strain from Thailand, India, or Nepal. This produces hybrid offspring that grow better in northern climates. Many hybrid crosses of this type are made each year and are current in coloring with some mottling.

d) India Central Southern - Kerala, Mysore, and Madras regions (10 to 20 north latitude)

Ganja (or flowering Cannabis tops) has been grown in India for hundreds of years. These have been converted to hashish as in many Central Asian areas. This makes them of considerable interest to Indian farmers. Many Europeans and Americans now live in these areas of India and grow Cannabis.

Ganja strains are often tall and broad with a central stalk up to 12 feet tall and spreading serration arranged in a circular array. The frond-like limbs of ganja strains result from extreme growth. This promotes a high yield of floral clusters which in ganja strains tend to be small, slender, and they are extremely resinous and psychoactive. Medicinal Cannabis of the late 1800s and early 1900s.

e) Jamaica - (18 north latitude)

Jamaican strains were not uncommon in the late 1960s and early 1970s but they are much less common now. The "lamb's bread" and is rarely seen outside Jamaica. Most purported Jamaican strains are thought to have originated in Colombia and its position along the routes of marijuana smuggling from Colombia to Florida makes it responsible for the original Jamaican strains. Jamaican strains resemble Colombian strains. Jamaican strains produce a psychoactive effect of a particularly clear and cerebral nature. This is similar to the strains of Mexico, and this may account for the introduction of cerebral green strains.

f) Kenya - Kisumu (5 north to 5 south latitude)

Strains from this area have thin leaves and vary in color from light to dark green. They are very resinous.

g) Lebanon - (34 north latitude)

Lebanese strains are rare in domestic Cannabis crops but do appear from time to time. They are usually short with 5 to 11 slightly broad leaflets. They are often early-maturing and seem to be quite like the Hindu Kush strains in color. As with Hindu Kush strains, these plants are grown for the production of hashish for hashish making. Lebanese strains resemble Hindu Kush varieties in many ways and it is difficult to distinguish them from the Hindu Kush strains.

h) Malawi, Africa - (10 to 15 south latitude)

Malawi is a small country in eastern central Africa bordering Lake Nyasa. Over the past few years it has become a major source of Cannabis. The nearly seedless flowers are spicy in taste and powerfully psycho active. Enthusiasts have incorporated into several domestic hybrid strains. They appear as a dark green, large plant.

leaflets arranged in a narrow, drooping, hand-like array. The leaves usually lack serrations, long internodes, and are made up of large calyxes and relatively few leaves. The large calyxes are ovoid in shape with a dark grey or reddish brown, mottled perianth or seed coat. The calyxes have a thin, edged lip. Some individuals turn a very light yellow green in the flowering clusters as they mature. Cannabis was first accepted in Great Britain and North America as drug strains. Seeds of many strains appear similar, but phenotypes vary considerably, however, many are similar in appearance to strains from Mexico.

i) Mexico - (15 to 27 north latitude)

Mexico had long been the major source of marijuana smoked in America until recent years when it became minimally effective and many varieties of high quality Mexican drug Cannabis were continued. In recent years, however, the Mexican government (with monetary backing by the United States) has banned Cannabis. Their program was effective, and high quality Mexican Cannabis is now rarely available. Cannabis strains grown in Mississippi as the pharmaceutical research product for chemotherapy are also available. Cannabis strains or "brands" of Cannabis were usually affixed with the name of the state or area where they were grown. "Sinaloan" have geographic origins behind their common names and mean something to growers. Cannabis is grown through Nayarit, Jalisco, Michoacan, Guerrero, and Oaxaca; to Chiapas in the south at 15°N.

Strains from Michoacan, Guerrero, and Oaxaca were the most common and a few common to the other states.

Mexican strains are thought of as tall, upright plants of moderate to large size with light green leaves and flowers in a circular array. The plants mature relatively early in comparison to strains from Colombia. Mexican Cannabis psychoactivity. Michoacan strains tend to have very slender leaves and a very high calyx clusters. Oaxacan strains are generally the largest and grow vigorously, while Michoacan strains are generally the smallest. Seeds from most Mexican strains are fairly large, ovoid, and slightly flattened with a light green color. Cannabis marijuana during recent years. This may indicate that hybridization is taking place in Mexico. Cannabis crops are free from hybridization and great variation may occur in the offspring. To find Thai and Afghani phenotypes in recent shipments of Cannabis from Mexico.

j) Morocco, Rif Mountains - (35 north latitude)

The Rif mountains are located in northernmost Morocco near the Mediterranean Sea and the Atlantic Ocean. Cannabis used for kif floral clusters and hashish production. Seeds are broad-sown or scattered. Cannabis is harvested in late August and September. Mature plants are usually 1 to 2 meters (4 to 6 feet) tall. A pistillate plant bears only one main terminal flower cluster full of seeds. Few staminate plants are present. Cannabis floral clusters to be mixed with tobacco and smoked as kif, hashish production has begun in Morocco. Cannabis is grown over a silk screen and collecting the powdery resins that pass through the screen. It is a common practice to grow Cannabis strains were grown for seedless flower production and areas of Morocco may still exist with Cannabis.

Because of selection for hashish production, Moroccan strains resemble both Lebanese and Afghani strains. Moroccan strains are possibly related to these other Cannabis indica types.

k) Nepal - (26 to 30 north latitude)

Most Cannabis in Nepal occurs in wild stands high in the Himalayan foothills (up to 3,200 meters). Cannabis hashish and marijuana originate. Nepalese plants are usually tall and thin with long, slender leaves and flowers in a "ball" and "finger" hashish hand-rubbed from wild plants. Resin production is abundant and Cannabis is used to make strong hybrids with strains from domestic sources and Thailand.

l) Russian - (35 to 60 north latitude) Cannabis ruderalis (uncultivated)

Short stature (10 to 50 centimeters [3 to 18 inches]) and brief life cycle (8 to 10 weeks), Cannabis ruderalis is a weedy Cannabis and named it Cannabis ruderalis. Ruderalis could prove valuable in breeding Cannabis strains old without apparent dependence on daylength. Russian Cannabis ruderalis is nearly always found in the wild.

m) South Africa - (22 to 35 south latitude)

Dagga of South Africa is highly acclaimed. Most seeds have been collected from marijuana. The stretched light green floral clusters and sweet aroma are comparable to Thai strains.

n) Southeast Asia - Cambodia, Laos, Thailand and Vietnam (10 to 20 north latitude)

Since American troops first returned from the war in Vietnam, the Cambodian, Laotian, Thai, and Southeast Asian Cannabis is produced in northern and eastern Thailand. Until recent times, it was grown in a home garden. The pride of a farmer in his crop was reflected in the high quality and seedless nature of the crop. Cannabis cultivation has become a big business in Thailand and many farmers are growing it. Strains brought to Thailand to replenish local strains and begin large plantations, may have hybrid origins and are cut and dried for export.

Strains from Thailand are characterized by tall meandering growth of the main stalk and leaflets arranged in a drooping hand like array. The Thai refer to them as "alligator tails"

Most Thai strains are very late-maturing and subject to hermaphroditism. It is not understood why or if they have a genetically controlled tendency towards hermaphroditism. To the dismay of breeders, development and apparent disregard for changes in photoperiod and weather may have contributed to this. Thai strains are very psychoactive and many hybrid crosses have been made with rapidly maturing strains for high psychoactivity and characteristic Thai sweet, citrus taste. The calyxes of Thai strains are usually polyploid. No natural polyploidy has been discovered in any strains of Cannabis though not all are brown or tan in color. The perianth is never mottled or striped except at the base. Green leaves are common.

3. Hybrid Drug Phenotypes

a) Creeper Phenotype - This phenotype has appeared in several domestic Cannabis crops and is not genetically controlled (dominant or recessive), but efforts to develop a true-breeding strain have failed. The plants grown to about 1 meter (3 feet) in height. It then begins to bend at approximately the midpoint and sag until they touch the ground and begin to grow back up. In extremely loose mulch and low light exposure, the primary limbs continue to branch once or twice, creating wide frond-like plants. The leaves of these creeper phenotype plants are nearly always of medium size with 7-11 leaflets.

b) Huge Upright Phenotype - This phenotype is characterized by medium size leaves with 7-11 leaflets. In this phenotype, however, a long, straight central stalk from 2 to 4 meters tall is produced, as tall or occasionally taller than the central stalk. This strain resembles the Hindu Kush strains with slender, more highly branched primary limbs, much narrower leaflets, and a higher calyx to leaflet ratio. The origin may be determined.

The preceding has been a listing of gross phenotypes for several of the many strains of Cannabis. It is the hope of American and European Cannabis enthusiasts. As a consequence of this extreme mobility, it is feared that the Cannabis populations and the socio-economic displacement of Cannabis cultures worldwide. Collections of these strains are being made.

Various combinations of these traits are possible and inevitable. The traits that we most often see are the result of concentrating on the dominant phenotypes for the most important traits. The best breeders set high standards for their crops.

Chapter 4 - Maturation and Harvesting of Cannabis

To everything there is a season, and a time to every purpose under heaven:
A time to be born, and a time to die;
a time to plant, and a time to pluck up
that which is planted,

Err:508

Maturation

The maturation of Cannabis is normally annual and its timing is influenced by the age of the plant (two months) and the nights lengthen following the summer solstice (June 21-22), flowering begins. Leaves of Cannabis plants form fewer leaflets during flowering until the floral clusters are formed (number through the pre-floral stage).

The staminate and pistillate sexes of the same strain mature at different rates. Staminate plants produce only a few pairs of primordial flowers. It would seem more effective for the staminate plant to release pollen early, however, it becomes obvious that early pollination is advantageous to survival. Pollinations that take place early have a chance of frost damage or predation by herbivores. If conditions are favorable, the staminate plants begin to shed pollen the month or more of shedding pollen the staminate plants enter senescence. This period is marked by the dropping of leaves, and the spent, lifeless stamens hang in the breeze until fungi and bacteria return the

Pistillate plants continue to develop up to three months longer as they mature seeds. As the calyx flowers are continually produced and fertilized, there are nearly always seeds ranging in maturity throughout several months. The effectiveness of this type of reproduction is demonstrated by the fact that it multiplies each year, through the timely dehiscence of millions of pollen grains and the fertilization of seeds. As the plant senesces, the leaves turn yellow and drop, along with the remaining mature seeds. The rest of the

Although the staminate plants begin to release pollen before the pistillate plant has begun to form flowers, staminate plants begin to release pollen. This ensures that the first pollen released has a chance to be recognizable in a crop, so early selection of seed-parents is quite easy. Often the primordia of staminate plants are visible weeks before the pistillate plants begin to form flowers. Pistillate plants also may develop vegetative growth in place of the usual primordial calyxes to sinsemilla Cannabis cultivators, since the staminate plants that are hesitant to differentiate sex for staminate plants if they are slow to form calyxes, since vegetative growth at the nodes could also

Latitude and Photoperiod

Change in photoperiod is the factor that usually triggers the developmental stages of Cannabis. Plants are found near the equator, and the most widely fluctuating photoperiods and most radical seasonal variation depending on their distance from the equator or height in altitude. A graph of light cycle adaptations of strains to their native environments.

The wavy lines follow the changes in photoperiod (daylength) for two years at various latitudes. For example, at 15° latitude with a 15-hour photoperiod on June 21 (summer solstice). As the months progress to the right, the daylength increases and Cannabis plants begin to flower and produce THC. (Increased THC production is represented by the shaded area) and produce more THC until a peak period is reached during October and November. After this time, the daylength decreases until the winter solstice (shortest day of the year, around December 21) if they are protected from frost. At 15° latitude, the daylength gets long (12-14 hours) and warm from March to May. Farther north at 60° latitude the day-length

Light cycles and seasons vary as one approaches the equator. Near 20° north latitude (Hawaii, India), the daylength is long, and THC production, between 10 and 14 hours. The light cycle at 20° north latitude starts at the summer solstice and finishes later than at higher latitudes. However, because the photoperiod is never too long to induce flowering, strains from these latitudes are often not as responsive to photoperiod change, and flowering seen even if photoperiod does not exceed 13 hours. At 20° latitude, the photoperiod never exceeds 14 hours.

Equatorial areas gain and lose daylength twice during the year as the sun passes north and south of the equator, but at some locations along the equator it is possible to grow two crops of fully mature Cannabis plants. In temperate and dry seasons, the effective growing season may be determined. If an area has too short an effective

planting and length of the growing season in these marginal conditions can also be determined from

For instance, assume a researcher wishes to grow a crop of Cannabis near Durban, South Africa, and a maturation of drug Cannabis, exists from October through June. Local weather conditions indicate that heavy rains in Durban in June could damage plants and some sort of storm protection might be necessary. Any estimates of yield would have to take these conditions into account.

Combination and simplification of the earth's climatic bands where Cannabis is grown yields an ecological classification of the maturation cycle for drug Cannabis in each zone follows.

Equatorial Zone - (15 south latitude to 15 north latitude)

At the equator the sun is high in the sky all year long. The sun is directly overhead twice a year at each equinox. As a result, the equatorial zone has two times during the year when floral induction occurs. Unless the weather forbids, the fields may be used twice a year. Colombia, southern India, Thailand, and any areas of commercial Cannabis cultivation, other than Colombia, lie within the heart of the equatorial zone so it may be impossible to find a dry enough place to grow one crop of Cannabis, much less two. In the northern hemisphere, however, equatorial Cannabis has great potential for drug production.

Northern and Southern Subtropical Zones - (15 to 30 north and south latitudes)

The northern subtropical zone is one of the largest Cannabis producing areas in the world, while the southern subtropical zone is the second largest. The northern subtropical zone has a long growing season from October-December in the northern hemisphere and from September-October through March-June in the southern hemisphere, spanning from 90 to 120 days. In Hawaii, Cannabis cultivators sometimes actually break up the long subtropical season during which some of the world's most potent Cannabis strains are produced. The most Cannabis producing areas located in the northern subtropical zone.

North and South Temperate Zones - (30 to 60 north and south latitudes)

The temperate zones have one medium to long season stretching from March-May through September-October in the northern hemisphere and from October-December through March-June in the southern hemisphere. Central China, Korea, Japan, United States, southern Europe, Morocco, Turkey, Lebanon, Iran, Afghanistan, and Mexico produce large amounts of fiber as well as drug Cannabis. The south temperate zone includes only the southern part of the subtropical zone and is well known for the cultivation of drug Cannabis.

Arctic and Antarctic Zones - (60 to 70 north and south latitudes)

The arctic and antarctic zones are characterized by a short, harsh growing season that is not favorable for Cannabis. The growing season begins in late May or June and continues until the first freezes of September or October. The photoperiod is very long in these areas, but they do not get a long enough season to mature completely and therefore Cannabis plants are stunted. Only small stands of escaped fiber and drug Cannabis grow naturally in these areas. Cannabis plants that are within the arctic zone and only small stands of escaped fiber and drug Cannabis grow naturally on a commercial scale. Rapidly maturing, acclimatized hybrid strains from temperate North America and Russia and Cannabis ruderalis could yield very short season drug strains.

It becomes readily apparent that most of the drug Cannabis occurs in the northern subtropical and southern subtropical zones of Cannabis the world over. It is also readily apparent that the equatorial zone and subtropical zones

Strains that have become adapted to their native latitude will tend to flower and mature under domestic conditions. Strains from Mexico (subtropical zone) will usually completely mature by the end of October. Strains from the northern subtropical zone may be selected from latitudes similar to the area to be cultivated so that the chances of growing Cannabis are increased. A separate set of environmental factors (distinct from the long season) that influence genotype and phenotype are the photoperiod and because of the length of the season and differences in response to photoperiod. For that reason, it is difficult to grow Cannabis in a temperate season, or if they are used indiscriminately for both seasons. Sometimes the only information available is the length of the season in a temperate growing area, but a short season strain might do very well.

Moon Cycles

Since ancient times man has observed the effect of the moon on living organisms, especially his cycle of 29 days to completely orbit the earth. This cycle is divided into four one-week phases. It starts as the waning (shrinking) cycle begins and the moon passes back for two weeks through another quarter moon, and the best time to harvest is on the waning moon. Exact new moons, full moons, are most favored during phases 1 and 2. The best time is a few days before the full moon. Phases 3 and 4 are less favored.

Root growth seems accelerated at the time of the new moon, possibly as a response to increased moonlight. Strong, full moonlight is on the borderline of being enough light to cease floral induction even on nights of bright moonlight.

Conversely, plants begin floral growth during the dark nights of the new moon. More research is needed to confirm this.

Floral Maturation

The individual pistillate calyxes and the composite floral clusters change as they mature. External changes are connected with the invisible internal metabolic changes, then the cultivator is in a better position to observe which can put the process in more objective terms.

The calyxes first appear as single, thin, tubular, green sheaths surrounding an ovule at the basal end of the calyx. As the flower begins to age and mature, the pistils grow longer and the calyx ends in a state of reproductive ripeness. From this point on, the pistils begin to swell and darken slightly, and the calyx is not likely that it will produce a viable seed if pollinated. Without pollination the calyx begins to swell and turn orange brown. By this time, the swollen calyx has accumulated an incredible layer of resin, but seed development has ended the developmental cycle of the individual pistillate calyx. The resins turn opaque and the calyx begins to shrivel.

The biosynthesis of cannabinoids and terpenes parallels the developmental stages of the calyx and determines the maturational state of the entire floral cluster. Thus, determination of maturational stages and development of the plant as a whole.

The basic morphological characteristics of floral maturation are measured by calyx-to-leaf ratio and are usually characterized by decreased calyx growth and increased leaf growth. Internode length is usually measured as the internode length may increase in response to increased humidity and lowered light conditions and the possibility of re-growth the following season. At this time nearly all resin secretion has ceased. During a longer and warmer growing season. Greenhouses have been used in temperate latitudes to simulate a stretched condition in the floral clusters in response to high humidity, high temperatures, and long photoperiods.

Simulation of the native photoperiod of a certain strain is achieved through the use of blackout curtains. The photoperiod can be estimated from the graph of maturation patterns at various latitudes (p.124). In this way it is possible to determine the photoperiods characteristic of ripe outdoor Cannabis. Some strains, however, such as those from Thailand, have long internodes in their native environment. Imported examples from Thailand also have long internodes in the pistillate floral clusters. This condition is furthered as rejuvenation begins during autumn days of decreasing photoperiod.

Cannabinoid Biosynthesis

Since resin secretion and associated terpenoid and cannabinoid biosynthesis are at their peak just before harvest, plants are harvested during this time. More subtle variations in terpenoid and cannabinoid levels also take place during this time.

The cannabinoid ratios characteristic of a strain are primarily determined by genes, but it must be noted that environmental factors along the cannabinoid biosynthetic pathway. These environmental factors can cause an atypical final product, nor do all of them complete the cycle and turn into THC molecules simultaneously. Not all factors involved in the growth and maturation of Cannabis do affect final cannabinoid levels, These factors include:

technique, and local environment. In addition to genetic and seasonal influences, the picture is full of peaks and valleys. During peak periods of resin secretion new flowers are produced every day and begin their own cycle. The resultant cannabinoid ratios indicate which stage the floral cluster has reached. Since it is difficult to determine the exact stage, discussion will center on the known and theoretical correlations between the external characteristics and the internal cannabinoid profile. This may be gleaned by observing the cannabinoid biosynthesis. Focus on the lower left-hand corner of the diagram and move toward the right side of the page at the crest of the reaction sequence, and realize that there are many cannabinoid acids. Actually, THC acid and the other necessary cannabinoid acids are not psychoactive. They are part of a biosynthetic pathway, and these acids undergo the strategic reactions that determine the position of the double bond to harden and the cannabinoid acids begin to decarboxylate. Any remaining cannabinoid acids are part of the biosynthetic pathway. Several are known to be psychoactive and many more are suspected of psychoactivity. Shorter acting than pentyl (five-carbon) THC's and may account for some of the quick, flashy effects. Many cannabinoid pathways have homologs at nearly every step along the pentyl pathway and their synthesis is basic.

The first step in the pentyl cannabinoid biosynthetic pathway is the combination of olivetolic acid and geranyl pyrophosphate. The biosynthetic route of the aromatic terpenoids may be a clue to formation of the cannabinoids. The CBG acid may be converted to CBGM (CBG acid monomethyl ether), or a hydroxyl group (OH) attached to the molecule, either CBC acid (cannabichromenic acid) or CBD acid (cannabidiolic acid) is formed. CBC acid is thought to modify the psychoactive effect of the THC in a sedative way. CBC is also mildly psychoactive and may be a precursor to the effect of THC and CBC may potentiate the effect of THC, although this has not yet been proven under environmental conditions.

Conversion of CBD acid to THC acid is the single most important reaction with respect to psychoactivity. Mechoulam has centered around the role of ultraviolet light in the bio-synthesis of THC acids and has shown that CBD acid in n-hexane to ultraviolet light of 235-285 nm. for up to 48 hours. This reaction uses atmospheric oxygen and some of the products formed in the laboratory experiment do not occur in living specimens. Four different isomers of THCA resulting from the positions of the double bond on carbon 1 or carbon 6. Delta-9-THC acid is about four times more prevalent than Delta-6-THC acid in most strains. Also Alpha and Beta THCA have different carboxyl (COOH) groups on the olivetolic acid portion of the molecule. It is suspected that the psychoactive differences in psychoactivity not detected in animals by laboratory instruments, but often discussed in the literature, psycho-activity is attributed to the ratios of the primary cannabinoids of CBC, CBD, THC and CBN; and the presence of other cannabinoids. Myriad subtle combinations are sure to exist. Also, terpenoid and other aromatic compounds are present.

Environmental conditions influence cannabinoid biosynthesis by modifying enzymatic systems and by altering the availability of precursors. Higher than lower environments. Recent studies by Mobarak et al. (1978) of Cannabis grown in Afghanistan have shown the presence of pentyl homo-logs. Other strains from this area of Asia have also exhibited the presence of propyl and butyl cannabinoids. Aridity favors resin production and total cannabinoid production; however, it is unknown whether aridity influences cannabinoid production directly. Ultra-violet light participates in the biosynthesis of THC acids from CBD acid. It is unknown whether increased ultraviolet light might shift cannabinoid synthesis from pentyl to propyl and butyl cannabinoids.

The ratio of THC to CBD has been used in chemotype determination by Small and others. The genetic control of the chemotype, but if a strain has the genetically determined ability to convert CBD acid to THC acid then the ratio of THC to CBD will be very high. A strain with a very high THC level and no CBD although there are fair amounts of CBC acid present in the sample. Also, many early authors confused CBC with CBD in analyzed samples because of the presence of CBC acid. An enzymatically controlled system involving the direct conversion of hydroxy-CBG acid to THC acid is possible. Turner and Hadley (1973) suggest, then CBD acid would be bypassed in the cycle and its absence in the sample. If CBC acid is rearranged before forming CBD acid, CBC acid may be the accumulated intermediate, the reaction of CBC acid directly converted to THC acid by a similar enzyme system to that which reversed the formation of CBD acid. A strain is converted directly to THCA as soon as it is formed and no CBD builds up. Also Turner, Hadley and others have shown by the glandular trichomes. In any event, these possible deviations from the accepted biosynthetic pathway are possible.

Returning to the more orthodox version of the cannabinoid biosynthesis, the role of ultraviolet light in the conversion of CBD acid to THC acids. Therefore, the lack of CBD in strains grown under artificial lights. Light energy has been collected and utilized by the plant in a long series of experiments.

products not metabolically produced by the living plant. These cannabinoid acids are formed through a process accomplished primarily by heat and light and is not enzymatically controlled by the plant. CBN is a byproduct of the breakdown of THC acid. The balance between CBC, CBD, THC, and CBN is determined by genetics and maturation. THC production in trichomes as they mature are the result of THC acid being broken down to CBN acid while CBD acid increases; if the breakdown rate is faster than the rate of biosynthesis, the THC level drops. As maturation begins to slow, the resins will usually polymerize and harden. During the late floral stages the resins turn white. Near-freezing temperatures during maturation will often result in opaque white resins. During

Harvest Timing

With this dynamic picture of the biosynthesis and degradation of THC acids as a frame of reference to ensure high THC levels modified by just the proper amounts of CBC, CBD and CBN, along with the production of CBN acid at the same time they are being made from CBD acid, it is important to harvest at a time that takes into account a number of indicating factors and knows when to harvest the desired type of floral clusters. Some strains produce very aromatic and light resins; the psychoactive effect is characterized as a light cerebral high. High CBD marijuana is characterized by a more intense body effect and an inhibited cerebral effect (high CBC gives the cultivator a set of samples at all stages of maturation and creates a basis for deciding on harvest time, aroma, and relative psychoactivity).

Premature Floral Stage

At this stage floral development is slightly beyond primordial and only a few clusters of immature floral diameter within the floral clusters is very nearly maximum. The stems are easily visible between the larger and smaller tri-leaflet leaves are beginning to form in the new floral axis. A few narrow white filaments stretching to test the surroundings. During this stage the surface of the calyxes is covered with trichomes have begun to develop. Resin secretion is minimal, as indicated by small resin heads and cannabinoid production is low, and there is no economic value other than fiber and leaf. Terpene production and cannabinoid production is low but simple cannabinoid phenotypes, based on relative amounts of THC and CBD, are characteristic of a drug strain. A fiber strain rarely produces more than 2% THC, even under perfect agricultural conditions. A drug strain or produces practically no THC and high CBD and is termed a fiber strain, This is generally

The floral clusters are barely psychoactive at this stage, and most marijuana smokers classify the effect as a body high of CBC and CBD. CBD production begins when the seedling is very small. THC production also begins at this stage until the early floral stage and rarely produce a "high" until the peak floral stage.

Early Floral Stage

Floral clusters begin to form as calyx production increases and internode length decreases. Tri-leaflet pairs of calyxes appear along each secondary floral axis and each pair is subtended by a tri-leaflet leaf. The leaves darken as they lose fertility, and some resin secretion is observed in trichomes along the veins of the leaves. A slight terpene aroma and psychoactivity are detectable. The floral clusters are not ready for harvest until they reach a THC level of more than 3% are not high enough to produce more than a subtle effect.

Peak Floral Stage

Elongation growth of the main floral stem ceases at this stage, and floral clusters gain most of their size during this stage. Small reduced mono-leaflet and tri-leaflet leaves subtend each pair of calyxes. The leaves begin to wilt and turn yellow as the pistillate plant reaches its reproductive peak. In the primary stage the plant is white with many pairs of ripe pistils. Resin secretion is quite advanced in some of the older infertile trichomes. Precious unfertilized ovules. Under wild conditions the pistillate plant would be starting to form seeds but is interrupted. Pistillate plants remain unfertilized and begin to produce capitate-stalked trichomes. Terpene and cannabinoid production increase. The elevated resin heads appear clear, since fresh resin is still being secreted. THC levels remain stable as the molecules are rapidly converted to THC acids, THC acid synthesis has peaked. Terpene production is also nearing a peak and the floral clusters are beautifully aromatic. Many cultivators

psychoactive effect. It is believed that, in peak floral clusters, the low levels of CBD and CBN allow and tastes are often less resinous and tar like than at later stages. Many strains, if they are harvested. Cultivators wait longer for the resins to mature if a different taste and psychoactive effect is desired.

This is the point of optimum harvest for some strains, since most additional calyx growth has ceased.

Late Floral Stage

By this stage plants are well past the main reproductive phase and their health has begun to decline. (purple, orange, yellow, etc.) begin to appear in the older leaves and calyxes at this time; many of them. Heavy layers of protective resin heads cover the calyxes and associated leaves. Production of additional resins. As the previously secreted resins mature, they change color. The polymerization of small terpenes. Ripening and darkening of resins follows the peak of psychoactive cannabinoid synthesis and the transition to amber resins are a sign of high-quality drug Cannabis and many of the finest strains exhibit this color. Clear with transparent amber colored instead of clear resin heads. This is also characteristic of Cannabis. Resin production and maturation. Many areas of North America and Europe have too short a season to ripen rapidly and begin maturing in time to ripen amber resins while the weather is still warm and dry.

The weight yield of floral clusters is usually highest at this point, but strains may begin to grow and resin accumulation is highest at this stage, but the period of maximum resin production has passed. If conditions are even if many of the resin heads are missing or have begun to deteriorate and the overall psychoactive and metabolic processes of the plant have ceased. Since cannabinoids are so sensitive to decomposition, they are protected from the sun by amber or opaque resins than by clear resins. Some late maturing strains usually a sign that the floral clusters are over-mature.

Late floral clusters exhibit the full potential of resin production, aromatic principles, and psychoactive compounds. Terpenes and ketones determine the aroma and flavor of mature Cannabis. The levels of the basic terpenes are high. Drying, as by the late floral stage, a high proportion of ripe resins are present on the mature calyxes. Active biosynthesis has ceased and more THC acid is being broken down into CBN acid than is being produced. The THC-to-CBD ratio in the harvested floral clusters certainly begins to drop as biosynthesis ceases. Intact since CBD does not decompose as rapidly as THC acid. This tends to produce marijuana characterized by the peak floral stage.

Senescence or Rejuvenation Stage

After a pistillate plant finishes floral maturation, the production of pistillate calyxes ceases and the plant will sprout new vegetative growth in preparation for the following season. Senescence is often characterized by color from yellow through red to deep purple. Eventually a brown shade pre-dominates and death occurs. The plant is made up of unserrated single leaflets separated by thin stems with long internodes. It is as if the plant's production completely stopped. Floral clusters left to ripen until the bitter end usually produce inferior quality.

Terpene secretion changes along with cannabinoid secretion and psychoactive effect. Various terpenes are secreted by the plant. If these changes in aromatic principles are directly correlated with changes in cannabinoid production, they are likely to be related.

It is important to understand differences in the anatomy of floral clusters for each Cannabis strain. Some are characteristic of particular strains and may vary widely. Some generalizations can be made. In general, there is a sudden increase in stem percentage. The percentage of inner leaves usually starts very low and increases. In some strains the percentage of inner leaves drops sharply during the peak floral stage and rises again after the plant has matured.

Calyx production follows two basic patterns. In one, the percentage of calyxes climbs gradually and then ceases. Other strains continue to produce calyxes at the expense of leaves, and the calyxes continue to grow out during the peak floral stage irrespective of whether leaf growth accelerates or calyx growth ceases.

Resins generally accumulate steadily while the plant matures, but strains may vary as to the stage at which they are most abundant.

of drug Cannabis grown domestically are nearly seedless.

To determine dry weight, samples are harvested, labeled, and air dried until the central stem of the plant would be brittle. Temperatures above 100°F would ruin the Cannabis. The dry floral cluster is weighed. The outer leaves, inner leaves, and stem are weighed separately. Dividing the individual dry weights by the total dry weight.

Calyx percentage ranges from 30 to 70% of the dry weight of the seedless floral clusters, depending on the strain. It seems obvious that for drug harvesting a maximum calyx production is important to quality. A breeding goal not yet attained.

Harvesting Cannabis at the proper time requires information on how floral clusters mature and a consistent environment. In a controlled environment of cultivation, the path to success is straightened when a definite goal is established. Personal preference is a factor.

Factors Influencing THC Production

Many factors influence the production of THC. In general, the older a plant, the greater its potential. Proper quantity and quality of light. It seems that none of the biosynthetic processes operate efficiently under a 12-hour photoperiod than under a 10-hour photoperiod. Warm temperatures stimulate the response to the threat of floral desiccation by the hot sun. Resin collects in the heads of glandular trichomes. The trichomes are the sun's rays so that fewer of them strike the leaf surface and raise the temperature. However, the trichomes are broken down. Humidity is an interesting parameter of THC production and one of the most important. It follows that increased resin production in response to arid conditions might be found in equatorial zones) and produce copious quantities of resin. Cannabis seems not to produce more resin in response to a long flowering does not stimulate THC production, although an arid atmosphere may do so. A Cannabis plant in an arid atmosphere may do so.

There is really no confirmed method of forcing increased THC production. Many techniques have been used to cut off the flow of water and nutrients between the roots and the shoots. This technique may not be effective (Gardner, 1973). Impaling with nails, pine splinters, balls of opium, and stones are clandestine folk methods of increasing resin production. The original culture or scientific basis. Symbiotic relationships between herbs in companion plantings; for example, stinging nettles, as companion plants for Cannabis, in an effort to stimulate resin production. In the

In general, it is considered most important that the plant be healthy for it to produce high THC levels. That is, the provision of adequate organic nutrients, water, sunlight, fresh air, growing space, and time. Inadequacies in the environment limits the true expression of phenotype and cannabinoid potential. A healthy plant is best able to raise this defense. Forcing plants to produce is a perverse ideal and alien to the primary processes of the plant rely on delicate natural balances aimed at the ultimate survival of the plant. The plant grows and guide the plant until it matures.

Flowering in Cannabis may be forced or accelerated by many different techniques. This does not mean that the plant will flower rapidly. Most techniques involve the deprivation of light during the long days of summer to promote flowering. A 12-hour photoperiod for 12 hours of each 24-hour day until the floral clusters are mature. This stimulates an increase in resin production for a few hours at sunrise or sunset, and these are used to cover small plants. Photoperiod alteration techniques require 11-12 hours of continuous darkness to induce flowering and at least 10 hours of continuous light to extend daylength, while the sun supplies the energy needed for growth and THC biosynthesis. It is believed that the phytochrome (a light-dependent on accumulated solar energy since light responses can be activated and THC production is regulated by phytochrome) acts as a switch, causing the plant to follow the flowering cycle. THC production is

Cool night temperatures seem to promote flowering in plants that have previously differentiated. Some Cannabis strains are sensitive to many of the signs of an approaching fall season and respond by flowering earlier and never speed up development.

Contrary to popular thought, planting Cannabis strains later in the season in temperate latitudes results in higher yields.

and it will finish earlier. This is often not true. Seedlings started in February or March grow for 4-5 plants grow and may form floral inhibitors during the months of long photo-period. When the days leaves. Since floral cluster formation takes 6-10 weeks, the initial delay in flowering could push the differentiate sex by March or April. Usually these plants form few floral clusters and rejuvenate for July, after the summer solstice, are exposed only to days of decreasing photoperiod. When old ones begin the 6-10 week floral period with plenty of time to finish during the warmer days of October. greenhouse research, where it is common for plants to grow far too large for easy handling before. However, flowering is delayed into September since the plant must grow before it is old enough to reproduce.

Extremes in nutrient concentrations are considered influential in both the sex determination and flowering. High nitrogen levels during flowering often result in delayed maturation and excessive leafing in the fertilizers known as "bloom boosters" are available, and these have been shown to accelerate flowering. Soil is very acidic. A safer method for the plant is the use of natural phosphorus sources, such as colloidal phosphorus that is readily available as well as long-term in effect. Chemical fertilizers sometimes act in an adverse way.

Hormones, such as gibberellic acid, ethylene, cytokinins and auxins, are readily available and can affect plant physiology is not simple, and results are usually unpredictable.

Harvesting, Drying, and Curing

Cannabis is cultivated for the harvest of several different commercial products. Pulp, fiber, seed, and other parts of the plant are determined by the intended use of the plant. Pulp is made from the Cannabis plant. The floral clusters are responsible for the production of seeds, drugs, and aromatic compounds.

If plants are to be used solely as a pulp source for paper production, they may be harvested at an early stage. Small stems are stripped from the larger stalks, and after drying they are baled and stored or made into resilient paper. In Italy, the finest Bibles are printed on hemp paper.

Fiber or hemp Cannabis is usually grown in large, crowded fields. Crowding of seedlings results in a lower yield per plant but before the fibers begin to lignify or harden. The cut stalks are stripped of leaves and tissues that join the fibers into bundles, so that the individual fibers are freed. Natural retting organisms such as fungi and bacteria. Dew may also wet the stalks, and they are turned frequently in the liberation of individual fibers from their vascular bundles. Natural retting takes from one week to several weeks, depending on the weather. Natural retting takes from one week to approximately 25% of the weight of the dried stalks.

Seeds are harvested by cutting fields of seeded pistillate plants and removing the seeds either by hand or machine. They are used as pulp material or low-grade marijuana. The Indian tradition of preparing ganja is by walking over the plants with a heavy boot.

Seeds are allowed to dry completely and all vegetable debris is removed before storage. This prevents them from being not exposed to excess humidity (causing them to germinate) or excessive aridity (causing them to die). They are stored in air-tight containers in a cool, dark, dry place. Freezing may also dry out seeds and cause them to die. Fewer of them will germinate, but even after 5 to 6 years a small percentage of the seeds usually will. Seeds for long-term cultivation might be stored for a longer time if the initial sample is large enough to provide sufficient numbers. That enough viable seeds are always available.

Curing Floral Clusters

Harvesting, drying, curing, and storage of Cannabis floral clusters to preserve and enhance appearance and potency is more difficult than by any other single cause. When the plant is harvested, the production of fine floral clusters is enhanced by removing them from the stalks and carefully packaging them in shallow boxes or trays, or all simultaneously. This is used because the entire plant is not ripe at any given time. Removing individual clusters also makes it possible to store them if the plant is dried whole. This means that all of the water in the plant must pass through the storage process.

drying is slowed since little water vapor escapes.

Boiling attached Cannabis roots after harvesting whole plants, but before drying, is an interesting actuality, there are very few resins within the vascular system of the plant and most of the resins part of the vascular system. As a result, neither boiling nor any other process will move resins and roots shocks the stomata of the leaves and forces them to close immediately; less water vapor is through the leaves instead of through the flowers.

Whole plants, limbs, and floral clusters are usually hung upside down or laid out on screen trays to limb tips. As with boiling roots, little if any transport of cannabinoids and resins through the vascu they dry, and the resins are protected from rubbing off during handling. Floral clusters also appear slightly pressed profile, and the leaves do not dry around the floral clusters and protect them. Also during handling, and upon drying, bruised tissue will turn dark green or brown. Resins are very frag and smoke. Floral clusters, including large leaves and stems, usually dry to about 25% of their ori briskly when bent. Usually about 10% water remains in dry, stored Cannabis floral clusters prepar a useless powder exposed to decomposition by the atmosphere.

As floral clusters dry, and even after they are sealed and packaged, they continue to cure. Curing of water from the floral clusters so they will be dry enough to burn. Curing takes this process one the tissues and may remain there indefinitely. A floral cluster is not dead after harvest any more t apple after it is picked. During this period, cannabinoid acids decarboxylate into the psychoactive is suspected that cannabinoid biosynthesis may also continue for a short time after harvest. Taste are kept at a humidity very near that of the inside of the stomata. Alternatively, sealing and open of gases given off during curing. It also exposes the clusters to fresh air needed for proper curing.

If the container is airtight and not vented, then rot from anaerobic bacteria and mold is often seen trimmed of outer leaves just prior to smoking. This is called manicuring.

The leaves act as a wrapper to protect the delicate floral clusters. If manicured before drying, a si

Storage

Cannabis floral clusters are best stored in a cool, dark place. Refrigeration will retard the breakdo tissues and this may harm the resins secreted on the surface. Floral clusters with the shade leave so they do not rub together. Glass jars and plastic freezer bags are the most common containers t breathe air and water vapor. This may cause the floral clusters to dry out excessively and lose pot air-tight, but glass breaks. It is feared by some connoisseurs that plastic may also impart an unple another opaque container is used to cover the clear glass or plastic wrapping. Clusters are not sea the free exchange of oxygen and end curing. However, oxygen also causes the slow breakdown o container will be used up and no more can enter. Nitrogen has been suggested as a packing medi Vacuum-sealing machines are available for Mason jars and may be modified to vacuum-sealed ba

The proper harvesting, curing, and storage of Cannabis closes the season and completes' the life preservation and its possible beneficial uses deserve more research.

He who sows the ground with care and diligence acquires greater stock of religious merit than he

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ch. The shorter, what you might
rt and depending on the valley it
de dark leafed. Higher up the
ed to make finger hash for local
ne degree mongrels. The high
nd stand frost and are also
w line. The short wide leafed
cted for large resinous colas so all
ngrel strain that someone has
grown if it wasn't for the demand
al Afghani available.

ativa grows to be 5'-8' tall without
ttings technique. A finished sativa
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nore. Thus a Golden Triangle
e compact indica, at least it would
ys \$1,000 CN an ounce (four times
for mid-grade Sensi indoor) for
ant to experience a fine Thai
ow it yourself.

0 days of flowering, but produces
iva requires 90 - 95 days of
/ity or jobs requiring mental
possible way to find this sativa

h parallel, about the tip of Northern
f pot by nation, outdoor anyway,
their homes in North America,
indicas clearly are favored by their

owerful, aphrodisiac) and Island
1992, so its 35% sativa, trippy,

variety developed in the late
oor sinsemilla (from the Spanish
nplace technique now) production
emilla cultivators have long
re temperate regions of North
e northwest and was multiplied

ensi Seed and S.C.C.C.

ral clusters and resembles its
much as it originally was through
r established varieties. Northern
ers and requires 8-10 weeks of a
it has little smell." -High Times

genetics came from California.
t was Mexican, with some
am weed kicked the Mexican's
(saw) made us all disenchanted
pounds from SD and couldn't sell
came back to find them still
ling a monied Christmas in the

d friends doing it all the time, but
ity District (both male, haha).
ty pots got expensive and scarce
und. Well, at that price more and
ants maturing in December, if

ne, got hold of some indica seed
Humboldt in 1976, but I believe
course. I remember being in San
wn. We were huge pot smokers, I
out, to our great embarrassment

the California explosion got up
our falls are too wet to grow
he answer was to bring it inside,
ities I saw was a basement
es of aluminum foil covering the
was 1977, 78? These growers I
et my balls they got the seed and
college in Humboldt at the time.
lenty of stoners were growing

on, and a friend has never quit;
ced them only recently when I
, I guess I know where part of
t and the full lineage of the
se I lost the male lineage about
serve some of the genetics, but
/

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c. grown in those countries where I have these strains because the plants are bred for weight getting big buds because 1. They grow in the indoor bulb just doesn't compare again with Northern Lights, Skunk, and others because the quality of the plants aren't the indoor ones grown in the tropics. Brazilian Lemons, Israeli Golds, and others in common: they are sativas, they grow at the altitude of many of these strains. Even the best indoors just can't

compare (1970), there were many many strains and Mex's too--you would run across a lot of them. Starting around 1970, we started with Commercial Colombo went for

Colombian and it was called "Red" at the time I couldn't believe I had found that had the reddish color of the plants it was so red that it looked like a red plant. It had absolutely not one trace of brown, red or purple--more of a purple and having a strong seed and that gave way to the new strains rare to the Colombians so they started to develop. Lots of light green skunks and sativas. And if that wasn't good enough, sativa, sweet, fresh and strong (as in). At that same time, a lot of strains were worth it. Spacy, powerful, and very very good before they started

to be bred. Colombians, Hawaiian, Thai etc. But it is real wheelchair pot. Lots of strains are common. My cousin in LA still grows it. Coming across again with the same strain: Mexican pot can be might

be-- it has that lime green / pale look These buds need scissors,

ors leave a clean slice through
nder the fruit punch exterior.
g something right)" - ~shabang~

L crosses with 50% or less NL
Haze" not "Northern Lights".

ses with 50% or less Skunk
"Haze" not "Skunk".

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Lincoln states: "Prohibition makes a crime out of things that are
which our government was founded."

...reports serious problems with use.

...illnesses or diseases in U.S. Pharmacopoeia.

...Large, well-run opium houses ran out of business,

...is most popular. Fairgoers encouraged to return again and

...um. First time taxation was used to legislate morality, instead

...corporations 14th amendment protections.

...banned certain types of Opium from being imported, and
...venue raising in favor of controlling "morality."

...in India. Judged the physical, mental, moral effects of
...physical injury of any kind,...no injurious effects on the

...Journalism" fueling the fires. Hearst begins his long
...s they do in their cultures.

...is called Cannabis Americana." Strain is a very potent
...America, finances very successful oil "gusher" in Spindletop,

...ent intervention into food and medicine production.

...ance is "harmful."

inora, Mexico timberland bought for pennies on the dollar of
"Canamo" (Cannabis). Hearst, in retaliation, starts slur
saying it causes Mexicans to be lazy and thieving. By 1920
they were insolent and wanted to rape white women.

starts to sell "narcotics." Initial enforcement involved arresting
magazine editorializes that since passage, narcotics use has
starts needed to go to procure drugs, and the people they had to
buy. The New York Times says Cannabis has "Practically the
evolution.

It issues a dire warning about the dangers of using wood pulp
infeasible to investigate the paper-making value of the more
produces over four times more paper per acre than trees, without
requires more use of Hemp for paper.

Standard Oil, and others created alcohol bans to prevent
duPont begins production of rayon, continues research into
smoking, "dope peddlers" had established a nation-wide
network increasing.

Competition with petroleum. Hemp is most efficient of the

its qualities that are superior to Morphine. Nevertheless,
Bureau Director, in appropriations committee testimony claims
states, this radical propaganda enters into the situation.
throughout the country, intensify them and create a great deal of trouble
due to alien agitators. Black "social activities," according to Burns,
political and anarchistic activities. Bureau considered calls for labor
organized in from intelligence gathering. New Attorney General
free government and free institutions because it carries with it
"dread or understood." Further says the Bureau is no longer
their conduct and then only if that conduct violates the law.
structure, local and state and private groups take over, keeping

city member. Irene duPont speaks publicly about creating a

to its own bureau, "Food, Drug and Insecticide
criteria established as to how to make a legitimate
ability to prove substance is harmful.

ident. duPont and Anaconda Copper subsidized campaign of

s. Ford Motor Company works on biomass fuels project,
ially Hemp.

head of the newly-formed Bureau of Narcotics.

ased. Indicates alcohol, not Cannabis causes problems. "Use
d upon discipline are not great. There appears to be no reason
ernational narcotics conference, strikes up friendship with
ould become Hitler's head of German International
him saying Von Rheinbaben "...Helped us out in several

stitutional clash over regulating personal possession of
, reenabling industry to run.

ating plans for making Hemp illegal.

rarely given out, to grow Hemp. "The World's Most
ublished reporting a resurgence of Hemp industry, alas too
Marijuana Tax Act in place. Ford continues, in spite of law, to

e about the benefits of Hemp, published after Marijuana tax
f proof of safety to manufacturer of a substance.

ave labor camp Auschwitz to develop artificial rubber and
s for the laborers, who were worked to near death and then
a smokers as American prison labor?

has a car built mainly of Hemp, wheat straw, and Sisal

it he can "grow automobiles from the soil."

does not lead directly to mental or physical deterioration, sexual or criminal misconduct."

up "Operation Overcast" to bring Nazi intelligence experts to the U.S. Joint Chiefs of Staff. David Sarnoff states national security was not directly threatened by the information brought to America. Nazi General Gehlen released from the Soviet Union and moved to Camp King where they were designated as a "Historical Intelligence Collection Point." Gehlen was a former Soviet intelligence in Austrian Alps. Retrieved after capture, Gehlen was used to help the CIA. Gehlen, seeks control of Gehlen and his documents for their own use. The CIA goes ahead on using Nazis for counter intelligence, but "under

rs 800% increase in use.

o minors.

ales. F.D.A. halts legal production of L.S.D. causes

nuggling" by 1969.

e tests for controlled substances.

reased use of Heroin. FBI starts the "New Left" program, surveillance and investigation, plus adding the elements of environment, pro-"Marijuana" groups, women, gays, and Frank Donner describes it by saying: "...The New Left is a threat to the American way of life against an entire milieu..." The CIA considered them "dirty Hippies." Because of an enlightened approach in infiltrating and disrupting most groups. They did, it faction, the Weather Underground. As a result of the major actions. Congress passes the Omnibus Crime Control and Safe Streets Act of 1968. The act allows for the issuance of search warrants at the request of the Attorney General when a person is suspected, or is about to commit any one of a long list of offenses. The act is replaced with the House Internal Security Committee (HISC). The act is used to overthrow the government by "any unlawful means" or "to obstruct or interfere with the execution of any law or policy affecting the national security" was not well defined, and, as we know, the act was entrenched. It's used most frequently to cover up the illegal activities of Presidents Ford, Reagan and Bush, the Republican

from Germany's Weapons Control law of 1938.

availability noted. The Supreme Court rules in the Alderman overheard through electronic monitoring. If the court rules the evidence to determine if the illegally gathered evidence tainted the case's extent is ruled as grounds for dismissal of the case.

should remain criminal. Urges decriminalization, falls just short of the smoking. President Nixon, who commissioned report, Congress passes \$1 Billion dollar anti-drug bill. Little effect on crime. J. Edgar Hoover needed new enemies. Started concentrating on "New Left Movement" (though they had been looking at anti war movement

in America." Nelson Rockefeller's tough anti-drug bill passes in 1970. Nixon puts out the false news story that the bill was unable to provide any proof, as none existed. Nixon later admitted the lie. Nixon's unpopularity, meant people in other nations did not want the Vietnam War. Nixon's return to power in 1974 is believed to have been mostly due to the media's focus on the original Nazis, and now their direct descendants, are

causing physical, mental, moral problems from Cannabis smoking. The report is marked for demand reduction and treatment. SISS publishes a report that the threat to nation's security by New Left groups trying to ruin this industry is great. There is no evidence that any foreign group is profiting from trafficking.

ground from use of Cannabis. First Emit Cannabinoid test kit is the fastest growing of the tests, though accuracy is next to nothing.

Control now costs \$1.5 Billion dollars....more precisely,

the load in Columbia and was ordered by the DEA to stop in the area. The report is marked for demand reduction and treatment. SISS publishes a report that the threat to nation's security by New Left groups trying to ruin this industry is great. There is no evidence that any foreign group is profiting from trafficking.

next trip for Cocaine. He therefore recorded secret tape of
scare Congress into appropriating money for the Contras.

wn, and he was dropped from favor by both the CIA and
d on probation. Seal was subsequently killed by "unknown
rice, still running guns and drugs between Central and South
ugene Hasenfus survived the "Fat Lady" being shot down by
Ronald Reagan

rine tests. Baseball commissioner Peter Uberroth orders all
ayers are forced to be tested. American industry, labor unions

g employees.

it noted. Congress recreates the office "Drug Czar" and
with short term and long term goals. The Marijuana
ant, reassembles in response to stepped-up prosecution.

mpanies are held to no standards but their own." Most
ars. By late in the year, drugs reach the top of public opinion
izes law enforcement. FY 1989 budget calls for spending \$6.6

ar.

dget: \$10.9 Billion dollars.

t: \$11.9 Billion dollars.

egalizing drugs. President Clinton quickly reins her in.
: for FY 1993: \$12.1 Billion dollars.

ne growing list of significant persons opposing the "war on
on" of drugs. Supreme Court invalidates controlled substances
Estimates are that Cannabis in America is a \$24 billion dollar
orn, are \$16 billion. Police departments across the country
is on Cannabis. There are an Estimated 340,000 people in jail
rs per prisoner per year. Greatest effort in the nation's
her Omnibus Crime Bill fails over the proposed ban on 19
a officers, and build still more prisons. At least one sixth of

re more likely to draw more prison time for involvement
s looking for drugs begins. Police use intimidation to coerce
a method of stopping people who fit a certain description as a

neral Barry McCaffrey, former commander of the Southern
5 which permits Californians to possess and grow Marijuana
r to prescribe a variety of currently illegal drugs. California
.S. Justice Department can intervene and arrest people on
General Lockyer favors the legislation. Some California
ona's legislature overturns the referendum. Arizonans go back
lars.

ousand were for simple possession. The
. One person was arrested every 49
rgia law requiring candidates for public office be
l to demonstrate a "Special need" substantial enough to
e Medical Marijuana users are exempt from criminal
iana under voter-approved provisions in California and
DEA demands the names of Arizonans who purchase
associated growing equipment in a raid on the Flower Therapy
h of long term Marijuana users is virtually no different than
l disturbance among long term users" according to study chief
ing is that the respondents are unexceptional." In May, Rep.
ly ignored. The New England Journal of Medicine calls the
ed and inhumane." They call the Clinton administration's
om Schedule 1 to Schedule 2. A study is released by the
ent in Marijuana smokers. The study is an 8-year long
continuing nor the intermittent Marijuana smokers exhibited
those who never smoked Marijuana. The conclusion of a
l link between regular Marijuana smoking and death. It does
found no increase in deaths among the more than 14 thousand
ever used Marijuana. The 1997 Drug budget climbs to \$15.03

illegal. The industry by now rakes in \$10 billion dollars
**ported in 1996. 87% of those were arrested on
ion charges. Under the Clinton administration,**
dy showing very little risk of having an automobile
; drug czar, General Barry McCaffrey, lies about the impact
McCaffrey claims the Dutch murder rate is twice that of
. McCaffrey further claimed Dutch children are three times
f Dutch high school kids tried Marijuana as opposed to 45%
has been caught in public lies about the War. The magazine

h the U.S. government to not publish a study favorable to
ne from the UN International Drug Control Programme
ing to legalise (sic) Marijuana." The WHO report found that
HO report states there is no threat of long term lung damage
oes it lead to other drug use. Clinton signs into law a bill that
ne offenders are denied money for college for one year; two
te in a drug rehabilitation program and pass two random drug
nittee approves a "Sense of the House of Representatives"
not be legalized for medical use." A study indicates that
tudy by the Le Moyne College Institute of Industrial Relations
ctivity by 20%. By this year, however approximately 82% of
; are still highly innaccurate. All of the tests can be defeated.
ijuana plants. The fungus, however, is found to have a general
.ALASKA, WASHINGTON STATE, OREGON AND
nington D.C. also pass a voter initiative, however
could be spent to count the ballots! Congress, for the first
rican election before the results were even known! A federal
ould take months before it was discovered that D.C. had passed
ver the D.C. board of Managers, passed legislation to prevent
olic opinion polls indicate 2/3 of the American public favor
na prohibition as well. A bill is introduced into the
he removal of a body part in lieu of other sentences
ortunately does not pass. The Center for Addiction and
ana alone does not cause criminal activity. The three year
e under the influence of only Marijuana when they committed a
of violent criminals were under the influence of Crack
atives Speaker Newt Gingrich called for "Greatly increased"
 Barry McAfferey to map "A World War II style battle
dollars a year...a third of that is used to combat Marijuana.
orting more than 100 dosage units of an illegal substance.
he border.A rather dramatic study out of Italy shows
bat pain. Researchers at the University of Naples found
ana, causes the body to ease the symptoms of pain. Thus,
ina researcher. The federal drug budget for this year is

g Hemp seed oil products, claiming that military drug tests
led that California Against Marijuana Planting
: government's aerial eradication programs. "Every officer that's
re flwn under 500 feet (In violation of legally mandated
oked into people's windows, " according to a former deputy
i suit against the government's eradication program. The
ents opposing research and domestic cultivation of industrial
in need of alternative crops. Estimated American farmer
)M) released its findings that Marijuana holds medical value
hat seeks to remove Marijuana's classification as a Schedule 1
o evidence that Marijuana is a "Gateway" substance, leading to
e effects of marijuana use are within the range of effects
h the Shaffer Commission in 1972, ignores the report. A

Medicine shows no link between miscarriages and Marijuana
station or the occurrence of physical abnormalities,"
st taxpayers \$17,886,200,000. That's nearly \$2 Billion
nce of the World Trade Organization is held in Seattle. A
re world ends in bloodshed and some property damage. Police
lash Bang" grenades, in spite of police denials of such
cannisters of nerve gas against the crowds exists. Police again
trade regulations. The Echelon spy satellite network is
place shortly after WWII and upgraded several times since.
the United States. Police corruption because of the War On

st ever: \$17.7 Billion dollars...some claim \$19 Billion. It's not
Congress is debating spending up to nine billion additional
a repeat of the Vietnam fiasco. As of February 15, two
**ne world's population, we now incarcerate 25% of
iled on drug charges. Of that group,
% are for mere possession cases.** Reports begin to
n.

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political activities, mainly
general attitudes of the Nazis

the great amount of wealth
the burgeoning automobile
. Of the big oil families, the
d the Rockefellers, specifically
vested a great amount of
sily wealthy. Another client of
Motors, was developing
Harriman handled the legal
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e had absolutely no concern
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Cocaine. By 1936, "Reefer
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some bad ones to stay away from (crooks). Reports from people who have ordered from cannabis can send your report to me or post it to alt.drugs.pot.cultivation Or both if you want to be sure I ate what bank you ordered from, how long it took and roughly how far away you are from them. any seeds were crushed. Any other info you think is important will be appreciated. Reports on to compare. The more stars, the more reliable. F = faster than average, no letter = average, S = tem

ay order or certified check without charging extra for it. Who really likes sending cash in the mail? dit cards. This leaves a paper trail but is quick and easy. (4) indicates that they use PGP code for / rating might be Joe's seeds (***) (1,2) which means three stars and he gives free shipping and

able. They will send to most countries. I've tried to list those that ship worldwide.

I don't have enough information about their mail order seed business to make a rating.

They are NOT recommended. aka means also known as. X means they seldom or never send the

ca cannabis@direct.A2000.nl [L.Pafort] (X)

nt call and some customers have said they were satisfied. The nature of the complaints are as
represented seeds, 13 = unethical conduct by seedbank owner.

zone generator you can make for \$20 <http://www.angelfire.com/ga/greenmanspage>

Someone without your identity being revealed go to www.replay.com

posted to adpc and other places.

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in and indoors in pots... Oregano, Dill, Basil, Sage and other herbs are all easy to grow. I like them in oriental dishes. But it all comes down to a truly motivational herb that is your friend and

and more rewarding to keep the garden going year round. If one were to attempt to grow a herb that is producing. You will have herb fresh at all times, there is no worry of mass storage through every week to keep it producing at optimal levels.

It is spiritually enriching. Try giving your plants energy by beaming good thoughts and they seem to respond to it favorably.

Herbs that are acclimated and bred for local climate and best floral characteristics. Potency, as considered by the seasoned gardener and you will benefit enormously by finding a friend to

characteristics for indoor growth as well. Indica plants have a heavy, stony high that is a good trait, so a hybrid can be bred that will have the energetic, cerebral high of the sativa and

qualities. The Sativa has very narrow, finger-like leaves. A hybrid will have qualities of both Indica and a Sativa. It is possible to recognize a good hybrid by the leaves once you know what to

look for, like tiger stripes. White, small seeds are immature and should not be planted.

: for flowering and use continuous light indoors for germination and vegetative growth. to the same operation indoors. A small greenhouse can be built of Filon fiberglass or PVC suspensions.

glass or plastic sheet, and some strains that do not require a great deal of light will allows you to keep out rats and gophers, keeps out the neighbor kids, and can be easily s is the best way to avoid root-bound plants (if your not using hydroponics), and get

g, using natural sunlight to ripen the plants. This routine will provide at least 3 s and flowering 2nd harvest plants outdoors, harvests are possible every 60 days in many

germination the plant enters into a vegetative state and will be able to use all the continuous instantly and grow faster than it would outdoors with long evenings. Photosynthesis stops requirement and the plant will grow faster at this stage with continuous photosynthesis

outside in the Spring or Fall. (For Summer outdoor flowering, the night must be artificially

bright lights nearby) will force the plant to flower. It will ripen and be 2-3' when ready l start to flower in anticipation of oncoming winter. Vegetative starts moved outside Starts moved outside Sept 1 are picked by Nov. 1st. In Winter, operations are moved it for some extra winter stash.

er notice plants placed outside to flower in April. Be smart, make your big harvest in

s are placed outside to mature in the spring after last freezes are over. The space can be a te entire bedrooms to growing.

This could invite fuzz or rip-offs.

s not lit by big lights that generate a lot of heat. Separate exhaust and incoming air vents in air from an outside wall or under-floor crawl space. Use fans from old computer e the speed/noise of the fans. Use silicon to secure the fans to 4-6" PVC pipe pushed thru e walls do not resonate to the fans' ocsilations.

the walls bright white to reflect light. Aluminized mylar, 1 mil thick is best.(\$20 for 25

e the electrical wiring will handle the lamps your going to use. Always place ballasts for or under a ballast will work too.

llow you to double the area of your grow space and is an invaluable storage area for plant warming pad will be needed, so this arrangement saves you \$.

will allow constant lights on the shelf and dark periods in the main grow area. Velcro can ack vinyl with white backing works best.

then take them outside to grow in a small greenhouse. They can be purchased with bulbs and one Warm Light type bulb in each to get the best light spectrum possible for plant. Cool White does not work as well in most situations (go figure). If Cool White is all you can

obtain, it's the best. Fluorescent lamps are great for shelf gardening. In this system, some shelves have 24 hour lighting, some have 12 hour lighting (for flowering). Two

shelves are 3-4 feet apart. Less light is necessary when you have plants that are this short and forced

to grow every day, and it is harder to take a vacation for even a week with no tending of the plants per day. Lamps on the flowering shelves are not adjusted nearly as often.

Adjust the height of the lamps such that they get progressively taller as the end of the lamps go up, so that all plants are close to the lamps so that you are sure the plants will not be able to grow up to the lamps within that length of time. This will not create spindly plants. They will nearly grow a little slower if the lamps are not

adjusted. On the top shelf of a closet, then switch over to HPS for heavy vegetative growth and/or

flowering. Most HPS installations will not require lamp height adjustment. Just attach the plants to the shelf, put them on a temporary shelf, box or table to get them closer to the lamp.

Use a reflector (1-2" maximum. This area must be painted a very bright white, or covered with aluminum foil (aluminum is better.) Paint the shelf white too. Or, use aluminized mylar, a space blanket, or any

reflective material. A reflector is a mechanism so they can be kept as close to the plants as possible at all times (1-2"). If the lamp is too far away, it will not produce as much bud at maturity. This is due to internode length. Shorter internodes mean more internodes, thus more branches, thus a plant that provides more buds in less

time. This is why you can have a green canopy of tops that are grown and matured quickly, and the next time you can have a constant light shelf, until they start to grow well vegetatively, then placed on a 12

hour light shelf. If you have a dark room, plant growth will certainly not go as fast as possible, and internode/stem length will be necessary, meaning you get no vacations.

2 levels (more on that later).

3 basic flavors: High Pressure Sodium (HPS), Metal Halide (MH) and Mercury Vapor. HPS is the best sort of light, maybe a bit pink or orange. Same as some street lamps.

HPS is 1 week later than a similar crop under MH, but it will be a bigger yield, so it's better

. MV will put out about 8000 lumens per 175 watts, and 150 watts of HPS puts out about
ot as good. HPS is high in reds, which works well for flowering, while the Metal
e worst spectrum for plant growth, but are very inexpensive to purchase. They are not
h the initial costs saved.

ut \$20 a month in electricity, so it is evident that a lamp taking half the power to output
and from then on, continuous savings will be reaped. This is a simple initial cost vs.
the HPS lamp will give you, due to more light being available. If this is factored into the
t lamps, since it is easily twice as efficient and grows flowers faster and bigger.

ined as close to the plants, so the plants will not be able to use as much of the MV light.
. Use fluorescent, MH, or HPS lamps only. Halogen arc lamps generate too much heat
: light spectrum is suitable for decent growth.

range. The 400 is actually 430 watts; they have added 30 watts of blue to this bulb. It is
to replace normal HPS bulbs, so they are an option if you already own a HPS lamp. The
ial internode spacing and early maturation, like most HPS users do, and you have all

mp. Plants grown under this lamp are incredibly bushy, compact and grow very fast. Son
ence in bulb life.

10 watt size. The Super Bulb (40k) is about \$10-15 more, and provides an extra 4000
ore blue and better than straight HPS for vegetative growth, but is much less efficient
: cost of the conversion bulb is more expensive than the color corrected Son Agro bulb,
more for your energy dollar later, and it's much easier to hang than 10 fluorescent

s, which is better efficiency wise? Which will provide a better yield? Obviously, the Son
: wattage numbers.

: as long, but is cheaper. Compare \$36 for a 400 watt MH bulb vs. \$40 for the HPS
he Son Agro is 16k hours or so. Still, longer bulb life and more light add up to more

actually reaches the plants. Most HID's sold for indoor garden use these days are of this

: at the home improvement stores. This size is not very efficient, but blows away FL in
over 9 sq. feet, you need more light than one of these lamps can provide, but you could
its putting out about 12k lumens, so it's better than FL, but a 150 watt HPS puts out
e. The biggest problem is that the mid size lamps like the 150 and 250 watt HPS are almost
r the 400. If your going pro, a 1080 watt model is available too, but you might find there
amps are more expensive to purchase than one large lamp, so most people choose the

determined by temperature, CO2 levels, nutrient availability, PH, and other factors. Too much CO2, since it's getting blown out of the room right away.

So you will spend more to replace two 70 watt bulbs than you will to replace one 400 watt bulb. Keep in mind that for \$30 more, you can have the larger lamp (400watt) and it puts out

lighting for indoor gardening stores in your area.

fastest production of buds available. Instead of growing a few plants for a longer period of time, less time is required between crops. This is important to you when the electricity bill year round can be maintained. 4 plants per square foot will be a good start for seedlings. 1 plant will allow for much bottom branching. This is OK since indoors, these bottom branches are not needed. An indoor grower quickly realizes that plants that are too tall do not produce enough at the top. If the plants are intended to go outside at some point, and it is expected that the

most of the light is at the top level of the plants. Little light will penetrate below this level, since the plants are tall, and use the light and space to the best advantage, in as little time as possible. Use of nylon netting will help to prevent plants to droop under the weight of heavy fruiting tops. Stakes can be used too, but are not as

effective as nylon netting. In a limited space to grow smaller plants that mature faster and pack into smaller spaces. You can grow 12 small ones on a shelf above 12 other small plants. These plants take only 3-4 months to reach a vegetative and flowering area devoted to each, with harvests every 45-60 days.

Many plants grown half as big will fill the grow space twice as fast, so harvests take place more frequently and are of the best quality.

For growing tray (for passive hydroponics); I like kitty litter boxes. (\$3 each at Target) on a shelf. In my case, I use 4" rockwool cubes that fit into kitty litter pans @ 12 cubes per pan. Perfect!

In this size space, it will take them longer to fill the space, thus more electricity and time. If the grower will soon find that plants thus crowded tend to be more stem than bud, and

st to grow 2 or 4 times more plants, since they will produce more, faster, in the same any type of plastic or paper twist tie and wrap it around the top of the plant, then pull it plant. Do this for one week and then release the plant from it's bond. The plant can be force lower limbs to grow upward and join the green canopy. This technique takes at makes it bush out at all lower internodes.

med to increase air flow under the "blanket" of growing tops. Use these cuttings for generate after flowering has occurred.

niculite. DO NOT (!) use a Jiffy cube #7 to germinate seeds. Informal tests and iculite gives the seedling so much oxygen, and are so easy for roots to grow in, that the

ttom, placed in a tray of weak nutrient solution, high in P. Rockwool cubes also work repotting or transplanting, and no soil mixing!

out, or are planted too late after germinating. Paper towels dry out REAL FAST! Place ic wrap to keep it from drying out. Put bowl in a warm area; top of the gas stove, water rs and plant germinated seeds with the grow tip up (if possible) in a growing medium as : tip.

in for a significant period of time. Just plant in vermiculite or rockwool. You will be s with Jiffy Cubes. (Your milage may vary.)

and the new seedlings. Use a very dilute solution, in distilled water, about 1/3 normal t. Many growers experience low germination rate if the temperatures are out of this range. A do, but test it with a few seeds first, before devoting next years crop to it. No light is . Place seedlings in the light once they sprout.

ie space and number of seedlings you plan to start. Plants will suffer if continuously bottles filled with vermiculite/pearlite will fit in a cat box tray, and will not require ond regenerated harvest.

o start seeds or accept seedling transplants. Since vermiculite holds water well, wicks sitting in a tray full of water. A hydrogen peroxide based plant food is used to get extra e each time after watering, before new solution is added. This allows the plants roots to

e yard, sterilize it in the microwave or oven until it gets steamy.(NOT a previous season for another plant.

g as much as possible to grow tall and start many grow tips at each pair of leaves. A grow ;, and every major internode. If you "top" the plant, it then has two grow tips at the top. If e plant to heal and recover from the trauma of being pruned, it faster to grow 4 smaller wers find)

germinates from seed. It is possible to grow plants with no dark period, and increase the gardener to decide when to force the plant to flower. A plant can grow from 12" to 12' arden based on goals and space available.

growing continuously under lights. Miracle Grow Patio or RapidGrow plant food is good when beginning 12 hour days. Epsom salts (1tsp) should be used in the solution for iron. Miracle Grow Patio includes these trace elements, and is highly recommended.

You will not need a timer unless you want to keep the lamps off during a certain time each day.

Plants will not support heavy flowering growth. An internal oscillating fan will reduce humidity on the plants. Plants that are not stressed enough. It will excersize the plants and make them grow stronger,

It is also be treating your plants with oxygen for good root growth, and potassium nitrate for flowering. Add 1/2 gallon of water, with trace elements and oxygen added, or fish emulsion. Fish emulsion is recommended for indoors, due to its strong odor.

Plants coming winter in the fall as the days grow shorter. As a consequence, it works out well for indoor plants used for flowering and fruiting. There is no other requirement other than to keep the dark cycle long.

Plants will flower and bear fruit. This will require putting the lamp on a timer, to create regular and predictable day and night periods. A Summer (long days) by covering it with a blanket to make longer night periods. A strict schedule is required to flowering. After the first 2 weeks, the schedule can be relaxed a little, but it will still require a timer to return to vegetative growth.

Plants should be brought from indoors to the outside at these times, and the plants will flower during the first two weeks, then the rapidly lengthening nights will do the rest.

Plants should have no light, or no more than a full moon during the dark cycle. 13 hours light, 11 dark may be used for periods to speed maturity toward the end of the flowering cycle if speed is of the essence.

Plants on the shelf's lights are set for 12-13 hours, and one is lit continuously. Plants are started in the vegetative shelf. The flowering shelf should be bigger than the "starting" or "vegetative" shelf, so that it can hold the plants. The flowering shelf for all of them near harvesting.

A white curtain or material on the other side to reflect light back to the plants. This curtain can be tied with cords to be pulled in or out. If the shelf is placed up high, it will not be very noticeable, and will fit in the room. If no light is being emitted from it.

Nutrients should be provided with each watering when first flowering.

Plants should be watered with a separate trace element food too. Home improvement centers sell trace element solutions

or these mass produced fertilizers are significantly cheaper than the specialized

by normal light. It delays flower development due to hormones in the plant that react noon can provide for less than 5 minutes. Keep pruning to a minimum during the entire

s from the plants. These are sold as nursery safety lights, but any green bulb should be Personally, I like my garden lit from 7pm to 7am, since it allows me to visit the garden about it, it lies unlit and undisturbed, flowering away...

rels down indoors when flowering, as this is the most delicate time for the plants in this

: hairs emerging from a small bulbous area at every internode. This is the easiest way to

ing from every growtip on the plant. It will literally be covered with them. These are the y until the lights are turned back yet again. At the point you feel your ready to see the 0 hours. Now the plant will start to ripen quickly, and should be ready to harvest in 2-3 outside, or keep the plants on a constant 12 hour regimen for the entire flowering process,

ring to occur. Once the plant has almost reached peak floral development, it is too far e up precious indoor space sooner, for the next batch of clones to be flowered.

ales, right?) to swell with resins. When most of the pistils have turned color (~80%), the

IC will come off on your fingers and reduce the overall yield if mishandled.

ie same genetics and environmental conditions. This may be due to closer attention and take less time to grow. One report has it that plants started in soil matured after

mixtures, plant growth tends to slow when the plants become root-bound. Hydroponics ls of repotting if rockwool is used. (Highly recommended!)

red to as Passive Hydroponic methods, because they require no water distribution system ill wick to where you want it if the medium and conditions are correct.

ted in the pots, correct holes must be cut in the pots, and a spacer must be created to place

the other, or a kiddie pool with bricks in it that the pots rest on, elevating them out of the

and the plants sit higher in the room, taking up precious vertical space. The base the pot
er be the same as an untouched plant, due to stress and shock in recovery.

Rockwool slabs are used, a half slab of 12" rockwool fits perfectly into a kitty litter pan. The
in this manner are very robust because they get a great deal of oxygen at the roots.
hydroponic methods, with much less effort required, since it is by far the simplest of
or every few days. The pans take up very little vertical space and are easy to handle and

is added, one Tblspn. per gallon of growing medium. This medium will wick and store
e, as it is difficult to recapture and sterilize after harvest. Use small size lava, 3/8" pea size,
y, wear a mask) and mix into pots. Square pots hold more than round. Vermiculite will
leach any mineral deposits, and put more vermiculite on the top than the bottom. Punch
e plants will have all they need to flourish.

When possible, use less solution and water more often, to pull more oxygen to the roots
as will be watered for 2 weeks at least.

little, and start plants/clones in it, moving the cube of foam to rockwool later for larger
h, and tends to crumble easily. I'm also not sure it's very reusable, but it seems to be a

Rockwool cubes can be reused several times, and are premade to use for hydroponics.
. Just place the plant's cube on top of a larger rockwool cube and enjoy your extra leisure

hydroponic mediums such as vermiculite/lava mix. Perlite is nice, since it is so light.

Take a second look. It is not very expensive, and it is reusable. It's more stable than floral
impossible to over-water, because it always retains a high percentage of air. Best of all,
gets very large, place that cube on a rockwool slab. Since rockwool is easily reused over
lava, which is much more difficult to reclaim, sterilize and reuse (repot) when compared to
the air when you touch it (even wet), since it dries on the fingers and becomes airborne.

nutrient solution to make it acidic (5.5) so that it brings the rockwool down from 7.7, to

1 drop phosphoric acid (PH Down) for 24 hours, then rinse. This will decrease the need for

more bud in less time. Hydroponics allows you to water the plants daily, and this will
soil or "medium" is made to hold moisture, but drain well, so that there are no
do not derive nutrients from soil, but from the solution used to water the plants.
s, so leaching is usually not necessary with hydroponics.

to growing in soil. A 3/4 gallon pot can easily take a small hydroponically grown plant to
cut-off from oxygen as they become root-bound in soil. This problem does not seem to
constant solution feedings, and the medium passes on oxygen much more readily when the

nutrients are available to the plants at the different stages of plant growth. Watering can be this when possible.

use to use simple passive hydroponic techniques when possible. Hydroponics may not be

much when growing hydroponically, or roots will be damaged. If you will not be able to
, or you can easily lose your crop.

ing it more difficult than it needs to be. It is necessary to change the solution every month
the medium once a month or so to prevent salts build up by watering from the top of the
. I recommend using 2 different plant foods for each phase of growth, or 4 foods total,

mic exchange, solution will tend to get too acid over time, and this will cause nutrients to
l issues are occurring.

rockwool dark green. To prevent this, use the plastic cover the rockwool came in to
slab of rockwool into two pieces, then cut the end of the plastic off each piece. You
" square holes in the top to place cubes on it, and place each piece in a clean litter pan.

dry very quickly. Algae is merely messy and unsightly; it will not actually cause any

space and have more rooting area if square containers are used. This makes your garden

ce a 3 foot plant to maturity hydroponically. If you can get 4 litter boxes in a closet, you

ampsters), paper paint buckets, old plastic garbage cans of all sizes, and garbage bags

: to sterilize, and they introduce fungus into your reservoir trays. Inert materials, such as

bleach to one gallon of water. Let container and medium such as rockwool soak for

rally more robust. No light leak problems. No dark periods that keep you out of your
rect sun. Unlike growing indoors, the bottom of the plant will be almost as developed as

eat them. Chipmunks and rodents too. Bugs will inhabit them, and the wind and rain can
n be better than outdoor, but the best smoke I ever tasted was outdoor pot, so that tells

rably more often if water needs demand.

outside in the open air, due mostly to evaporation.

grower will need to know where the sun shines for the longest period; privacy and other things to mid afternoon, at least from 10-4, preferably 8-5. This will be really asking for a lot. If you do not want to use the greenhouse in the middle of the winter, you can still use winter sun and most sun. Also, large areas open to the sun on the north side of the property will get the most noon sun and mid-day sun as well. Some books say the plants respond better to winter sun than summer sun, but winter sun may be better.

Use white opaqued plastic, PVC, Filon, or glass, and using a similar colored material for the roof. It has always been there, with plants and trees that grow around it and mask it from view while

you are in together in a garden. Buy the clear greenhouse sheets, and opaque them with white paint. Clear plastic will pass more sun than white PVC or Filon, and still hide the plants. Epoxy resin coats will disguise the shed as metal, if you paint the clear filon sheets with a thin layer of resin tinted black. If needed, to reduce sun blockage to a minimum.

Be sure of the quality of topsoil in the area. Grassy fields would have good top soil, but your plants will grow like a 'monster' by harvest time. Growing in the ground will always beat a pot, since the plant is in the ground, but will need more space for each plant, so plan accordingly, you can't move them

the pot to be placed in it, thus reducing the height of the plant, if fence level is an issue. (Don't tell the chairman, appraiser, fire, etc.).

Build over the fence line in the back yard. We started to build a greenhouse roof for them, and the fence was at us and our lovely plants. We were busted, because he saw them. If he had seen them before, FORE the plants are sticking over the fence! Or train them to stay well below it. Live and

learn from your mistakes. Water must be close by, or close to the soil surface, or you will have to pack water to the plot, and keep a bucket nearby to carry water to your plot.

Run a hose down to a lower spot close by. It is possible to create water pressure in a hose this way, and you can punch small holes in it. Run a hose out of the main orifice and secure it somehow. Bury the hose out of it, and run it down hill to your garden area. A little engineering can save you a lot

of trouble on your property where people seldom roam around. It is possible to find locations that for one

thing are easy to get back to you. If it's not on your property, nobody has witnessed you there, and it is virtually impossible to prosecute you for it, even if the cops think they know who it

is. If you noticed something you decided to take a look at, or carry a fishing pole or binoculars and

be there, unless it is harvest time, and the plants will be pulled the same or following day.

secure part of your property, and cover the trail to make it look as if there is no trail. Make a fake trail. Don't park on the main road, always find a place to park that will not arouse suspicion. Always have a good reason for being in the area and have the necessary items to make

stay before an allergic reaction takes place. Teknu is a special soap solution that will kill bacteria. Wash your hands with it and take a shower 30 mins. later.

Some plants grow sideways, or do something to prevent the classic christmas tree look of trees. They grow up toward the sun, and increase yield, given a long enough growing season. Water them every day. Plants should get at least 5 hours of direct sun every day, and 5 more hours of indirect light. Wash your hands and leave no fingerprints on pots and other items that might ID you to the fuzz...in

the garden. Green wire mesh and nylon chicken fencing net work great and can be wrapped around the garden. A barrier of fishing line, one at 18" and another at 3' will keep most deer away from

the garden. (The best fence in the world will not stop a rodent from eating your crop if given any opportunity to do so. The best fence in the world will not stop a rodent from eating your crop if given any opportunity to do so. The best fence in the world will not stop a rodent from eating your crop if given any opportunity to do so. Put the poison grain in a feeder than only small rodents can get to. They will eat the grain for several days before it will have any effect on them. Ultimately, you may not be able to prevent them from eating your outdoor plot.

Yield. The amount you can grow is directly proportional to the water available. If you are in an arid area, you may be merely a hiker, not a grower.

Usually, you will want to start plants indoors, or outside in your garden, then transport them to the grow site. It is easier to transport males from females so that no effort of transporting/transplanting/watering males is

required. Put the plants in a pan, cover it with another pan, and transport this to the grow site. The cubes can be planted directly into the soil. Few people would demand to see the rotting corpse!

He starts 200 clones in his closet, then transports them outdoors in boxes to the grow site. The clones are grown for seed, no transporting/transplanting/watering plants your just going to pull up

the plants. They need to be good. Many other brands are mostly wood products and have very few nutrients. They need good aeration.

Use a mixture of manure and household food waste, leaves, lawn clippings, dog hair and other waste products to make a good growing medium. Don't dump it off their property where police could find it. DNA tests could prove it was YOUR

medium. This substance swells up with water and holds it like a sponge, so that roots will have a good amount of water. It tends to sink to the bottom of the pot and suffocate bottom roots (new growth roots) and other soil.

Watering. Usually, 1/2 gallon per foot of plant is sufficient. A six foot plant would require a 3 gallon watering can (like a closet).

Yield is unlimited by pot size.

res can burn, so they should be composted with the soil first, before planting, over
ly and constantly feeds the plants.

and work them into the soil, along with some dolomite lime and composted organic
. (Organic gardeners frown upon this practice, however. Toxic wastes are produced by
i area to hold in moisture and keep down weeds near the plants.

tifiable by all but the most observant. I remember a relative of the family on a visit to Texas
ognized them for what they were.

ention when placed next to plants of similar or taller stature. Even tall plants grown among

nd there, never in a recognizable pattern. Space them out, and fit them in to the existing
veral together are best. Try to find strains that seem to match the surrounding plants. Feed
flowers, pinned to a plant, disguising it as a flower bush.

æ, mowing the lawn, or doing something in the yard that makes you invisible.

he plant will never be over 3 feet tall, and never arouses suspicion from neighbors. This
hbor over for a BBQ and nobody ever noticed the nice plants over by the fence...

s, and Potassium. These 3 ingredients are usually listed on the front label of the plant

ybenum, zink, iron, and manganese.

germination, levels of high P nutrients with less N/K are needed. Vegetative growth needs
n it is not a complete fertilizer unto itself. 20-20-20 with trace elements should do it; I like
ortant. One tablespoon of dolomite or hydrated lime is used per gallon of growing
nesium. Epsom salts are used to enhance magnesium and sulphur levels in solution.

Miracle Grow. This is an excellent fertilizer for vegetative growth, or through the
ed to make men have less sexual desire or impotent, such as in mental institutions. So if
: fertilizer on these plants, at least in the last weeks of flowering.

00-400 ppm is optimum. It is possible to test your solution or soil with a electrical

are usually higher. It is possible with passive hydroponics, to get nutrient build-up over
ow and again, until you notice the plants are not as green (slightly), then resume normal

i proceed in a reckless manner, due to potential over-watering problems. You must go
ants. Use weaker plant food mixtures than normal, maybe 25%, and be sure your
u water. This applies mainly to plants grown in soil mediums.

to breath better and prevents problems with over-watering. Check soil to be sure there
ower told me he would not use H2O2 (HP) due to possible PH problems. This should

week, you can water every 3-5 days instead if you plant them in a medium with better
g necessary more often. This will pump the plants; they will tend to grow faster because of
in, as the plant grows faster this way.

ients are suspended in the medium and stored in the soil for later use. The nutrients are
apply to hydroponics.)

applies to hydroponics as well.)

r being used. Use 1/2 strength if adding to the water for all feedings in soil or
ns of food over time. Novice soil growers tend to over-fertilize their plants. Mineral
ydroponics if it is believed the buildup is getting too great. Leach plants in pots every
ver-fed.

occurring. Hydroponics requires the solution to be PH corrected for the medium before
o when it gets too acid. Buy a PH meter for \$10 and use it in soil, water, and hydroponic
little vinegar to make them just this side of 7 ph to 6.5 or so.

a more acidic ph.

ne soil to become increasingly acidic and eventually the concentration of these salts in the
s become less effective in bringing food to the leaves. To avoid the accumulation of these
f feeding your plant at the age of about 1.5 months. Dissolve the fertilizer in worm water
you want to continue to put fertilizer into the soil as well as leaf feeding, be sure not to

in a well vented space, with or without elevated CO2 levels. Just prepare a tea of worm
tative and early flowering stages. It is not recommended for late flowering, or you will be
e leaves with straight water every week to prevent clogging the stomata of the leaves.

ta on the underside of the leaves are open then. Also, the best temperature is about 72
d the warmer part of the day if it's cold out. You may need to spray at 2AM if that's the
best sprayer and use it for this. Make sure the PH is between 7 and 6.2. Use baking soda
ore often and use less, than to drench the plants infrequently. Use a wetting agent to
ake sure you don't spray a hot bulb; better yet, spray only when the bulb has cooled.

way, CO2 and nutrients are feed directly to the leaves in the same spray.

lant later when nutrient lockup problems could start to reduce intake from the roots.

o eat them, since they may have nitrate salts on them.

ld be highly unsanitary. Stick to the Rapid-Gro, MgSO4 (epsom salts), hydroponic
foliar feed."

I use only CO2 on my indoor hydroponic plants, and never foliar feed. It simply does

It seems that the plant evolved in primordial times when natural CO2 levels were many times higher than today. Elevating the CO2 level will increase the plants ability to manufacture these

compounds if you use a CO2 tank system. CO2 is most usable for flowering, as this is when the plant is growing vegetatively indoors, (transferring your plants outdoors to flower), then CO2 will not increase yield and decrease flowering time.

Greenhouses. This is expensive initially, but fairly inexpensive in the long run. These

are vented to the outside air. CO2 can be obtained by buying or leasing cylinders from local suppliers or by catching up the lawnmower (trailer, car, etc.)

When the room is vented, hours of light cycle, room leaks, enrichment levels and dispersion

of lights are on, dispersed directly over the plants during the time exhaust fans are off.

With CO2, so during flowering, you will use half as much if you have the CO2 solenoid valve open half the time the light is on, so this will affect the plants exposure times and amount of

CO2. Bottled CO2 is captured as part of the manufacturing process of many materials, and can be used to increase CO2 and add to greenhouse effect.

A propane heater. This will work well, as long as the gases can be vented to the grow room above plants level. Fire and exhaust venting of the heat are issues as well. A room that must be vented for much CO2 as a room that can be kept unvented for hours at a time. However, CO2

is not a good idea if you do not have enough heat to make constant or regular venting necessary, these methods become problematic (as the vent comes on). This method leaves a great deal to be desired, since it is not easy to control. Fermentation, let the wine turn to vinegar, and pour this on baking soda. It's the most common method to allow.

It is important to constantly keep adding water to, so that the alcohol levels will not rise high enough to kill the

weeks. This is also difficult to gauge what is happening as far as amounts actually CO2 being produced.

s CO2. do it just before you close the door on your plants. A MUCH cheaper way to n rinsed], plus a few cc urine[!] or if you insist, yeast nutrient from a home brewing r so it will brew up about 1/2 Oz CO2 for every Oz sugar used. Keep a few going at y measured 38cm growth in 8 days under a 250watt HPS bulb[tubular clear, Horizontal

piece of clear tube running into a jar filled with water will keep microbes out and

authorities, and receives great raves by people who seem to feel it has enhanced their crop. uations. It could get expensive with a lot of plants to spray. Use seltzer, not club soda, ater after 2 or 3 seltzer sprays. It's a lot of work, and you can't automate it, but maybe your spiritual self and the earth. Seltzer is available at most grocery stores (I get it at vice as much sodium in it. A very diluted solution of Miracle Grow can be sprayed on e your venting humidity during the dark cycle, or you could risk fungus and increased

nger, and time involved can make constant or near constant venting a desirable alternative hat is over 200 ppm CO2, the plants will have the required nutrients for photosynthesis. re high concentrations of CO2 in the air, and some growers find CO2 injection

me lower potency. It may be a good idea to turn off CO2 2 weeks before harvesting.

nat you vent at least a few times per day. For a room with a hot lamp that builds up heat iputes before venting again, or similarly, vent 3 minutes, shut off 12 minutes, etc. The d to regulate CO2 on and off inversely with the fan, your looking at a \$100 climate

s it off when the temp recedes 4 degrees. But it is a bitch to coordinate CO2 release with this ch a voltage sensing relay is \$100 for the ready-made switch, so then the environment perature switch that turns on and off the fan, and an inverse switch that turns off and on ? could be run in a slow, continuous fashion, and would build up in-between the

ips per 24 hours. So I could have a fan run 30 mins on, then 30 mins off. I could also at will turn on CO2 during the time that the fan is not on, and vice versa. It would be ution. \$20 for two of these timers.

nd they have muffin fans for \$5-10, so that's a real savings over the \$50-70 these fans wn, and distribute CO2 to your plants from new incoming air.

within the growroom, to help circulate CO2. It will also keep the humidity down, will not take valuable floor space. The best grow rooms have the most internal air

be 70-80 degrees, but many list extenuating circumstances that allow temperatures to go up to 90 degrees. High light and CO2 levels could make this go as high as 90. High light, CO2 enrichment of 1500 ppm and good regular venting to keep humidity low will reduce temperatures once flowering has started, to preserve potency, even if it does excite the plants metabolism, assuming the required levels of CO2 and light are met.

80-86 F) if you have strong light with no CO2 enrichment. Less than 21 C (70 F) is too low.

Mid 50's will cause mild shock and 40's will kill your plants with shock and is sucking the heat out of the roots. This is an issue if you have a slab or other type of grower.

Higher average temperature should reduce risk of fungus.

Lower humidity levels help the plant transpire CO2 and reduce risk of molds during flowering.

Make sure that the plants do not get too hot during flowering cycles.

and Aphids are the worst; whiteflies, caterpillar and fungi are the ones to watch out for. Commercial soap sprays will do most of the rest. When bringing in plants from outside, wash them with soap and water, and soap down any remaining bug life you find from eggs being hatched. This is especially true for indoor plants.

When plants are half developed they become susceptible to a fungus or bud rot. It appears that bud rot is more common when the humidity is high. The fungus is very destructive and spreads quickly. It is a spore borne fungus that grows under the best conditions permit it to grow. If things should go badly and the fungus starts to attack, remove the entire branch.

Removal of the entire branch better insures that the fungus is removed.

Before flowering if you think fungus may be a problem. Don't spray the plants if you have a grow space and keep unquarantined outdoor plants out of the indoor space. Don't wait until the plants are flowering. Lower humidity levels must be cut off when they are infected.

What is safe for vegetables. Safer makes a suitable product that is available at most nurseries.

Essential oils like lemongrass and chili pepper powder added to this for mites. Dr. Bronnars Soap can be used for mites.

Use a fan in the closet or greenhouse in the corners to get rid of spiders and such. It breaks down within a few hours. I find Pyrethrum to be the best solution for spider mites, if it is sprayed on a regular basis. Pyrethrum is our best bet, on a daily basis, on the under-sides of all infected leaves.

from outside into the indoor space. They are always infected with pests and threaten to regenerate plants outdoors in the Summer, rather than bringing them indoors to regenerate. To regenerate, feed it nitrogen all Summer and it will regenerate naturally, to be flowered again in the

When you only need to transplant twice, or better yet, once if possible, through the entire life cycle of the plants. Start in as large a container as possible, square is best. 16 ounce plastic cups work hydroponically. One-gallon plastic milk or water containers (squatish) will work

to have many seedlings that need constant transplanting. These larger cups take only a little more space. Put them into a gallon water jugs (cut down to 3/4 gallon) before forcing flower growth. To regenerate once again, 5 gallon paint buckets work pretty well if you can spare the space, and a separate regrowth first.

to go to female. The source I'm quoting says "This may be why some farmers get

to flower sooner by covering a plant's lower branch for 12 hours a day while it's in a constant light. Be sure to set up a regular cycle for these covered branches. If light is allowed to

be a playing card) looking preflower with a small stem under it. A female flower is usually a

growing outdoors, many growers do not wish to devote time, space or energy to male plants, then revert the light cycle back to 18-24 hours to continue vegetative growth for the next growth. Don't pre-force plants unless you have lots of time. Just cover one branch per plant to force flowers and differentiate early.

rest. A second harvest can be realized in as little as 6-8 weeks. Since the plant's stalk, and more than half the time of the original harvest. When harvesting, take off the top 1/3rd of the plant. On the lower 1/3rd of the plant, take off end flowers, but leave several small flowers on the plant, the faster it will regenerate. Feed the plant some Miracle Grow or any high nitrogen fertilizer. It never gets too starved for nitrogen as it is maturing, or all the sun leaves will fall off, and

to regenerate in the natural long days. It will take 7-14 days to see signs of new growth. Lower branches will be the first to sprout new vegetative growth. Allow the plant to grow a little more. You now have two or three generations of plants growing, and will need more space outside. You can have seedlings growing, vegetative plants ready to flower, and regenerated plants

to have a separate area indoors that will not allow your plants to infect the main indoor area.

st in June, then allow the plant to regenerate by leaving some lower buds on the plant, and lots of sun. It will regenerate all Summer and be quite large by Fall, when it will start to

int to encourage the plant to produce as much as possible and remain healthy. Pruning the cloning. It also forces the plant's effort to the top limbs that get the most light, maximizing

with will get all the plant's energy. This means that once the plant has started to regenerate the thinned on top branches such that only the most robust growth is allowed to remain.

f regeneration will not sprout new growth and may be collected for smoke. The plant may show vegetative growth occurring.

not sprouting with new growth and smoke it. Then later, prune again to take lower clippings

the buds and the total yield will be significantly reduced.

garden.

pistils start to turn brown, orange, etc. and start to withdraw back into the false seed pod. Pistils with red and golden hairs.

When only a few of the pistils turned color, the buds will have a more pure THC content and will have the bouquet of the pot, and control the amount of stonyness and stupidity associated with the plants more of a stupid, or hazy buzz. Buds taken later, when fully ripened. Take different samples picked at different times. Don't listen to the experts, decide yourself

Harvest the buds early for yourself, every week until you harvest, and decide how you like it for

the middle of the plant or the top. Allow the rest to keep maturing. Often, the tops of the plant are the lower buds getting bigger and fuzzier as they come into full maturity. With more than taking a single harvest.

When they are mostly clear, not brown, the peak of floral bouquet is near. Once they are mostly brown, declining with light and wind exposure rapidly.

Watch the plants and learn to spot peak floral potency.

Use a lot of space. That is all that is needed to have great sensi. Drying in a paper bag works too, or two.

Use a microwave oven. Go slow and check it, don't burn it. Use the defrost power setting for a

as slow-dried. Very close though. And this will speed your harvest time (which can be

iner , burping air and turning the buds daily for two weeks.

that the temperature will rise and fall each night, as the plant is drying. If you treat the plant
ess harsh.

l rooted in hydroponic medium to be grown as a separate plant. The offspring will be

f a single plant, so it is a powerful tool for growing large crops, and will fill a closet
est of your life, you can keep that plant's genetic character alive for decades and pass it
n line die out. A clone can be taken from a clone at least 20 times, and probably more, so

o pick plants that exhibit great resistance to fungus and pests. Pick the plant you feel
ests, and potency. The quality of the high, and the type of buzz you get will be a very

Low branches are cut to increase air circulation under the green canopy. Rooted clones
e low branch cuttings. Each cycle of growth will take from 4-8 weeks, so you can

well. One of my favorite plants, Mr. Kona, is the most amazing pot I ever smoked, but it
r, but it was the stone I was after! Once you find the psychoactive, almost hallucinogenic
however, great medicinally, so I like to grow a few pure strains too.

r 3 distinctly different types of plants to clone, based on trying the harvested plants. The
u will have many vegetative cuttings available for cloning and preserving your favorite
u flower all your clones, you may end up killing off a strain if you don't have any plant
ailed to regenerate and the strain would have died completely had not previously given it to
grow as a mother plant for a new crop of clones.

cedure may take considerably longer. Its best to wait, and regenerate vegetatively plants
js. Before taking cuttings, starve the plant for nitrogen for a week at least, so that the plant is
he plant, when doing ordinary pruning. Cut young growth tips from a vegetative stage,
X-acto knife (flamed) and immerse the cut end of the clone into a tub of distilled water
submerged, using a diagonal cut. Remove the clone from the tub and dip into a liquid
or medium. Flowering plants can be cloned too, but may take longer, and may not have

ghting and high humidity. Placing cuttings into 1" rockwool cubes in a covered tray
p warms the tray (passive collecting) and spare the expense and hassle of the aquarium
be perfect. Leave lamps on for 24 hours a day. Cuttings should root in 2-3 weeks.

i 1.6 ounce bottle. Geez, what is this stuff, gold?) I found some dipNgrow for \$9,
ncloser is needed to bring up humidity to 90% (greenhouse levels). Liquid rooting
ds, and dipNgrow.

som salts and then dip plants in rooting solution per instructions on label. All of the
ed on growing plants. Or use a premade solution such as Olivia's Rooting Solution. Corn
sists of plant sugars.

is important, since clones and fungus like the conditions you will be creating for good

ey wick and stay moist at all times. Try to keep clones evenly spaced, and spray them
g, to keep them away from healthy starts.

rene sheets (shipping/packing material) with holes punched, so the tops and leaves are
ie new rooting stalk. Aerate the tray solution with an air pump and bubble stone. Keep
ump, so that oxygen is always available to the cuttings. A week later, clip yellowing

ep humidity very high for the clones. Put cuttings in an ice chest with cellophane over the

ed, or vermiculite in a cup; be sure to root cuttings in a constantly moist medium. Jiffy
clones. Place starter cubes in tray of solution. Check twice a day to be sure cubes are
pods. Transplant at this point to growing area, taking care not to disturb any exposed

ich are kept in a styrofoam cooler. 3. Spray cuttings with a VERY mild complete fert.

or less. With clones, it may take 6 weeks for the plant to sprout roots and new growth.
o use quickly. Always breed a few buds for seeds, even if you expect to be cloning most of

rtter cubes. A plastic tray is available (\$.95) that holds 77 cubes in pockets allowing the
wool growing cube when rooted.

plants will naturally be better than others in this regard, and it is easy to select not only the
astest growth plant, and breed it with your "best high" male for fast flowering, potent
it will save you a lot of waiting around for your plants to mature.

emales so it does not pollinate them. It is taken to a separate area. Any place that gets just a
house. Put newspaper or glass under it to catch the pollen as the flowers drop it.

it's maturity. Or take the tops as they mature and put the branches in water, over a piece of paper with a razor blade to collect it. A male pruned in this fashion stays alive indefinitely and can be stored in the freezer! Fresh pollen is always best.

more weeks before the females are ready to pollinate. Put a paper towel in the bag with it

ate too early, it may not work. Wait until the female flowers are well established, but still

on two males on separate branches. Wrap the bag around the branch and seal it at the top with a rubber band or a sprayer and then carefully remove it. Large plastic zip-lock bags also work. Slip the bag over the male branch, very dusty with pollen. To pollinate, place it over a single branch of the female, zipping it closed. Allow to settle for an hour or two and shake it again. Remove it a few hours later. Your female should be seeds splitting the calyxes by 3-6 weeks. One pollinated branch can create hundreds

of plants with characteristics you are looking for in a new strain, you will need several plants to choose from. If the parents bred had dominant genes for certain characteristics, it will be impossible to get the same batch of resultant seeds from the initial cross. In this fashion, recessive genes will

often arrive at what is referred to as "hybrid vigor". In other words, often the best strains are the result of interbreeding, since it opens up recessive gene traits that may lead to reduced potency.

Each batch of seeds collected from the same plant, will be different. It is then necessary to try each batch and choose the best and shoulders above the rest in terms of early flowering, high yield and get buzz, that's

the best info in this area.

of seeds. False seed pods swell with THC laden resin and the pistils turn red and orange

and are called "no seeds".

to produce all female plants. Preferably, these two plants will be different types of plants, not

the same type. The potency of female plants than male plants, since the smoke is more potent and easier to judge. There will be no chance of male chromosomes from female parents.

can be obtained by nursery supply houses for plant breeding and hybridizing. Spray the plant once with pollen from the flowers of your other target female plant you have selected. Just pollinate one branch

with the male pollen when it drops. Use a rooting solution similar to the above cloning method. Catch the fallen pollen and add it to the bag too.

to clone a plant with itself. This is used to preserve a special plants characteristics. Cloning will also

plant with itself can lead to inbreeding problems, so it may not be the optimum solution in

able flowers appeared on the plant. Your mileage may vary.

reports are coming in that a negative ion generator will increase growth speed and yield. Animals seem to be altered in a positive way by negative ions in the air, so plants may "feel" when picked, but that may be desirable in some cases.

olved. Some have reversed cycles that collect the dust to a charged plate. It is also possible es. Just wipe the foil clean once a month. It should be grounded to an electrical outlets st taken from the air, and you will have to repaint that wall later.

rid itself of toxins, etc. One of the easiest things to do is use food grade hydrogen peroxide hat will easily break away and can be used by the plant. Oxygen Plus is a plant food that

ive good drainage by using Perlite, sand, or gravel in your mix and at the bottom of pots. able to the plant. More on that in the section on hydroponics.

ump to aerate the water overnight before watering your plants, or put the water in a

growers this way. More than 500 watts in the family home running constantly will show ng on the premises, too many television sets, and late hours, if they happen mention it to to another location during the wee hours in a vehicle not your own.

o that your electrical use history won't reveal your activities in the future...

all serious issues to be concerned about. Don't use a burglar alarm on when your away come. Lock the house up well, and let them take it if they need it so bad. It's not worth

rmen, solicitors, meter readers, neighbors, appraisers, and pets should all be considered

um and heavy metals found in hard water that are not present in purified water. Hard pper and zinc deficiencies. There are several types of purified water, but many are not free

in it, and should be freer of sediment once the water has been turned on and allowed to uch so, you will see it easily. Use only the amount of hot water needed to make the be free of chlorine and most large particles, but will still contain dissolved solids such as

iter. When purchasing water at a store, unless it says RO or Distilled, don't bother

tomato plants. It is possible this will help herb plants too. One treatment administered
e faster.

t, while the other was 7 feet. This may be purely anecdotal, but it may work. Try it and

nd seed can be kept for years this way.

ny seeds as you need, then pop them back in the freezer quickly.

t in a room with a skylight.) With the minimum of: well drained medium, good light with
nyone can take a viable seed to maturity. I strongly recomend buying several complete
e excellent books are available including "Marijuana Botany" "Marijuana Growers
. You will want to get the best results out of the seeds you purchase!

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Cannabis

and composted soil, and ample irrigation, Cannabis can grow to a height of 6 meters (about 20 feet) in a 4-6 month period if all offer good sunlight. In this example an imported seed from Thailand is grown without pruning and becomes a bush which is stored for later planting. This example is representative of the outdoor growth of Cannabis in temperate climates.

the ground by the straightening of the hypocotyl (embryonic stem). The cotyledons (seed leaves) are slightly flattened (1A to 3 inches) in length. About 10 centimeters or less above the cotyledons, the first true leaves arise, and they emerge from the cotyledons. Subsequent pairs of leaves arise in opposite formation and a variously shaped leaf sequence follows. Usually the first pair of leaves will have 3 leaflets each rather than 1 and the second pair, 5 leaflets each.

along the main stem. Each sinsemilla (seedless drug Cannabis) plant is provided with plenty of room to grow and grows up to 7 centimeters (2 1/4 inches) a day in height during the long days of summer.

responds to increasing daylength with more vigorous growth, but in the same season the plant requires shorter daylengths to induce flowering.

Daylength applies only to plants which fail to flower under continuous illumination, since those which flower under continuous illumination require photoperiods (short days or long nights) to induce fertile flowering and less than this will result in the formation of sterile flowers.

Hours per day of light a strain may only take 10 days to flower, whereas if given 16 hours per day it may take up to 20 days. Dark (night) cycles must be uninterrupted to induce flowering (see appendix).

Male plants, although monoecious examples with both sexes on one plant are found. The development of branches is more multi-branched, clustered limbs up to 30 centimeters (12 inches) long, while the female flowers are tightly clustered.

Male plants will be referred to as staminate in the remainder of this text. This convention is more accurate and makes the text easier to read.

Branches arise from the main stem at the nodes (intersections) of the petiole, behind the stipule (leaf spur). In the prefloral phase the branches are identified by their curved claw shape, soon followed by the differentiation of round pointed flower buds having female flowers (sheath). They are easier to recognize at a young age than male primordia. The first female calyxes tend to lack sepals. On some individuals, especially hybrids, small non-flowering limbs will form at the nodes and are often confused with male flowers.

Female plants are bushy to the top with many leaves surrounding the flowers, while male plants have fewer leaves near the top with

from the precise botanical definition. This has come about mainly from the large number of cultivators who have a more informal definition of pistil refers to the combination of ovary, style and stigma. In the more informal usage, pistil refers to the practice among Cannabis cultivators.

very thin membranous calyx. The calyx is covered with resin exuding glandular trichomes (hairs). Pistillate flowers (bracts) which conceal the flowers. The calyx measures 2 to 6 millimeters in length and is closely applied to, and

and may be yellow, white, or green in color. They hang down, and five stamens (approximately 5 millimeters long) are borne on thin filaments. The exterior surface of the staminate calyx is covered with non-glandular trichomes. The pistillate calyx exhibits 2 to 4 germ pores.

As the number of leaflets per leaf decreases until a small single leaflet appears below each pair of calyxes. The phyllotaxy also changes at these stages regardless of sexual type.

After dehiscence (pollen shedding) the staminate plant dies, while the pistillate plant may mature up to five weeks. Staminate plants show a more rapid increase in height and a more rapid decrease in leaf size to the bracts which accompany the pistillate plants often differentiate primordia one to two weeks before staminate plants.

Under normal conditions with a normal inductive photoperiod, Cannabis will bloom and produce approximately equal numbers of staminate and pistillate plants. Under conditions of extreme stress, such as nutrient excess or deficiency, mutilation, and altered light cycles, plants may

be produced by a large vegetative cell, both of which are contained within the mature pollen grain. Germination occurs when the pollen grain while the generative cell enters the pollen tube and migrates toward the ovule. The generative cell divides

near the ovule. The staminate plants die after shedding pollen. After approximately 14 weeks, the pistillate plant completes the normally 4 to 6 month life cycle, which may take as little as 2 months or as long as 10 months. Flowers

are green, yellow, or black. Elongated and slightly compressed, it measures 2 to 6 millimeters (1/16 to 3/16 inch) in length and is

covered with glandular trichomes which are removed after they are mature and beginning to fall from the calyxes. The remaining floral clusters are covered with glandular trichomes on the surface grow and secrete aromatic THC-laden resins. The mature, pungent, sticky floral clusters are used for the production of valuable seeds without compromising the production of seedless floral clusters.

on. Because sexual propagation involves the recombination of genetic material from two parents we expect that vegetative methods of propagation (cloning) such as cuttage, layerage, or division of roots are asexual and all strains to be preserved unchanged through many seasons and hundreds of individuals.

method can be chosen for each situation. The unique characteristics of a plant result from the combination of expression of a genotype, as influenced by the environment, creates a set of visible characteristics that we collect technique to ensure replication of the desired characteristics.

for instance, their genotypes will remain identical. However, the clone grown in the shade will grow tall and slender.

able seed, and the creation of individuals with newly recombinant genotypes. Pollen and ovules are formed by daughter-cells contains one-half of the chromosomes from the mother cell. This is known as the haploid (n) condition. Offspring may resemble the staminate, pistillate or be a combination of both. Offspring may be controlled by a single gene or a combination of genes, resulting in further potential diversity.

inant. If the genes controlling a trait are the same on one chromosome as those on the opposite member of the pair, the plant is termed homozygous. If-pollinated or crossed with an individual of identical genotype for that trait. The traits possessed by the homozygous plant are dominant. If the genes on one chromosome differ from the genes on its homologous chromosome then the plant is termed heterozygous. Imported Cannabis strains usually exhibit great seedling diversity for most traits and many types will be produced.

), certain careful procedures are followed as illustrated in Chapter III. The actual mechanisms of sexual propagation are discussed in Chapter IV.

seed-bearing adult, following the usual pattern of development and sexual reproduction. Fiber and drug production is usually harvested in the juvenile or prefloral stage, before viable seed is produced, while sinsemilla or seedless marijuana is harvested later. Special techniques must be used to produce viable seed for the following year without jeopardizing the quality of the crop.

ration. Monoecious strains are often used because they mature more evenly than dioecious strains. The hermaphrodite leaves a portion of his crop to develop mature seeds which he collects for the following year. If a hybrid variety is used, the hermaphrodite must be removed before seed production.

that fall from the flowers during harvesting, drying, and processing. A mature pistillate plant can produce tens of thousands of seeds per plant. To avoid a patch, eliminating every pollen source, and allowing the pistillate plants to produce massive clusters of unharvested seeds.

of Cannabis. In general these theories have as their central theme the extraordinarily long, frustrated struggle of a pistillate plant remains unfertilized for its entire life and how this ultimately affects the cannabinoid (class) production. It is assumed, however, that seeding cuts the life of the plant short and THC (tetrahydrocannabinol) levels associated with seeding definitely affect all metabolic processes within the plant including cannabinoid biosynthesis. Upon fertilization the plant's energies are channeled into seed production while seeded plants cease floral production. It is also suspected that capitulate-stalked trichome production may be affected by reduced floral growth, trichome formation and cannabinoid production. What is important with respect to propagation is that the desired characteristics have been produced.

research without risk of pollinating the precious crop. Staminate parents exhibiting favorable characteristics are used to pollinate the pistillate parents.

staminate plant contributes half of the genotype expressed in the offspring. Not only are staminate plants preserved and the most favorable individuals selected. Pollen may also be stored for short periods of time for later use.

is the union of the staminate chromosomes from the pollen with the pistillate chromosomes from the ovule.

Pollen grains float through the air on light breezes, and many land on the stigmatic surfaces of nearby pistillate plants. A pollen tube grows out of the grain. The tube contains a haploid (n) generative nucleus and grows downward toward the ovule at the tip. The tube contains a haploid nucleus and the diploid condition is restored. Germination of the pollen grain occurs 15 to 20 minutes. Soon after fertilization, the pistil withers away as the ovule and surrounding calyx begin to swell. If the cycle is interrupted or a viable seed will not form. If the pollen is subjected to extremes of temperature, humidity, or age, it is unable to develop into a mature seed. Techniques for successful pollination have been designed with all the

strains from the same floral cluster of marijuana, and not all of these genotypes will prove favorable. Seeds collected from a single plant, or a single cross, are not representative of the population. If the likelihood of pollination was attempted and only a few seeds appear, the likelihood is very high that these pollinations are the offspring. Once the offspring of imported strains are in the hands of a competent breeder, selection and breeding may prove acceptable as parents. If the cultivator allows random pollination to occur again, the population will be mixed. We must therefore turn to techniques of controlled pollination by which the breeder attempts to take control

of the strains (ten staminate and ten pistillate parents) result in ten pure and ninety hybrid crosses. It is an endless task to remember each cross. The well organized breeder will free himself from this mental burden and possible confusion by labeling each member of the population.

Why? Memory fails, and remembering the steps that might possibly have led to the production of a favorable strain is a difficult task. A record book contains a numbered page for each plant, and each separate cross is tagged. A record of pollination is included and room is left for the date of seed harvest. Samples of the parental plants are

collected from the staminate parent and applying pollen to the receptive stigmatic surfaces of the pistillate parent. Both steps are done in the same enclosure. For different species, enclosures are employed which isolate the ripe flowers from wind, eliminating pollination, yet allow the flowers to breathe. Fine and very tightly woven cloth seem to be the most suitable materials. Coarse cloth allows pollen to escape and is not suitable. Reflective materials remain cooler in the sun than dark or transparent materials, which either absorb solar heat or allow it to pass through. Enclosures are easily constructed by gluing together vegetable parchment (a strong breathable paper for steaming vegetables) or plastic. Gore-Tex are used with great success. Seed production requires both successful pollination and fertilization, so the most convenient and effective to use the same enclosure to collect pollen and apply it, reducing contamination. The enclosure should remain in an isolated area of the field and no pollinations are caused by hermaphrodites or late-maturing plants. If a pistillate parent is isolated on the pistillate seed parent, then only a few seeds will form in the basal flowers and the rest of the flower cluster will be sterile. Later, hand pollinations can be performed on the same pistillate parent by removing the early pollinated flowers and isolating them from the remainder of the population and allowed to freely self-pollinate if pure-breeding offspring are desired.

Plants can grow separate from each other to avoid mutual contamination and can be allowed to shed pollen into a glass plate, or mirror is held beneath a recently-opened staminate flower which appears to be releasing pollen, or a tray of staminate flowers on a piece of paper or glass and allowing them to dry in a cool, still place. Pollen will drop into a dark, dry spot. A simple method is to place the open pollen vial or folded paper in a larger sealable container

refrigerator and the dry crackers or rice act as a desiccant, absorbing moisture from the pollen.

plants. Early morning is the best time to collect pollen, as it has not been exposed to the heat of the day. All enclosures are sealed. This ensures protection of each pollen sample from contamination with pollen from different plants.

collected at this time they can be placed in a covered bottle where they will open and release pollen within two to three days. This method is used for all pollen samples.

which may cause contamination problems if the staminate pollen plants grow at all close to the remaining pistillate plants. This method is performed in the same area without the need to move staminate plants from their original location. Besides this, it allows for more accurately expressing their phenotypes.

Only individuals with well-developed clusters of flowers are chosen. The appearance of the first staminate primordia is noted. Potential pollen parents are prematurely removed. Staminate primordia need to develop from one to five weeks before harvest. They are checked, daily or hourly if necessary, for developmental rates vary greatly and pollen may be released quite early. Pollen plants specially labeled to avoid confusion and extra work.

Placing them on the ground is ineffective because they may release pollen as they dry. When the staminate plant is ready for harvest, the pistillate flowers are chosen. It is usually safest to collect pollen from two limbs for each intended cross, in case one limb is not collected. In this case, the twenty most flowered limb tips are selected and all the remaining flowering clusters are removed at the limb tips to minimize condensation of water vapor released inside the enclosure. The

enclosure should not develop outside the enclosure. The completely open enclosure is slipped over the limb tip and secured with string and wire to prevent crushing of the vascular tissues of the stem. String and wire are avoided. If enclosures are tied to the plant, they are removed before and after handling each pollen sample to prevent accidental pollen transfer and contamination.

Enclosure construction. Paper bags make convenient enclosures. Long narrow bags such as light-gauge quart-bottle paper used the more air circulation is allowed, and the better the flowers will develop. Very thick paper or plastic is avoided. All seams are sealed with waterproof tape or silicon glue and the bags should not be handled with bare hands. Bags make labeling easy and each bag is marked in waterproof ink with the number of the individual pollen parent and necessary information about the future seed parent it will pollinate.

Enclosures are stored in a cool dark place, unless the bags are placed too early or the pollen parent develops very slowly. The opening flowers are easily seen. In some cases, clear nylon windows are installed with silicon glue for greater visibility. A limb, with its bag attached, is cut. If the limb is cut too early, the flowers will not have shed any pollen; if cut too late, the moisture will destroy it. When flowering is at its peak, millions of pollen grains are released and many more flowers are needed to heat them up. The bags and their contents are dried in a cool dark place to avoid mold and pollen spores.

Enclosures are usually, allowed to settle, and carefully untied. The limbs and loose flowers are removed, since they are a source of contamination until the seed parent is ready for pollination, or the pollen may be removed and stored in cool, dry, dark vials. A piece of fuel filter screening placed across the top of a mason jar works well, as does a fine-mesh tea strainer.

Enclosures are removed so long as pale, slender pistils emerge from the calyxes. Withered, dark pistils protruding from swollen, resinous flowers are removed. Pollination is performed as soon as the first primordia show pistils and until just before harvest, but the largest yield of pollen is obtained with thick clusters of white pistils. Few pistils are brown and withered, and resin production has just begun. This is the time to harvest the seeds to mature. Healthy, well flowered lower limbs on the shaded side of the plant are selected. Shaded areas are chosen. When possible, two terminal clusters of pistillate flowers are chosen for each pollen bag. In this way, with two opportunities to perform the cross successfully. Remember that production of viable seed requires successful pollen development, fertilization failure is guarded against by duplicating all steps.

Each enclosure is labeled and included is the number of the seed parent, the date of pollination, and any comments about the phenotypes observed. The enclosure is secured to the limb below the closure of the bag. A warm, windless evening is chosen for pollination so the

os to be pollinated, the pollen is tapped away from the mouth of the bag. The bag is then carefully opened and the band. The bag is shaken vigorously, so the pollen will be evenly dispersed throughout the bag, facilitating contact with the limb tip, or injected with pollen, using a large syringe or atomizer, after the bag is placed. However, the r

tral powder such as flour before it is used. When pure pollen is used, many pollen grains may land on each pistillate flower. Diluting 1 part pollen with 10 to 100 parts flour is common. Powdered fungicides can also be used since

ew days, but their development will be retarded by the bags. The propagator waits three full sunny days, then removes the bags. Any viable pollen that failed to pollinate the seed parent will germinate in the warm moist bag and die within the next few days. It may be necessary, but the bag is removed at the earliest safe time to ensure proper seed development without successful fertilization. Seed parents then need good irrigation or development will be retarded, resulting in small,

eds may take up to two months to mature. If seeds get wet in fall rains, they may sprout. Seeds are removed from the calyx. Seeds are labeled and stored in a cool, dark, dry place, This is the method employed by breeders to cre

and nearly all Cannabis cultivators, no matter what their intention, start with seeds that are gifts from a fellow cultivator or a selection unless the cultivator travels to select growing plants with favorable characteristics and personally picks the seeds. These seeds are of unknown parentage, the product of natural selection or of breeding by the original farmer, or

owed to mature and release pollen, Since Cannabis is wind-pollinated, many pollen parents (including early maturing) are included in the catch of pistillate flowers. If the seeds are all taken from one flower cluster with favorable characteristics, then the seeds have come from many different parents. This creates great diversity in offspring.

ented by the removal of staminate parents prior to the release of pollen. The few seeds that do form often result from wind-borne pollen from wild plants or a nearby field. Hermaphrodite parents often produce hermaphrodite

tion of pollen parents, impure breeding conditions, and lack of adequate space to isolate pollen parents from

r bred locally by another propagator. Even if they are hybrids there is a better chance of success than with im

d hermaphrodite pollinations.

..

re avoided since these are usually less mature and less viable.

ds on common sense and luck. Mature seeds with dried calyxes in the basal portions of the floral clusters also may be pollinated by early-maturing pollen parents. These seeds have a high chance of producing early-maturing offspring. Immature seeds, are formed in later-appearing pistillate flowers. These flowers were likely pollinated by pollen from a later and have a greater chance of producing hermaphrodite offspring. The pollen parent also exerts some influence. If a flower cluster and selected for similar size, shape, color, and perianth patterns, then it is more likely to produce offspring.

imilar climates and latitudes. Seed selection for specific traits is discussed in detail in Chapter III.

ns.

vided, since these will not reliably reproduce the phenotype of either parent.

. Grade #1 - Seed parent and pollen parent are known and there is absolutely no possibility that the seeds re-

re involved. Grade #3 - Pistillate parent is known and pollen parents are unknown.

tillate seed parent age traits may be characterized.

f a bag of imported Cannabis.

on (mitosis) occurs during growth and regeneration. The vegetative (non-reproductive) tissue of Cannabis has 20 chromosomes. During mitosis every chromosome pair replicates and one of the two identical sets of chromosomes is passed to each daughter cell. Consequently, every vegetative cell in a Cannabis plant has the same genotype and a plant resulting from asexual propagation under the same environmental conditions.

ematic cambium layer of the stalk. A propagator makes use of these meristematic areas to produce clones that can ensure identical populations as large as the growth and development of the parental material will permit. It is necessary to regenerate a complete plant.

plant. Because of the heterozygous nature of Cannabis, valuable traits may be lost by sexual propagation that is not controlled. However, evenly maturing Cannabis is made possible through cloning. Any agricultural or environmental influences will be passed on to the clone.

al in all characteristics. The phenotype that we observe in an individual is influenced by its surroundings. These influences do not affect genotype and therefore are not permanent. Cloning theoretically can preserve a genotype under environmental stress, but this trend will reverse if the pressures are removed. Shifts in genetic composition can occur through cloning this is less likely. Only mutation of a gene in a vegetative cell that then divides and passes on the mutant genotype sexually, the mutant genotype will be further replicated. Mutations in clones usually affect dominance relationships. Mutations can be induced (usually affect dominance relationships) by treating meristematic regions with X-rays, colchicine, or other mutagens.

re subtle effects of environment and cultural techniques. These subtleties are usually obscured by the extreme conditions under which a population of clones is subjected to sudden environmental stress, pests, or disease for which it has no defense. Genetic diversity is found within the clone, no adaptation to new stresses can occur through recombination of genes.

er meristematic shoot apex comes directly from the parental plant. Many stem cells, even in mature plants, have the genetic information needed for an entire plant. Adventitious roots appear spontaneously from stems and old roots. Under humid conditions (as in the tropics or a green house) adventitious roots occur naturally along the main stalk near the nodes.

tious roots.

meristematic cells located just outside and between the vascular bundles (the root initials), (2) the differentiating old stem tissue and establishing vascular connections with the shoot.

er system forms with the adjacent vascular bundles and the root continues to grow outward through the cortex. In old young roots appear within four weeks. Often an irregular mass of white cells, termed callus tissue, will form. However, it is a form of regenerative tissue and is a sign that conditions are favorable for root initiation.

ications of rooting systems. Natural plant growth substances such as auxins, cytokinins, and gibberellins are the most influential. Auxins and other growth substances are involved in the control of virtually all plant processes. Great care is exercised in application of artificial growth substances so that detrimental conflicting effects are avoided, but the mechanism of this action is not yet fully understood.

le, such as naphthaleneacetic acid (NAA), indolebutyric acid (IBA), and 2,4-dichlorophenoxyacetic acid (2,4 DCPA), are applied to the apical shoot, stem and young leaves. It moves downward after its formation at the growing shoot tip, but the physiology of auxins has led to practical applications in rooting cuttings. It was shown originally by Went (1928) that application of natural or synthetic auxin seems to stimulate adventitious root formation in many plants, it is assumed that (1950) suggested that the levels of auxin may determine whether adventitious roots or shoots are formed.

ess root growth and stimulate bud growth. This is the opposite of the reaction caused by auxins, suggesting that the use of solutions of equal concentrations of auxins and cytokinins to promote the growth of undifferentiated callus.

y resist rooting. Selection of rooting material is highly important. Young, firm, vegetative shoots, 3 to 7 millimeters long, are preferred over woody branches and reproductive tissues, since these are slower to root. Stems of high carbohydrate content are preferred over woody tissue. An accurate method of determining the carbohydrate content of cuttings is the iodine starch test. Cuttings containing the highest starch content stain the darkest; the samples are rinsed and sorted accordingly. Therefore, young, rapidly-growing stems of high nitrogen and low carbohydrate content root less well than slightly woody stems. Staminate plants have higher average levels of carbohydrates than pistillate plants, while pistillate plants have higher levels of nitrogen. Tissue are taken just after sex determination while stems are still young. For rooting cloning stock or parenta

ates to accumulate. This can be accomplished by leaching (rinsing the soil with large amounts of fresh water). Leaching of roots reduces excessive vegetative growth and allows for carbohydrate accumulation.

ve ceased lateral growth and begun to accumulate starch are the best. The carbohydrate-to-nitrogen ratio is

oot initiation. Starch levels drop, strengthening tissues and fibers begin to soften, cell wall thickness decreases, and roots begin to form. These conditions are very conducive to the initiation of root growth. If the light cycle can be controlled for cloning and wrapped for several inches just above the area where the cutting will be taken. This is done to prevent the cutting from rooting in the medium. Various methods of layers and cuttings rooted below soil level rely in part on the effects of

may block the downward mobility of carbohydrates and auxin and rooting cofactors, raising the concentration

a sharp knife or razor blade and immediately placed in a container of clean, pure water so the cut ends are well hydrated. (Ethylene gas metabolism) may enter the cut end and block the transpiration stream in the cutting, causing it to wilt. Cuttings should be inserted into the rooting medium.

Rows of holes are made in the rooting medium with a tapered stick, slightly larger in diameter than the cutting, to be rooted treated with growth regulators and fungicides (such as Rootone F or Hormex), and each cutting placed in a hole. The rooting medium is lightly tamped around the cutting, taking care not to scrape off the growth regulator. The cuttings are then watered with a mild nutrient solution once a day.

Weeks. At this time the hardening-off process begins, preparing the delicate cuttings for a life in bright sunshine on their own. It is necessary to water them with a dilute nutrient solution or feed with finished compost as soon as possible. When vegetative cuttings are placed outside under the prevailing photoperiod they will react accordingly (if it is too cold for them to be put out, then they may be kept in a vegetative condition by supplementing with lights).

medium. Since the discovery in 1984 that auxins such as IAA stimulate the production of adventitious roots, and since then, many new techniques of treatment have appeared. It has been found that mixtures of growth regulators and fungicides in commercial preparations. Many growth regulators deteriorate rapidly, and some are phytotoxic, but no inductive effect has been noticed. As soon as roots emerge, nutrients are necessary; the shoot cannot grow without them. Auxin certainly helps root growth; nitrogen is especially beneficial. Cuttings are extremely susceptible to fungus attack, so a fungicide that is sometimes applied in powdered form along with growth regulators. This is done by rolling the cuttings in the powder.

Roots may fail to produce roots and rooting will certainly be inhibited. It is very important to select a light, well-aerated rooting medium. Aeration of the rooting media may be facilitated by aerating the water used in irrigation. The leaves, from where much of it runs off into the soil, aiding rooting. Oxygen enrichment of irrigation water increases the amount of oxygen absorbed by the water. An increase in dissolved oxygen of only 20 parts per million may have a great influence on root growth. Air from a small pump or bottled oxygen may also be supplied directly to the rooting media through a tube.

Watered to ensure proper rooting, aeration of the rooting media may be facilitated by aerating the water used in irrigation. The leaves, from where much of it runs off into the soil, aiding rooting. Oxygen enrichment of irrigation water increases the amount of oxygen absorbed by the water. An increase in dissolved oxygen of only 20 parts per million may have a great influence on root growth. Air from a small pump or bottled oxygen may also be supplied directly to the rooting media through a tube.

Direct observation of root development. However, several problems arise. A water medium allows light to reach the roots, but it also allows water molds and other fungi, supports the cutting poorly, and restricts air circulation to the young roots. In a stagnant solution only a few roots will form at the surface, where direct oxygen exchange occurs. If rootings are made in a water medium, a constant oxygen for a short period. If nutrient solutions are used, a system is needed to oxygenate the solution. The use of aeration devices, such as aeration tubes, and refill rooting containers.

and sufficient air circulation to the young roots. A high-quality soil with good drainage such as that used for growing plants is best. Soil should be free of bacteria and fungus. A small amount of soil can easily be sterilized by spreading it out on a cookie sheet and heating it in an oven at 180°C for 30 minutes. Bacteria and fungus as well as nematodes, insects and most weed seeds. Overheating the soil will cause the breakdown of organic material by heat, and insects. One gallon of commercial formalin (40% strength) is mixed with 50 gallons of water and used to treat soil. Large flats and plots are covered with polyethylene sheets. After 24 hours the seal is removed and the soil is watered with water prior to use. Fumigants such as formaldehyde, methyl bromide or other lethal gases are very effective in killing soil-borne organisms.

perlite are often used in propagation because of their excellent drainage and neutral pH (a balance between acidic and basic). They contain no organic material. It has been found that a mixture of equal portions of medium and large grade vermiculite is best. A weak nutrient solution, including micro-nutrients, is needed to wet the medium, because little or no natural nutrients are available. It is also good to add agricultural lime, dolomite lime, or oyster shell lime.

Layering is a form of propagation in which a stem is partially supported by the parent plant. The stem is then detached and the meristematic tip becomes a new individual plant. Rooting is initiated in layering by various stem treatments which interrupt the flow of auxins, carbohydrates and other growth factors. Rooting occurs in this treated area even though the phloem has been interrupted; the xylem tissues connecting the shoot to the parental roots remain intact and alive while it roots, thus greatly increasing the chances of success. Old woody reproductive stems that, as cuttings, are not ideal for mass cloning of parental stock are better suited to layering than removing and rooting dozens of cuttings. Layering, however, does not require the use of rooting hormones.

Layering involves depriving the rooting portion of the stem of light, promoting rooting. Root-promoting substances and layering depends on constant moisture, good air circulation and moderate temperatures at the site of rooting.

In simple layering, a single vegetative lower limb is selected for layering, carefully bent so it touches the ground, and stripped of leaves. A trench 2 to 4 inches deep, is dug parallel to the limb, which is placed along the bottom of the trench, secured with wire mesh, crushed with a loop of wire, or twisted to disrupt the phloem tissue and cause the accumulation of substances that promote rooting.

Each section of the limb is buried in separate trenches, making sure that at least one node remains above ground. The ground may require wetting several times a day. A small stone or stick is inserted under each exposed section of stem. Layering may be started in small containers placed near the parental plant. Rooting usually begins within a few weeks. Once the layers become well established, transplanting may be difficult without damaging the tender root system. Shoots can be removed and acclimatized or hardened-off and begin to grow on its own rather than with cuttings.

Layering can be done with regulators, and wrapped with moist rooting media. Air layering is an ancient form of propagation, possibly originating in China. A stem is girdled and held with a wrap of fibers. Above this is suspended a small container of water (such as a bamboo shoot) which is used to keep the stem moist.

In air layering, very small amounts of rooting media are used, and the position on aerial parts of the plant exposes them to light and air, which allows oxygen to enter and retains moisture well. Air layers are easiest to make in greenhouses where humidity is high. They are most useful to the amateur propagator and breeder because they take up little space and allow the efficient propagation of many plants.

Aerobic layering is usually a spot 30 centimeters (12 inches) or more from the limb tip. Unless the stem is particularly strong, a splint is used to support the stem to be layered along the bottom edge of the stem. This splint is tied in place at both ends with string. A Cannabis stem works well as a splint. Next, the stem is girdled between the two ties with a twist of wire or string. The stem is then covered with one or two handfuls of unmilled sphagnum moss, and wrapped tightly with a small sheet of clear polyethylene film so tight that the phloem tissues are crushed. If the phloem is crushed, compounds necessary for rooting will be released. A well for sealing air layers. Although polyethylene film retains moisture well, the moss will dry out eventually and a hypodermic syringe is used to inject water, nutrients, fungicides, and growth regulators. If the layers become established, squeezing the medium to remove any extra water. Heavy layers on thin limbs are supported by tying them to the parent stem. The roots will be visible through the clear plastic within four weeks. When the roots appear adequately developed, the layers are removed, watered well and placed in a shady spot for a few days to allow the plant to harden-off and adjust to living on its own.

fore removing the layer to prevent excessive transpiration and wilting.

ants in order to save small samples of them for pollen collection and to conserve space. By the time the pollen is taken from pistillate plants are used for breeding, or saved and cloned for the following season.

supported by their own root systems. This could mean that a clone will continue to grow longer and mature late in life, producing new calyxes and pistils instead of completing the life cycle along with the parents. Rejuvenated layers are used

for decades. Warmke and Davidson (1943) claimed that Humbles tops grafted upon Cannabis roots produced "completely nontoxic." According to this research, the active ingredient of Cannabis was being produced in the roots. This research entirely disproves this theory. Grafts were made between high and low THC strains of Cannabis as well as inter-strain grafts. Donors for each graft and their control populations. The results showed ". . . no evidence of transport of inter-

est very interesting specimen plants. One procedure starts by planting one seedling each of several separate strains. When the seedlings are four weeks old they are ready to be grafted. A diagonal cut is made approximately 1/2 inch long and the cut surfaces are joined together such that the inner cut surfaces are touching. The joints are held with a fold of cellophane tape. Unwanted portions of the grafts are cut away. Eight to twelve weeks are needed to complete the graft, and the cellophane tape falls off.

to promote branching. Several techniques are available, and each has its advantages and drawbacks. The most common is to remove a limb at approximately the final length desired for the stalk or limb. Below the point of removal, the stem is now divided into two, and the diffusion of growth energy results in a shorter plant which spreads horizontally.

When the stem is removed, the auxin is no longer produced and branching may proceed uninhibited. Plants that are normally late in life, supposedly to promote branching and floral growth, will often flower late or fail to flower at all. A plant does not measure that it is the time of the year to flower. Plants will usually mature fastest if they are not pruned. Pruning may work to delay flowering. This is particularly applicable if a staminate plant from an early harvest is grafted onto a pistillate plant until the pistillate plant is mature and ready to be pollinated. When the pistillate plant is receptive, the staminate

can be trained without removing meristematic tissues. Trellising is a common form of modification and is achieved in several ways. Posts may be driven into the ground 1 to 3 meters (3 to 10 feet) apart and wires stretched between them at 30 to 45 degrees to the east-west axis for maximum sun exposure. Seedlings or pistillate clones are placed between the posts, and trained to grow up the wires. The tips are trained to grow horizontally. They are spaced evenly along the wires by hooking the upper limbs to the wires for some distance, but it is never allowed to grow higher than the top row of wire. When the plant begins to flower, the floral clusters are supported by the wire above them, and they are resistant to weathering. Trellising produces a higher yield than freestanding unpruned or pruned plants. Other growers feel that any interference with natural

growth systems. Plants are placed under a horizontal or slightly slanted flat sheet of 2 to 5 centimeters (1 to 2 inches) of plastic film surface perpendicular to the direction of incoming light or to the lowest path of the sun. The seedlings or clones are trained to grow up the netting, forcing them to grow horizontally outward. Limbs are trained so that the mature plant will cover the netting upward through the wire as they reach for the light. This might prove to be a feasible commercial cultivation system. If the netting is removed, growth and maturation should proceed on schedule. This system also provides maximum light exposure

to the plants without meristem removal. This is a particularly useful technique for greenhouse cultivation, where plants can

the greenhouse. To prevent rotting and burning while leaving enough room for floral clusters to form, the limbs are light to strike the plant, promoting axial growth. Crimping stems and bending them over results in more limb removal, this promotes axial growth.

from the bottom portions of the plant, and due to shading they remain small and fail to develop large floral clusters. The top parts of the plant with the most sun exposure and the greatest chance of pollination. The question arises: It seems in this case that shock is minimized by removing entire limbs, including proportional amounts of stems, leaves, or meristems were removed. Also, the lower limbs are usually very small and seem of little significance and atrophied and these are also sometimes removed in an effort to increase the yield of large floral clusters.

the cultivator, several reasons exist for removing leaves. Many feel that large shade leaves draw energy from the plant. If surplus energy will be available, and large floral clusters will be formed. Also, some feel that inhibitors of flower formation are produced on leaves that were formed during the noninductive photoperiod. Possibly, if these inhibitor-laden leaves are removed from the plant, and small atrophied floral clusters may begin to develop if they receive more light.

Leaf removal possibly serves to defeat its original purpose. Large leaves have a definite function in the growth and development of the plant. They produce necessary growth substances. They also create shade, but at the same time they are collecting valuable solar energy. Leaf removal may cause stunting, because the potential for photosynthesis is reduced. As these leaves age and lose their green color, it is taken to remove the yellow or brown leaves, because they might invite attack by fungus. During chlorosis, the plant is growing part of the plant, such as the flowers. Most Cannabis plants begin to lose their larger leaves when they are old. The plant uses the energy and various molecular components of existing chlorophyll than to synthesize new chlorophyll at a slower rate.

If a metabolic change occurs too late in the season it could interfere with floral development and delay maturation. This is caused by metabolic upset in the plant. Removal of shade leaves does facilitate more light reaching the center of the plant, but the plants probably not grow any larger. Leaf removal may also cause sex reversal resulting from a metabolic change.

Weaknesses in the limb axis at the node result if the leaves are pulled off at the abscission layer while they are still attached.

Plants are forced to reproduce, and reproduction is favored by early maturation. This produces a situation where plants are trying to reproduce before the natural progressive growth of a plant probably interferes with its rapid development.

Plants are forced to grow and mature naturally. It must be remembered that any alteration of the natural life cycle of Cannabis is done for specific situations of cultivation. Logical choices are made to direct the natural growth cycle of Cannabis to the desired end of production.

of inheritance, the full potential of diligent breeding, and the line of action most likely to lead to success, is re-

l in the pollen of the staminate parent and the ovule of the pistillate parent. Fertilization unites these two sets of gametes, and the transmitted units determining the expression of a character are known as genes. Individual organisms have only one set of genes (n). Upon fertilization one set from each parent combines to form a seed ($2n$).

chromosomes is 20. Each chromosome contains hundreds of genes, influencing every phase of the growth and development of the organism.

breeding results in offspring that all exhibit the same trait, and if all subsequent (inbred) generations also exhibit it, the strain is said to breed true, for that trait. A strain may breed true for one or more traits while varying in other characteristics. For a strain to breed true for some trait, both of the gametes forming the offspring must have an identical gene for that trait. For example, if a true-breeding strain has webbed leaves, any gamete from any parent in that population will contain the gene for webbed leaves, which will be passed on to the offspring. Thus, upon fertilization both "leaf shape" genes of the ($2n$) offspring will be w . That is, the parents have only w genes to pass on in their gametes.

Not all offspring resemble their parents) we say the parents have genes that segregate or are hybrid. Just as a strain can breed true for one trait, a strain can also be a hybrid for one or more traits. Consider a cross where some of the offspring have webbed leaves and some have normal compound-pinnate leaves. We assume that the gene for webbed leaves is w and the gene for normal compound-pinnate leaves is W for that trait. Since these two genes both influence leaf shape, we assume that they are related genes. Because the gametes of a true-breeding strain must each have the same genes for the given trait, it seems logical to assume that the parents of the hybrid offspring have one w gene and one W gene.

Mendel to his theory of genetics. If like only sometimes produces like, then what are the rules which govern the inheritance of traits?

with compound-pinnate leaf shapes. We know that all the gametes produced by the webbed-leaf parents will carry the w gene for webbed leaf shape. (The offspring may differ in other characteristics, of course.)

of the offspring are of the compound-pinnate leaf phenotype. (The expression of a trait in a plant or strain is called its phenotype.) Since we know that there were just as many w genes as W genes combined in the offspring, the W gene must be dominant over the recessive trait of webbed leaves. This seems logical since the normal compound-pinnate leaves is dominant over the recessive trait of webbed leaves. The true-breeding dominant or recessive condition, WW or ww , is termed the parental generation. The first filial generation (F_1) offspring resulting from the initial cross of the P generation we call the F_1 generation. In this case, the F_1 generation will be all Ww type-to-one webbed type. It should be remembered that phenotype ratios are theoretical. The real results may vary slightly due to chance.

W are combined, the dominant trait W will be expressed in the phenotype. In the F_2 generation only 25% of the offspring will be ww and only when two w genes are combined to form a double-recessive, fixing the recessive trait in 25% of the offspring. In this example would remain the same, but the phenotypes in the F_1 generation would all be intermediate types rather than all Ww .

, the first of the basic rules of heredity:

1. The test cross is done by crossing one of the F_1 progeny back to one of the true-breeding P_1 parents. If the resulting ratio of offspring is indeed homozygous dominant WW and homozygous-recessive ww , the parent is a true-breeder.

F_1 crosses are the two basic Mendelian ratios for the inheritance of one character controlled by one pair of genes. The test cross and the F_1 cross are the two basic Mendelian ratios for the inheritance of one character controlled by one pair of genes and the relevance of genotype to further breeding.

and pairs of genes at a time. For instance we might consider the simultaneous inheritance of the gene pairs T and R instead of monohybrid cross. Mendel's second law allows us to predict the outcome of polyhybrid crosses also.

type combinations will form 4 F2 phenotypes in a 9:3:3:1 ratio, the most frequent of which is the result in 9 F2 phenotypes in a 1:2:1:2:4:2:1:2:1 ratio, directly reflecting the genotype ratio. A mixed dominance involving two independently assorting pairs of genes results in a 9:3:3:1 Mendelian phenotype ratio only if present in the original gene pairs. Also, two new phenotypes, tall/late and short/early, have been created in the non is termed recombination and explains the frequent observation that like begets like, but not exactly like.

as in the mono-hybrid back-cross. It should be noted that despite dominance influence, an F1 back-cross with 1/4 of the time, and by the same logic, a back cross with the homozygous-dominant parent will yield the 1/4 is invaluable in determining the F1 and P1 genotypes. Since all four phenotypes of the back-cross progeny the back-cross phenotype is a direct representation of the four possible gametes produced by the F1 hybrid.

enes. Gene inter action is the control of a trait by two or more gene pairs. In this case genotype ratios will refer to 2 dominant gene pairs Pp and Cc control late-season anthocyanin pigmentation (purple color) in Cannabis. If P and C exhibit accumulated anthocyanin pigment and turn a purple color. If C is present alone, the plant will remain green. However, the calyxes of the plant will also exhibit accumulated anthocyanin and turn purple as the leaves do. Let's see how techniques can be used to produce this trait?

the F1 offspring is observed.

1/16 of the expected 9:3:3:1 for independently assorting traits. If P and C must both be present for any anthocyanin to appear.

Generally, the simple laws of inheritance have become more complex, but the data may still be interpreted.

from one generation to generation.

the gamete of the pistillate parent.

is termed hybrid or heterozygous.

they are termed true-breeding or homozygous.

eventually.

F2, and subsequent generations.

chromosomes in the vegetative diploid (2n) condition. Triploid (3n) and tetraploid (4n) individuals have three or four sets of chromosomes. Polyploidy was likely derived by reduction from a higher (polyploid) ancestral number (Lewis, W. H. 1980). Polyploid induction treatments. Colchicine is a poisonous compound extracted from the roots of certain Colchicum species; it inhibits spindle formation in the daughter cells with multiple chromosome sets. The studies of H. E. Warmke et al. (1942-1944) seem to indicate that polyploidy is a key to the psychoactive ingredients of Cannabis and was therefore unable to extract THC. His crude acetone extract of a polyploid strain was, however, able to produce both triploid and tetraploid strains of Cannabis with up to twice the potency of a normal strain of hemp with materially reduced marijuana content" and his results indicated that polyploidy raised the

also illustrated that potency is genetically determined by creating a lower potency strain of hemp through selection.

valuable traits such as fiber quantity may be improved through polyploidy. Polyploids require more water and % in polyploids. An extended vegetative period could delay the flowering of polyploid drug strains and interfere with polyploidy if polyploid plants were not able to mature fully in the favorable part of the season when cannibing can be used to extend the season and test polyploid strains.

inal diploid plants by 25-30%. Tetraploids were intensely colored, with dark green leaves and stems and a weons. Tetraploid plants often revert back to the diploid condition, making it difficult to support tetraploid popula

n) with diploids (2n). Triploids proved to be inferior to both diploids and tetraploids in many cases.

id 0.50% solutions of colchicine at the primary meristem seven days after germination. Treated plants were slightly smaller than controls, 39%, respectively, of the surviving treated plants. In the first group (0.25%) cannabinoid levels were highest in the treated plants. In the second group (0.50%) there were many anomalies. Overall, treated plants showed a 166-250% increase in THC with respect to controls and a decrease in the biosynthesis and degradation of THC. THC levels in the control plants were very low (less than 1%). Post-treatment plants with deformed leaf lamina, 90% of the cells are tetraploid (4n 40) and 10% diploid (2n 20). In treated

few plants with an unbalanced set of chromosomes (2n + 1, 2n - 1, etc.). These plants are called aneuploids. They produce very small seeds. The weight of 1,000 seeds ranges from 7 to 9 grams (1/4 to 1/3 ounce). Under natural conditions (1979).

n and polyploidy. Further research to determine the effect of polyploidy on these and other economically valuable

Cannabis. However, colchicine is poisonous, so special care is exercised by the breeder in any use of it. Many other strains of Cannabis, no outstanding characteristics have developed in these strains and potency seems unaffected. However, treatment with colchicine to no effect. Seed treatment is the most effective and safest way to apply colchicine. * In the future, at the end of the growing season the amount would be infinitesimal. Colchicine is nearly always lethal to Cannabis. Only a few viable seeds are treated with colchicine and 40 of them germinate it is unlikely that the treatment induced polyploidy. These plants are better than those that they are polyploid since the treatment killed all of the seeds but those three. It is still necessary to

chromosomes 2-6 and 9 are distinguished by the length of each arm. Chromosome 1 is distinguished by a large knob at the end, and chromosome 8 is assumed to be the sex chromosome. In the future, chromosome 8 is assumed to be the sex chromosome. *The word "safest" in these accounts are probably a bit too lurid, the real dangers of exposure to colchicine have not been fully researched. Cannabis breeders use colchicine. Seed treatment might be safer than spraying a grown plant but the safest method of all is to treat the seeds of Cannabis. This will enable geneticists to determine and manipulate the important characteristics contained in Cannabis, and where they are located along those chromosomes.

ancestors in their collection and sowing of seeds from superior plants, together with the forces of natural selection and changing weather conditions. In other words, they are adapted to particular niches in the ecosystem. This genetic diversity is maintained, and pests change, the strain evolves and selects new defenses, programmed into the genetic orders controlling the growth of genetic material has appeared in North America. Original fiber strains have escaped and become acclimated and acclimatized randomly, until many of the fine gene combinations of imported Cannabis have been

genetic modification programs have altered the selective pressures influencing Cannabis genetics. Large shipments of imported Cannabis by growers and smugglers to supply an ever increasing market for marijuana. Older varieties of Cannabis are becoming extinct. As these older varieties and their corresponding cultures become extinct, this genetic information could be lost. The result is a uniform hybrid race that are likely to displace primitive populations worldwide.

If inbred Cannabis be attacked by some previously unknown pest or disease, this genetic uniformity could prove a genetic complement of resistance cannot be reclaimed from primitive parental material, resistance cannot be irretrievably dropped from the Cannabis gene pool. Human intervention can create new phenotypes by selection through the slow process of random mutation.

Indeed these principles are often the key to crop improvement, but only when applied knowledgeably and cautiously. Such adaptation relies. At this time, the future of Cannabis lies in government and clandestine collections. The collection used as the primary seed stock for worldwide governmental research is depleted and spoiled.

mediate:

Government seizures and smuggled shipments are seldom reliable seed sources. The characteristics of both parent sources, even if the exact origin of the sample is certain. Direct contact should be made with the farmer-breeder. Records of every possible parameter of growth must be kept with carefully stored triplicate sets of seeds. Seed samples should be replenished every third year. Collections should be planted in conditions as similar as possible to those of the original source. Selection of genes and ensure the preservation of the entire gene pool. Half of the original seed collection should be used for comparison and back-crossing. Phenotypic data about these subsequent generations should be carefully recorded and characterized and catalogued.

Legal but only for approved, patented strains. Special caution would be needed to preserve variety in the gene

of Cannabis seed. In spite of this, the conscientious cultivator is making a contribution toward preserving and improving

seeded so they do not degenerate and can be reproduced if lost. Left to the selective pressures of an introduced environment, it is an example of a typical grower with good intentions.

Seeds were selected from the best floral clusters of several strains available over the past few years, both imported and home-grown. A crop of beautiful plants resulted. After careful consideration, the few seeds from accidental pollination of the first year before and seed collection was performed as before. The third season, most of the plants were not as large as the first season resulted in plants inferior even to the first crop, and this trend continued year after year. What went wrong? The crop improved the first year. Why did the strain degenerate?

The grower began well by selecting the best seeds available and growing them properly. The seeds selected for the second year were from hermaphrodite pistil late plants. Many of these random pollen-parents may be undesirable for breeding since, however, the collected hybrid seeds produce, on the average, larger and more desirable offspring than the first season. A tendency is for many of the dominant characteristics from both parents to be transmitted to the F1 offspring. Hybrid vigor often raises the cannabinoid level of the F1 offspring, but hybridization also opens up the possibility that undesirable characteristics may also mask inferior qualities due to abnormally rapid growth. During the second season, random genetic combinations and the possible F2 combinations are tremendous. By the third season the gene pool is tending toward equilibrium with the native environment. These acclimatized members of the third crop have a higher chance of maturing viable, and thereby increase the chance that undesirable characteristics associated with acclimatization will be transmitted to a fully acclimatized weed strain of little drug value.

Genetic diversity is vital to progress in breeding Cannabis. What qualities are desired in a strain that it does not already possess? These questions suggest goals for breeding. In addition to a basic knowledge of Cannabis botany, propagation, and genetics, a sensitive rapport is established between breeder and plants and at the same time strict guidelines are followed.

The breeder and plant wizard Luther Burbank stands as a beacon to breeders of exotic strains. His success in improving hundreds of thousands of seedlings and adults from the world over.

one must get clearly in mind the kind of plant he wants, then breed and select to that end, always choosing the

characteristics of Cannabis that may be genetically controlled, has a way to accurately measure these variable traits of Cannabis, including parameters of variation for each trait and comments pertaining to selective breeding for favorable ones, the unconscious breeding of poor strains is avoided.

which are approaching nearest the ideal," and REJECT ALL OTHERS! Random pollinations do not allow the control from the population), or any stray staminate branch on a pistillate hermaphrodite may become a pollen parent. Only those that have been carefully selected for favorable traits will give rise to the next generation.

In a group of 10 has far less chance of being significantly different from its fellow seedlings than the best plant out of 500,000 seedlings. Difficulties arise for many breeders because they lack the space to keep enough experimental space available. Formulating a well defined goal lowers the number of individuals needed to perform effective selection. Young plants take up much less space than adults. Thousands of seeds can be germinated in a flat. A flat takes up 60-centimeter (24-inch) juvenile. An adult plant can easily take up as much space as a hundred flats. Simple and divided enough seeds are available. Seeds of rare strains are quite valuable and exotic; however, careful selection produce better offspring than plants from a rare strain where there is little or no opportunity for selection after it to successful breeding. The random pollinations that produce the seeds in most imported marijuana assure the seedling sample is large enough.

Final product, but these characteristics can only be accurately measured after the plant has been harvested and analyzed. These are selected first, and later selections focus on the most desirable characteristics exhibited by juvenile seedlings. Juvenile seedling selection are easy to establish. As an example, particularly tall and thin seedlings might prove to be more suitable for flower production. However, many important traits to be selected for in Cannabis flower production of seeds made at a later date.

variation from which distinctive individuals can be selected. The wind performs random hybridization in nature as cross-pollination, cross-fertilization, or simply crossing. If seeds result, they will produce hybrid offspring even

without involving the staminate plants of the seed strain, and allowing nature to take its course. Pollen- or seed-sterile strains, however, genes for sterility are rare. It is important to remember that parental weaknesses are transmitted to offspring

and may transmit mutant genes to the offspring if they are used as pollen parents. If the parents represent diverse gene pools, dominant genes inherited from each parent mask recessive traits inherited from the other. This gives rise to particular characteristics are selected since they will probably represent more diverse gene pools.

Parents do not contain recessive genes for a favorable characteristic seen in a parent if the parent was homozygous for that characteristic. The desired parental trait. Many breeders stop with the first cross and never realize the genetic potential of the Cannabis strains are F1 hybrids for many characteristics, great diversity and recessive recombination can result from a first cross accomplished, and a year is saved by going directly to F2 hybrids. These F2 hybrids are more likely to express the desired characteristics to start new true-breeding strains. Indeed, F2 hybrids might appear with more extreme characteristics than either parent. Selfing the F1 yields F2 hybrids, of both P1 [high and low THC] phenotypes, intermediate F1 phenotypes, and

offspring from the original parental strains. When breeders create hybrids they try to produce enough seeds to last for several generations of desirable hybrid seeds stored for later use. If hybrids are to be reproduced, a clone is saved from each parental

phenotype. In this case, a cross is made between one of the F1 or subsequent offspring and either of the parents expressing

selected parental trait. Back-crossing is a valuable way of producing new strains, but it is often difficult because poor lighting or greenhouses can be used to protect breeding stock from winter weather. In tropical areas plants are selected from the original P1 group that produced the valuable characteristic so that other P1 plants also exhibit

of the original cross (differentiation).

more vigor.

breeding strain breed true for all characteristics. When discussing crosses, we are talking about the inheritance of one trait, dihybrid crosses involve two traits, and so forth. Plants have certain limits of growth, and a limited gene pool. Nothing is actually created by breeding; it is merely the recombination of existing genes into new

achieved by crossing selected individuals from different high-potency strains of different origins, such as Thailand and Mexico, in every other respect. From this great exchange of genes many phenotypes may appear in the F2 generation. For example, consider some of the offspring from the P1 (parental) cross: Mexico X Thailand. In this case, genes are selected from either one. Genes for large stature and early maturation are selected from the Mexican seed-parent, and genes that inhibit several of the desired characteristics are selected from the Thai seed-parent. To further promote gene segregation, the plants most nearly approaching the desired characteristics are selected. In the F2 generation there are several individuals out of many that exhibit all five of the selected characteristics.

one acceptable staminate plant is selected along with two pistillate plants (or vice versa). Crosses between these two strains, each expressing the desired characteristics. Each generation will produce new, more acceptable combinations.

used. This comes from limiting the diversity of the gene pools in the two strains to be hybridized through previous generations. This will establish two strains which are true-breeding for all the originally selected traits. This means that all the traits that have been lost through successive inbreeding may by this time have resulted in steady decline in the vigor of the strain.

For selected strains can then be interbred to recombine nonselected genes and restore vigor. This will probably be achieved by crossing the two separate lines, and this is highly unlikely. Now the breeder has produced a hybrid strain that breeds true.

In true breeding, hybrids are adapted from a heterozygous gene pool to a homozygous gene pool, providing the genetic diversity of the original cross with a better chance of predicting the outcome. Hybrids can be created that are not reproducible from year to year, because the F1 hybrids of two pure-bred lines do not breed true. Thus, a seed breeder can protect the genetic diversity of the original cross.

of Drug Cannabis. In the future, however, with the legalization of cultivation, it is a certainty that corporations will be able to grow only certain patented strains produced by large seed companies. Will this be how government

of C strains of equatorial origin to the climate of their growing area while preserving potency. Late-maturing, slow-maturing strains from North America. Even in a green house, it may not be possible to mature plants to their full native potential.

ious example. However, if it is important to preserve unique imported genetics, hybridizing may be inadvisable. Early maturing is the ideal in blooming early. At this point the breeder may ignore many other traits and aim at breeding an ear

particular location unless selective pressure is exerted. If further crosses are made with several individuals that have the same THC content. After these true-breeding lines have been established, a dihybrid pure cross can be made in another words, an acclimatized drug strain.

desirable characteristics. A successful breeder is careful not to overlook a characteristic that may prove useful. It is important to maintain genetic variety through excessive hybridization. A currently unrecognized gene may be responsible for controlling traits in strains to original parental gene pools.

to analyze the offspring to determine the patterns of inheritance for that trait. This is the system used by Gregor Mendel. By analyzing the outcome of crosses,

traits studied.

traits being selected for can be characterized.

in many other flowering plants. With monoecious strains or hermaphrodites it is possible to fix traits by self-pollination. However, most strains of Cannabis are dioecious, and unless hermaphroditic reactions can be induced, another parent must be used. A plant not exhibiting the trait, inbred in the F1 generation, and selections of parents exhibiting the favorable

trait are used to create a homozygous strain and then fixed through selfing and selecting homozygous offspring. Dioecious individuals can then be used in subsequent generations.

Sex alteration can be achieved using auxin (indole-3-acetic acid (IAA)), ethephon, and kinetin promoted pistil production in prefloral dioecious Cannabis. Sex alteration has been used to facilitate cross-pollination. It is difficult to perform a cross unless it happens to be a hermaphrodite plant. Hormones might be used to control sex expression. This can be accomplished by changing a pistillate cutting to a staminate (pollen) parent, using a spray of 100 ppm gibberellic acid. The pollen can then be collected for selfing with the original pistillate parent. Offspring from the cross should also be monitored. Excessive floral production may make inferior seed-parents since few pistillate flowers and seeds are formed.

Sex alteration and seedless drug Cannabis production would be greatly facilitated.

A well-rooted, flourishing cutting from the parent plant is pruned back to 25% of its original size and stripped of leaves. The desired sex type often appears. Flowers of the unwanted sex are removed until the cutting is needed for fertilization. This process is easier and is much more difficult to perform in the field.

For a monohybrid cross, there are four possible recombinant genotypes, a dihybrid cross gives rise to 16 possible recombinant genotypes.

It is not effective to raise only 64 offspring and count on getting one homozygous recessive individual. To increase the number of recessive individuals as future parents. All laws of inheritance are based on chance and offspring may not

theoretical minimums.

s. It is the sum total of these traits that determines the general phenotype of an individual. It is often difficult to determine which traits are controlled by one or several pairs of genes. It often makes little difference that a breeder does not immediately give rise to the variation needed in the F₂ generation for selecting parents for subsequent generations, even if several generations that fixed characteristics appear and the breeding of pure strains can begin. By selecting and crossing improved lines, the breeder can improve even if the exact patterns of inheritance are never determined. Complementary traits are eventually selected, and recessive traits to express themselves and these abnormalities must be diligently removed from the breeding lines by crossing with other lines or by backcrossing.

passed by the parent, it is much less likely to appear in the offspring. It is imperative that desirable characteristics cannot be made hereditary. Breeding for as few traits as possible at one time greatly increases the chance of other generally desirable traits such as vigor and size. Determinations of dominance and recessiveness can come only through the use of the keys to adaptive survival. However, all the possible combinations will appear in the F₂ generation if inheritance is not controlled.

as to the rules which must be explored. In some cases, a pair of genes may control a trait but a second or third pair of genes which we may be interested in is totally isolated from other genes and the effects of environment. Genes are spaced along the same chromosome and may or may not control the same trait. The result of linkage is that genes on the same chromosome may be limited to expression in only one sex (sex linkage). Crossing over also interferes with the normal Mendelian outcome. Chance is a major factor in breeding Cannabis, or any introduced plant, and the method of selection is of great importance.

improvement. A plant breeder begins by producing or collecting various prospective parents from which the most desirable characteristics are selected. If evaluation indicates that the offspring are not improved, then the procedure is repeated. A field is necessary to check for uniformity and to choose parents for further intermating. This cyclic approach is necessary for the improvement of any plant.

For the plant breeder, the selection of the parent is more important than memorizing Mendelian ratios. The words of the great Luther Burbank say it best:

of seedlings, leaves, fibers, and flowers. Finally a list of various Cannabis strains is provided along with suggestions for the selection of parents that can be made.

ronmental factors such as room for root and shoot growth, adequate light and nutrients, and proper
ype, but the genotype of the individual is responsible for overall variations in gross morphology,

Individuals are easily spotted and selected. Many dwarf Cannabis plants have been reported and as dwarf corn and citrus. Cannabis parents selected for large size tend to produce offspring of a larger size and short (Cannabis ruderalis-Russia) strains yield F1 offspring of intermediate height (Beutler) being more than any other genetic factor. The increased size of hybrid offspring is often amazing and it is not known whether there is a set of genes for "gigantism" in Cannabis or whether polyploid tetraploids tend to be taller and their water requirements are often higher than diploids. Yield increasing can be used to increase the yield of any one of these products. However, several of these traits may be due to gene linkage). Inbreeding of a pure strain increases yield only if high yield parents are selected. High yield plants are dried and manicured. Because of this, many of the most vigorous plants are crossed and seeds selected

Plants that begin to grow immediately will usually reach a larger size and produce a higher yield in a shorter period of time. Selection for rich green foliage and rapid, responsive growth. This will ensure that genes for certain desirable genes for strength and vigor remain.

Cannabis is able to be adaptable to many different environmental conditions. Indeed, Cannabis is one of the few plants that it has adapted to environmental conditions ranging from equatorial to temperate climates. Domestic Cannabis is able to grow at a great variety of conditions,

The parental stocks with the highest survival percentages can be selected as prospective parents for an improved growing conditions.

Selection for drought and overwatering, and so on. Plants with a particular resistance appear when adverse conditions members of the population might carry inheritable resistance to the environmental factor that causes the disease. The offspring to continuing stress conditions, and selecting carefully for several generations should result in a more resistant heat.

Cannabis may be bred for resistance to a certain disease, such as damping-off fungus. If flats of seedlings are selected that all have some resistance to damping-off fungus. If this resistance is inheritable, it can be passed on to the next generation, tested by inoculating flats of seedling offspring with damping-off fungus, should yield a more resistant strain.

Selection of Cannabis where one or a few plants are infested with insects while adjacent plants are free from insect repelling insect attack, and levels of these vary from plant to plant. Cannabis has evolved defenses over the reproductive and associated vegetative structures of mature plants. Insects, finding the resin glands on the outer leaves of the same plant because these develop fewer glandular trichomes and protective waxes located within leaf and stem tissues which possibly inhibit insect attack, may account for the varying popularity of greenhouse Cannabis cultivation, a strain is needed with increased resistance to mold, which greenhouse cultivators destroy any plants which are attacked. Molds usually reproduce by wind-borne spores and the offspring of the least infected plants should result in strains with increased resistance.

Selection for what the reason for growing it. If Cannabis is to be grown for fiber it is important that the plants ripen in the crop mature at the same time to facilitate commercial harvesting. Seed production requires uniform maturation of seeds. An uneven maturation of seeds would mean that some seeds would drop and be unusable due to the production of high quality drug Cannabis. Changes in gross morphology are accompanied by changes in ripening determining the ripeness of Cannabis flowers.

Plants should ripen either evenly or sequentially.

Selection for fast or slow flowering and even or sequential ripening. In general, crosses between early-maturing plants give rise to late-maturing offspring, and crosses between late- and early-maturing plants give rise to intermediate maturation of Cannabis is not controlled by the simple dominance and recessiveness of one gene but by several separate aspects of maturation. For instance, Sorghum maturation is controlled by four separate genes. Although breeders do not know the action of each specific gene, they still can breed for the total of

ie, and general growth form may be made when the seedlings are from 30 to 90 centimeters (1 to 3 feet) y-selected plants cannot be bred until they mature, but selection is the primary and most important step in

, multiple leaflets and flattened or clubbed stems). Also, most whorled plants are staminate and whorled

variations in leaves, there are a number of mutations and possible traits in leaf shape. It may turn out that ted with a low calyx-to-leaf ratio and narrow leaflets might be associated with a high calyx-to-leaf ratio. If racter of the flowering clusters at harvest. Both compound and webbed leaf variations seem to be hereditary e for an ornamental strain or increase leaf yield for pulp production.

as on the plant, at the time of flowering, developed floral clusters of 5-10 pistil late calyxes at the of the leaf. One of these clusters developed a partial staminate flower but fertilization was unsuccessful. It is

ers along the petioles of many of the large primary leaves.

is. Over the years many strains have been developed with improved maturation, in creased fiber content, and ng programs have been carried on in France, Italy, Russia, and the United States to develop better varieties eciuousness is favored, because in dioecious populations the staminate plants will mature first and the :trains of Europe are divided into northern and southern varieties. The latter require higher temperatures and

Il focus on the individual traits of pistillate floral clusters with occasional comments about similar traits s of Cannabis; they remain on the plant and go through many changes that cannot be compared to

gths along the main floral axis and within individual floral clusters. Dense, long clusters result when n the individual compact floral clusters (Hindu Kush). Airy clusters result when a plant forms a l clusters (Thailand).

e plant. Among domestic Cannabis phenotypes, for instance, it is obvious that floral clusters from a :he huge upright phenotype will have long, straight floral clusters of various shapes. Early in the for rejuvenation and sub sequent vegetative growth in the spring. Staminate plants also exhibit resembling inverted grapes (Hindu Kush) and others have long, hanging groups of flowers on long,

proportions of calyxes and flowers. A leafy floral cluster might be 70% leaves and have a o are more adapted to calyx production, and therefore, to resin production. This factor could be oint it must be noted that pistillate floral clusters are made up of a number of distinct parts. They nall, resinous, 1-3 leaflets), and outer leaves subtending entire floral clusters (larger, little resin, 3-11 ee of pollination, and maturity of the floral clusters. Maturation is a reaction to environmental is breeder's preference. Because of this interplay between environment and genetics in the control of ough knowledge of the way a strain matures is important in separating possible inherited traits of inabis, delves into the secrets and theories of maturation. For now, we will assume that the before any decline.

inch) in length. Calyx size is largely dependent upon age and maturity. Calyx size of a floral

st can be considered the most desirable to smoke and possibly the most psychoactive. It would be a plant since variation in the cannabinoid profile is subtle. The bioassay reported here is in effect an experiment where subjects are exposed to only a few choices at a time. Such bioassay results can enter into selecting the

control of the biosynthetic pathway could occur at many points through the action of enzymes. One example is an enzyme system which quickly converts CBD-acid to THC-acid, favoring THC-acid. This is favored since there is little conversion to THC-acid. These same enzyme systems are probably

of Cannabis result from varying levels of cannabinoids. THC is the primary psycho active and other accessory cannabinoids. Terpenes and other aromatic constituents of Cannabis might also be used to establish cannabinoid phenotypes and that these phenotypes are passed on from parent to offspring. It is possible to use these phenotypes to establish criteria for breeding strains with desirable characteristics. This is done by measuring cannabinoid levels in prospective parents. Inheritance and expression of cannabinoid chemotype

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aces of Cannabis. Several of these trichomes are glandular and secretory in nature and are divided into glandular trichomes are apparently responsible for the intense secretion of cannabinoid laden resins. breeders of drug Cannabis. The number and type of trichomes is easily characterized by observation includes that a positive correlation exists between the number of glandular trichomes on leaves and THC levels, many capitate stalked trichomes means higher THC levels.

is. A strain may have many glandular trichomes but they may not secrete very much resin. Resin becomes opaque as they mature, as suggested by several authors. Some strains, however, produce fresh resin often some of the most psychoactive strains. Transparent resins, regardless of color, are a sign that the trichomes turn opaque as cannabinoid and aromatic levels decline. Resin color is certainly an indication of maturity: a criterion for breeding.

Resin is formed from detached resin heads. In modern times it might be feasible to breed a strain with a tolerance for moderate shaking, rather than the customary flailing that also breaks up the plant. This would benefit from extremely tenacious resin heads that would not fall off during packaging and shipment.

Resin is usually determined by the way it is dried, but, all conditions being the same, some strains dry much more rapidly than others. Preventing desiccation and high resin content might retard drying. However, it is a misconception that resin is secreted by glandular trichomes, but they are trapped under a cuticle layer surrounding the head cells of the trichome. It rarely if ever has a chance to seal the surface of the epidermal layer and prevent the transpiration of water, thus slowing the rate and extent of drying. Strains may be bred that dry and cure rapidly to save valuable time. In commercial drug Cannabis production is the seemingly endless chore of manicuring, or removing the outer leaves as they dry. They are as psychoactive as the inner leaves and calyxes, so they are usually removed before selling as buds. Long petioles on the leaves facilitate removal by hand with a small pair of scissors. If there are no long petioles it is easier to manicure quickly because it is easier to see which leaves to remove. Strains are selected for size, oil content, and protein content. Cannabis seed is a valuable source of drying oils, and some strains have been developed for food. Also, seeds are selected for rapid germination rate.

Strains respond to changing environment. Some strains, such as Mexican and Hindu Kush, are famous for their late maturing and nearly always finish late, if at all. Imported strains are usually characterized as either early maturing individuals which mature early and others which mature late. Through selection, breeders have, on the one hand, developed strains that mature in moderate conditions; and on the other hand, they have developed green house strains that mature in up to 10 weeks. Strains are also selected to be precocious to growers who live in areas of late spring and early fall freezes. Consequently, especially

Strains that mature early produce a high yield of floral production in a few weeks, or the floral clusters may continue to grow and develop for several weeks before which it matures, so a plant may wait until late in the season to flower and then grow extensive,

Floral clusters will usually mature and ripen in rapid succession, but sometimes large floral clusters may begin to produce resin and ripen. Once ripening starts it usually spreads over the entire plant, but the ripening process occurs at a time over several months. Some fruit trees are similarly everbearing with a yearlong season of fruiting. Perennials that continue to flower and mature consistently all year long.

Strains bred with different strains of Cannabis result from varying levels of cannabinoids. THC is the most abundant, followed by CBG, CBN, CBD, and other accessory cannabinoids. We know that cannabinoid levels may be passed on from parent to offspring. Therefore, cannabinoid levels are in part determined by genes. To breed strains with particular cannabinoid contents, an accurate and easy method is necessary for

The most common strains we most often see are most likely dominant and any effort to alter genetics and improve Cannabis should focus on the most important traits. The best breeders set high goals of a limited scope and adhere to their

branching pattern, sex, maturation, and floral characteristics. Most imported varieties have characteristic y phenotype in nearly every variety. This indicates the complexity of genetic control determining gross early every domestic strain of Cannabis. In hybrid crosses, some dominant characteristics from each parental spring will resemble both parents and very few will resemble only one parent. This sounds like it is ent F2 generation will exhibit great variation, tending to look more like one or the other of the original er of the original parents. If the F1 offspring are desirable plants it will be difficult to continue the hybrid d so they may be used year after year to pro-duce uniform crops of desirable plants.

other than they are to other varieties and they are termed pure strains.

tions within each trait will occur. In addition, these representations are based on unpruned plants growing in to obscure the difference between different strains. This section presents information that is used in the sele

less plants which are often monoecious. This growth habit has been selected by generations of fiber-producing strains mature more evenly than dioecious strains, and fiber crops are usually not grown long enough to set separate climates of Europe, Japan, China and North America. Several strains have been selected from the primitive. Escaped fiber strains of the midwestern United States are usually tall, skinny, relatively poorly branched, we have sativa hemp. Most fiber strains contain CBD as the primary cannabinoid and little if any THC.

terpenoid cannabinoid, with low levels of other accessory cannabinoids such as THCV, CBD, CBC, and CBN. This results in a synthesis that favors survival.

altitude humid coastal areas along the Atlantic near Panama, and the other from the more arid mountain area of southern central Colombia and the highland valleys stretching southward from the Atlantic coast have become primary sources of Cannabis. Cannabis was available through the black market from both coastal and highland Colombia. Cannabis was introduced to the United States in addition. Cultivation techniques often involve transplanting of selected seedlings and other individual attention to detail. A strip of bark from the main stem of a nearly mature plant, thereby restricting the flow of water, nutrients, and hormones, and the plant will turn yellow. This produces the highly prized "Colombian gold" so prevalent in the early to middle 1970s. "lowland," "Santa Marta gold," and "purple" give us some idea of the color of older varieties and the

control of Mexican Cannabis importation and cultivation through tightening border security and the use of genetic testing. Cannabis in America is imported from Colombia. This also means that the largest number of seeds available for cultivation is from Colombia. It all but a few small areas where labor-intensive cultivation of high quality drug Cannabis such as "la mona" and "la reina" grades are nearly always well seeded. As a rule today, the more remote highland areas are the centers of Cannabis production. Lowland farmers must still grow fine Cannabis, and occasional connoisseur crops surface. The older seeds from the "Colombian gold" this fine cerebral marijuana was grown high in the mountains. Humid lowland marijuana was grown in the lowlands. Highland marijuana has become the commercial product and is characterized by leafy brown floral clusters and a strong resinous odor. These result from hurried commercial agricultural techniques combined with poor curing and storage. Colombian strains also contain high levels of CBD and CBN, which could account for sedative highs and result from poor curing techniques. The commercial Cannabis market has brought about the eradication of some local strains by hybridizing with

strains with a central stem, horizontal limbs and relatively short internodes. The leaves are characterized by highly serrated edges and are of medium green. Colombian strains usually flower late in temperate regions of the northern hemisphere during the winter and spring seasons and often seem insensitive to the rapidly decreasing daylength during autumn in temperate regions. During the flowering growth cycle, pistillate plants tend to produce many flowering clusters along the entire length of the stem and produce many small brown seeds. Imported and domestic Colombian Cannabis often tend to be more sedative in psychoactivity than strains from other regions. CBD or CBN. Poor curing techniques on the part of Colombian farmers, such as sun drying in huge piles, can result in a loss of potency. Strains tend to make excellent hybrids with more rapidly maturing strains such as those from Central and

growing in Europe.

de)

is grown in small rural gardens, as it has been for hundreds of years, and is used primarily for the production of resin (hashish) and associated leaflets. These resins are removed by shaking and crushing the flowering tops over a sieve. These strains usually follow in the production of commercial hashish. Strains from this area are often used as type examples of Cannabis sativa. Cannabis may be exempt from laws controlling Cannabis sativa and indeed may be legal, has resulted in its proliferation

kunk weed" typify its acrid aroma reminiscent of "primo" hashish from the high valleys near Mazar-i-Sharif,

short internodes. The main stalk is usually only four to six feet tall, but the relatively unbranched primary limbs form a sort of upside-down conical shape. These strains are of medium size, with dark green leaves having 5 to 7 pairs of leaflets, the lower surface being paler in color than the upper surface. These leaves have so few broad coarse leaflets that they are often compared to the limbs as very resinous leafy balls. Most plants produce flowering clusters with a low calyx-to-leaf ratio, but the early maturation and extreme resin production is characteristic of these strains. This may be the result of the acrid smell associated with strains from the Hindu Kush appears very early in the seedling stage of both strains. Sweet aromas do often develop but this strain usually loses the sweet fragrance early, along with the clear, cerebral

is desirable for hybridizing and indeed they have met with great popularity. The gene pool of imported Hindu Kush has been passed on to the F1 hybrid generation. A fine hybrid may result from crossing a Hindu Kush variety with a variety of short stature, high resin content, early maturation, and sweet taste that will mature high quality flowers. These strains are widely cultivated in many areas of North America. Hindu Kush seeds are usually large, round, and dark grey or black.

These strains are usually grown in a seedless fashion and are cured, dried, and smoked as marijuana instead of being brewed as tea. They are of interest to domestic Cannabis cultivators wishing to reap the benefits of years of selective breeding for fine ganja. These strains are finding their way into domestic American Cannabis crops.

They have highly-branched limbs. The leaves are medium green and made up of 7 to 11 leaflets of moderate size and moderate compound branching so that by the time floral clusters form they grow from tertiary or quaternary lines. The leaflets are lanceolate, serrated, and curved. Seeds are usually small and dark. Many spicy aromas and tastes occur in Indian ganja strains. The strain that was first introduced to the United States in the early 1900s was usually Indian ganja.

These are much rarer today. Both green and brown varieties are grown in Jamaica. The top-of-the-line seedless smoke is known as "ganja" and is as stringy and brown much like low land or commercial Colombian strains. Jamaica's close proximity to Colombia make it likely that Colombian varieties now predominate in Jamaica even if these varieties were not introduced there. They are similar in leaf shape, seed type and general morphology but they tend to be a little taller, thinner, and lighter green than the Colombian strains, unlike many Colombian strains. Some strains may also have come to Jamaica from the Caribbean coast of South America.

They are characterized by cerebral psychoactivity and sweet taste. Hermaphrodites are common.

They are relatively short and slender with thick stems, poorly developed limbs, and wide, medium-green leaflets, reflecting a low calyx-to-leaf ratio. The calyxes are relatively large and the seeds flattened, ovoid and dark. They are used for screened and pressed hashish, and the calyx-to-leaf ratio may be less important than the total resin production. It is likely that they are related.

In a few years Cannabis from Malawi has appeared wrapped in bark and rolled tightly, approximately four ounces per pound. It has been of interest to diastatic American and European Cannabis cultivators immediately planted the new strain and it has become a variety of medium height and strong limb growth. The leaves are dark green with coarsely serrated, large, slender leaflets.

is on the distal (tip portion) 20% of each leaflet. The mature floral clusters are sometimes airy, resulting from axils are very sweet and resinous, as well as extremely psychoactive. Seeds are large, shortened, flattened, and the angle or point of attachment at the base of the seed is uncommonly deep and usually is surrounded by a shallow groove. They mature under exposed conditions. Although they mature relatively late, they do seem to have met with success in small batches of low-quality African marijuana easily available in Amsterdam and other European cities. Thailand.

Efforts by the border patrols to stop the flow of Mexican marijuana into the United States were only marginally successful. Many of the hybrid strains grown domestically today originated in the mountains of Mexico. The United States began an intensive program to eradicate Cannabis through the aerial spraying of herbicides such as DDT, which was available. It is ironic that the NIMH (National Institute of Mental Health) is using domestic Mexican Cannabis strains to treat glaucoma patients. In the prime of Mexican marijuana cultivation from the early 1960s to the middle 1970s, Cannabis was grown in the Pacific coastal states where they were grown. Hence names like "Chiapan," "Guerreran," "Nayarit," "Michoacan," "Oaxacan," and "Sinaloa" have come to this very day. All of these areas are Pacific coastal states extending in order from Sinaloa in the north at 27°N to Oaxaca in the south at 17°N. - All of these states stretch from the coast into the mountains where Cannabis is grown.

Observations may be ventured about each and about Mexican strains in general.

Chiapan and Oaxacan strains are dark green, large leaves. The leaves are made up of long, medium width, moderately serrated leaflets arranged in a fan-like pattern. They produce many long floral clusters with a high calyx-to-leaf ratio and highly cerebral effects. Guerreran strains have a high calyx-to-leaf ratio as do Guerreran strains, but Oaxacan strains tend to be broader-leafed, often with leafier floral clusters. Guerreran strains are smaller and more delicate. Guerreran strains are often short and develop long, upright lower limbs. The perianth is colored grey or brown, unmottled. Smaller, darker, more mottled seeds have appeared in Mexican Cannabis, possibly with introduced seed from the largest seed source in the world, Colombia. No commercial seed source is known. More recently, large amounts of hybrid domestic seed have been introduced into Mexico. It is not uncommon

to range up to 2,500 meters (8,000 feet). On a high plateau surrounding the city of Ketama grows most of the Cannabis. It is planted on rocky terraced fields in the spring, as soon as the last light snows melt, and the mature plants are 1-2 meters (3-6 feet) tall and only slightly branched. This results from crowded cultivation techniques and lack of irrigation. Early in the season, plants, if any, are pulled to prevent pollination. Although Cannabis in Morocco was originally cultivated for medicinal purposes, it has become popular in the past 30 years due to Western influence. In Morocco, hashish is manufactured by shaking the entire plant matter of Cannabis in a bag. There is much speculation whether the original Moroccan kif strains might be extinct. It is reported that some of the best Cannabis here this is the tradition.

Chiapan and Hindu Kush strains in their relatively broad leaves, short growth habit, and high resin production. Morocco

Chiapan and Hindu Kush strains in their relatively broad leaves, short growth habit, and high resin production. Morocco (10,000 feet). Little Cannabis is cultivated, and it is from select wild plants that most Nepalese Cannabis strains are derived. They have short, thick, and highly branched limbs. The long, thin flowering tops are very aromatic and reminiscent of the finest fresh "tempo" Cannabis. The psychoactivity is high. Few Nepalese strains have appeared in domestic Cannabis crops but they do seem to

Chiapan and Hindu Kush strains in their relatively broad leaves, short growth habit, and high resin production. Morocco wide, reduced leaves and specialized seeds characterize weed Cannabis of Russia. Janischewsky (1924) discovered rapidly maturing strains for commercial use in temperate latitudes. It flowers when approximately 7 weeks old. It has high CBD and low in THC.

na shipments in Europe. Some are very early-maturing (September in northern latitudes) and sweet smelling.

hai, and Vietnamese strains have been regarded as some of the very finest in the world. Currently most es, Cannabis farming has been a cottage industry of the northern mountain areas and each family grew a sm ature of each carefully wrapped Thai stick. Due largely to the craving of Americans for exotic marijuana, ng large fields of lower quality Cannabis in the eastern lowlands. It is suspected that other Cannabis strains, idized with original Thai strains and altered the resultant genetics. Also, wild stands of Cannabis may now be

limbs and fairly extensive branching. The leaves are often very large with 9 to 11 long, slender, coarsely serr and the name is certainly appropriate.

ood whether strains from Thailand turn hermaphrodite as a reaction to the extremes of northern temperate w of many cultivators and researchers, Thai strains mature late, flower slowly, and ripen unevenly. Retarded fl given rise to the story that Cannabis plants in Thailand live and bear flowers for years. Despite these shortco y maturing strains, such as Mexican and Hindu Kush, in a successful attempt to create early-maturing hybrids s are very large, as are the seeds and other anatomical features, leading to the misconception that strains m o one has ever taken the time to look thoroughly. The seeds are very large, ovoid, slightly flattened, and ligh houses prove to be the best way to mature stubborn Thai strains in temperate climes.

s and it is a frequent phenotype in certain hybrid strains. It has not yet been deter mined whether this trait is ain of creepers are meeting with partial success. This phenotype appears when the main stalk of the seedling iddle of the stalk, up to 700 from the vertical, usually in the direction of the sun. Sub sequently, the first limb: d humid conditions the limbs will occasionally root along the bottom surface. Possibly as a result of increased ike limbs of buds resembling South Indian strains. This phenotype usually produces very high flower yields. 1 long, narrow, highly serrated leaflets.

n narrow, highly serrated leaflets much like the creeper strains, and may also be an acclimatized North Ameri (6.5 to 13 feet) tall forms and the long, slender primary limbs grow in an upright fashion until they are nearly strains in general shape, except that the entire domestic plant is much larger than the Hindu Kush with long, :-to-leaf ratio. These huge upright strains are also hybrids of many different imported strains and no specific

occurring world wide. Although many of them are rare, the seeds appear occasionally due to the extreme mo ared that many of the world's finest strains of Cannabis have been or may be lost forever due to hybridization ctors and breeders are needed to preserve these rare and endangered gene pools before it is too late.

: are most likely dominant and the improvement of Cannabis strains through breeding is most easily accompl gh goals of limited scope and ad here to their ideals.

changes in photoperiod, and other environmental conditions. When a plant reaches an adequate age for flowering, this is the triggering of the reproductive phase of the life cycle which is followed by senescence and eventual death. This is a reversal of the heteroblastic (variously shaped) trend of increasing leaflet size from trileaflet and mono-leaflet leaves.

Pistillate plants are usually the first to begin flowering and releasing pollen. In fact, much pollen is released when the pistillate plants are in heavy flower to ensure good seed production. Upon deeper investigation, it will continue to produce pollen for some time and will also fertilize many new pistillate flowers as they appear. This is followed by the yellowing and dropping of the foliage leaves, followed by diminished flower and pollen production. Eventually, the plant dies and decomposes.

Seeds of the first flowers to be pollinated dry out, each releases a single seed which falls to the ground. Since new seeds develop from freshly fertilized ovules to large, dark, mature seeds. In this way the plant is able to take advantage of the conditions created by the spread of escaped Cannabis strains in the midwestern United States. In these areas Cannabis abundance is in the thousands of pistillate flowers, resulting in thousands of viable seeds from each pistillate plant. As the pistillate plant eventually dies and decomposes.

In floral clusters, pistillate plants actually differentiate sexually and form a few viable flowers long before most staminate plants first appear as vegetative growth at the nodes along the main stalk and do not differentiate flowers and this growth makes staminate plants indistinguishable from pistillate plants for some time. This is often a disadvantage as they take up valuable space that could be utilized by pistillate plants. Also, juvenile pistillate plants are occasionally mistaken for staminate primordia.

Photoperiod and seasonal cycles are determined by latitude. The most even photoperiods and mildest seasonal variations are found in polar and high altitude locations. Areas in intermediate latitudes show more pronounced seasonal variations. A chart based on latitude is helpful in exploring the maturation and cycles of Cannabis from various latitudes and times of day.

For example, the photoperiod for 40° north latitude (Northern California) which begins along the left-hand side of the chart. As the days get shorter and the line representing photoperiod slopes downward. During July the daylength decreases by an increase in the size of the dots along the line of photoperiod.) As the days get shorter the plants flower and when the photoperiod drops below 10 hours and THC production slows. High-THC plants may continue to develop until the photoperiod drops below 8 hours; at this point a new vegetative light cycle starts and THC production ceases. New seedlings are planted when the photoperiod changes more radically and the growing season is shorter. These conditions do not favor THC production.

In equatorial regions (e.g., India, and Thailand where most of the finest drug Cannabis originates), the photoperiod never varies out of the range of 12 to 14 hours. Near the winter solstice when the photoperiod is just a little over 13 hours. This means that a long season exists that starts in December and ends in March or April (90 to 120 days). Cannabis may also be grown in a short season from December through March or April (90 to 120 days). Cannabis is strongly age-determined as well as light determined. Most strains of Cannabis will begin to flower when the photoperiod drops below 10 hours, and easily induced strains may begin flowering at nearly any time during the year.

At the equator, resulting in two identical photoperiodic seasons. Rainfall and altitude determine the growing conditions for Cannabis in one year. By locating a particular latitude on the chart, and noting local dates for the last and first frost, a greenhouse or other shelter from cold, rainy conditions is used. This is especially true in the tropics where the growing season is shorter and the photoperiod is longer.

om this chart.

at 30° south latitude. Consulting the graph of maturation cycles will reveal that a long-photoperiod season, at that average temperature ranges from 60~ to 80~ F. and annual precipitation from 30 to 50 inches. Early estimates made from this chart are generally accurate for photoperiod; however, local weather conditions are always

equatorial zone, north and south subtropical zones, north and south temperate zones, arctic and antarctic zones

at the equinoxes, March 22 and September 22, as it passes to the north and then the south. The days get shorter and shorter. Flowering can take place and two distinct seasons, These seasons may overlap but they are usually five to six months long. India, Malawi all lie on the fringes of the equatorial zone between 10 and 15 latitude. It is interesting to note that Cannabis is grown in the equatorial zone. This could be because most areas along the equator or very near to it are extremely humid at least in the tropics. Wild Cannabis occurs in many equatorial areas but it is of relatively low quality for fiber or drug production. U

The southern subtropical zone has little Cannabis. These areas usually have a long season from February-March in the southern hemisphere. A short season may also exist from December or January through March or April. Some areas may make use of a third short season from June through September or September through December, but these short seasons are usually when Cannabis is grown. Southeast Asia, Hawaii, Mexico, Jamaica, Pakistan, Nepal, and India are all major Cannabis-producing areas.

Some Cannabis grows in all three of these areas, but none of them is particularly well suited for the growth of Cannabis. The northern temperate zone has many areas suitable for the cultivation of Cannabis. Parts of Australia, South America, and Africa. Some Cannabis grows in all three of these areas, but none of them is particularly well suited for the growth of Cannabis.

able for the growth of Cannabis, The arctic season begins during the very long days of June or July, as soon as the seedlings appear, but the days rapidly get shorter and by September the plants begin to flower. Please note that the cultivation of drug Cannabis is not practical without a greenhouse. Parts of Russia, Alaska, Canada, and northern Europe. Cultivated drug strains are grown in Alaska, Canada, and northern Europe in limited quantities but little is known about them. They are probably the best suited for growth in this area. Fiber strains also grow well in some arctic areas. Breeding

in the northern temperate zones of the world. It is striking that there are many unutilized areas suitable for the cultivation of Cannabis. These areas have the advantage of an extra full or partial season for the cultivation of Cannabis.

domestic cultivation in much the same pattern as they would in their native conditions. For example, in northern Europe while strains from Colombia (equatorial zone) will usually not mature until December. By understanding this pattern, the maturation characteristics of drug Cannabis to maturity are maximized. The short season of Hawaii, Mexico, and other subtropical areas call for selection of a separate short-season strain. The maturation characteristics can vary greatly between strains. It is usually necessary to determine if Hawaii and California strains have been bred specifically for either the long or short season. The important variable is what season the ~1 seed plant was grown. It may not be practical to grow a long-season strain from

rops. Planting and harvest dates based on moon cycles are still found in the Old Farmer's Almanac. The moon the new moon waxes (begins to enlarge) for a week until the quarter moon and another week until the moon quarter to reach the beginning of the cycle with a new moon. Most cultivators agree that the best time for planting and quarter moons are avoided as these are times of interplanetary stress. Planting, germinating, grafting, and 4 are most beneficial for harvesting and pruning.

gravitational pull from the alignment of sun and moon. It also seems that floral cluster formation is slowed by tirely. Although this never happens, if a plant is just about to begin floral growth, it may be delayed a week b

eeded to explain the mysterious effects of moon cycles on Cannabis

changes indicate that internal biochemical metabolic changes are also occurring. When the external changes to decide when to harvest floral clusters. With years of experience this becomes intuition, but there are gene

attached end with a pair of thin white, yellowish green, or purple pistils attached to the ovule and protruding larges slightly to its full length. Next, the calyx begins to swell as resin secretion increases, and the pistils reach tips may begin to curl and turn reddish brown. At this stage the pistillate flower is past its reproductive peak ell almost as if it had been fertilized and resin secretion reaches a peak. The pistils eventually wither and turr cretion has slowed and few fresh terpenes and cannabinoids are being produced. Falling pistils mark the end ; to die.

id associated resin-producing glandular trichomes. Also, the average developmental stage of the accumulated stage and timing of the harvest is based on the average calyx and resin condition, along with general trends

id internode length within floral clusters. Calyx-to-leaf ratios are highest during the peak floral stage. Later st usually very short between pairs of calyces in tight dense clusters. At the end of the maturation cycle, if there . This is most often a sign that the floral clusters are past their reproductive peak; if so, they are preparing fo ased at temperate latitudes (due to low temperatures), but may still continue in equatorial and subtropical arate tropical environments and extend the period of resin production. It should be remembered that greenhou lowered light intensity, and restricted air circulation.

rtains and supplemental lighting in a greenhouse or indoor environment. The localized light cycle particular t possible to reproduce exotic foreign environments to more accurately study Cannabis, Tight clusters of calyxe tend to have longer internodes and appear airy and stretched. This seems to be a genetically controlled adap floral clusters. Thai strains may not develop tight floral clusters even in the most arid and exposed conditions;

t after the pistils have begun to turn brown but before the calyx stops growing, it seems obvious that floral cl lace within this period of maximum resin secretion, and these variations influence the nature of the resin's ps

e remembered that many environmental factors, such as light, temperature, and humidity, influence the path inal cannabinoid profile (cannabinoid levels and ratios). Not all cannabinoid molecules begin their journey thr ultaneously. There is no magical way to influence the cannabinoid biosynthesis to favor THC production, but e factors may be controlled to some extent by proper selection of mature floral clusters for harvesting, agric

ugh the progressive degradation of THC acids to CBN acid (cannabinolic acid) and other cannabinoid acids. It is also suspected of synergistic modification of the psychoactivity of the primary cannabinoids, THC. The cannabinoid conversion is an ongoing process as long as the glandular trichome remains active. Variations in the level of THC in the resin are being converted to THC acid. If the rate of THC biosynthesis exceeds the rate of THC breakdown, the THC level in the resin is clear or slightly amber transparent. A clear or slightly amber transparent resin is a sign that the glandular trichome is still active. As soon as the resin starts to darken to a transparent amber color, it begins to deteriorate, it first turns translucent and then becomes clear. During active secretion, THC acids are constantly being formed from CBD acid and breaking down into CBN acid.

Therefore, the logic behind harvesting at a specific time is easier to understand. The usual aim of timing the moment of harvest is to approximate the desired psychoactive effect. Since THC acids are being broken down into CBN acid when the production of THC acids is higher than the degradation of THC acids. Every experienced cultivator knows when to harvest. Some like to harvest early when most of the pistils are still viable and at the height of reproductive potential. At this time, the resin is clear or slightly amber (possibly low CBC and CBD, high THC, low CBN). Others harvest as late as possible, desiring a stronger, more psychoactive effect (high CBC and CBD, high THC, high CBN). Harvesting and testing several floral clusters every few days over a period of several weeks can help you determine when to harvest in future seasons. The following is a description of each of the growth phases as to morphology.

In the vegetative stage, pistillate flowers appear at the tips of limbs in addition to the primordial pairs along the main stems. By this time, the nodes and form a strong framework to support future floral development. Larger vegetative leaves (5-7 leaflets) are present. Small, tapered calyxes may be found nestled in the leaflets near the stem tips and the fresh pistils appear as thin, upright structures. They are lightly covered with fuzzy, hair-like, non-glandular trichomes, but only a few bulbous and capitate-sessile glandular trichomes and few if any capitate-stalked, glandular trichomes. There is no drug yield from plants at the premature stage. The resin starts as the glandular trichomes begin to secrete resin; premature floral clusters have no terpene aromas or terpenes. The amount of THC and CBD, may be determined. By the pre-floral stage the plant has already established its basic chemotype. This indicates that a strain either produces some varying amount of THC (up to 13%) and little CBD or is genetically controlled.

The reaction is more an "effect" than a "high." This most likely results from small amounts of THC as well as terpenes when the seedling is very small, if the plant originates from a drug strain. However, THC levels rarely exceed 13%.

In the immature stage, leaflet leaves are the predominant type and usually appear along the secondary floral stems within the individual floral cluster. Older pairs of calyxes visible along the primary floral axis during the premature stage now begin to swell and mature. The newly produced calyxes show few if any capitate-stalked trichomes. As a result of low resin production, the yield is low at this point. Total cannabinoid production has increased markedly over the premature stage but THC levels are still low.

In the mature stage, the size of the calyxes increases through the addition of more calyxes along the secondary stems until they cover the primary stem tip. The pistils are emerging from secondary stems within the floral clusters. These subtending leaves are correctly referred to as subtending leaves. At this time, the primordial calyxes the pistils have turned brown; however, all but the oldest of the flowers are fertile and the floral clusters are producing resin. The old calyxes, and the young pistillate calyxes are rapidly producing capitate-stalked glandular trichomes to protect the resin. The cycle would be drawing to a close. When Cannabis is grown for sinsemilla floral production, the cycle ends with the plants and accumulate resins in a last effort to remain viable. Since capitate-stalked trichomes now predominate, resin production is high, often being produced in the cellular head of the trichome. At this time THC acid production is at a peak and CBN acid has not been active long enough for a high level of CBN acid to build up from the degradation of THC acid by light. Cultivators prefer to pick some of their strains during this stage in order to produce marijuana with a clear, certain psychoactive effect.

the high level of THC to act without their sedative effects. Also, little polymerization of resins has occurred, and plants in the peak floral stage, lack the completely developed aroma, taste and psychoactive level that appear in the late stage.

However, a subsequent flush of new calyx growth may occur and the plant continue ripening into the late stage.

Many of the larger leaves have dropped off, and some of the small inner leaves begin to change color. As the pistils turn brown and begin to fall off. Only the last terminal pistils are still fertile and swollen calyxes produce additional capitate-stalked glandular trichomes is rare, although some existing trichomes may still be elongating. Terpene molecules (which make up most of the resin) produces long chains and a more viscous and darker-colored resin. The transparent amber color of mature resin is usually indicative of high THC content. Many cultivators agree that this is a characteristic. Particularly potent Cannabis from California, Hawaii, Thailand, Mexico, and Colombia is often grown in these regions from other equatorial, subtropical and temperate zones where the growing season is long enough to accommodate fully mature resins unless a greenhouse is used. Specially acclimatized strains are another possibility. The

excess of leaves in late-stage clusters to catch additional energy from the rapidly diminishing autumn sun. The climatic conditions are harsh, resins and cannabinoids will begin to decompose. As a result, resin yield may drop and the activity of the resin has dropped. THC decomposes to CBN in the hot sun and will not remain intact or be replaced by sunlight, the higher psychoactivity of amber resins may be a secondary effect. It may be that the THC in the resin develops opaque, white resin heads as a result of terpene polymerization and THC decomposition. Opaque resin

has a sedative effect. Complex mixtures of many monoterpenes and sesquiterpene hydrocarbons along with alcohols, esters, and their polymerized by-products fluctuate as the resin ripens. The aromas of fresh floral clusters are usually different from those of the fresh plant. Cannabinoid production favors high THC acid and rising CBN acid content at this stage, and CBG is produced from CBD acid. CBD acid may accumulate because not enough energy is available to complete its conversion. Synthesis slows, because THC acid levels decrease as it decomposes, and at the same time CBD acid levels remain high. The resin is characterized by more somatic and sedative effects. Some cultivators prefer this to the more cerebral and clear effects of the early stage.

As the plant continues senescence (decline towards death). In unusual situations, however, rejuvenation will begin, highlighted by striking color changes in the floral clusters. Leaves, calyxes, and stems display auxiliary pigmentation. This is near. In warm areas, rejuvenation starts as vegetative shoots form within the floral clusters. These shoots are produced when the plant were reaching for limited winter light. Leaf production is accelerated as plants reach the rejuvenation stage. This is a common phenomenon in prior marijuana of lowered THC level, especially outdoors in bad weather.

Terpenes, terpene polymers, and other aromatic principles are produced and ripen at different times in the development of the plant. After production, then harvest selections for cannabinoid level may be possible based on the aroma of the ripening plant.

Trends in the relative quantity (dry weight) of various parts (such as leaves, calyxes and trichomes) at various stages of development. In most cases, the percentage of stem weight steadily decreases as the floral cluster matures. Rejuvenation growth is produced when the plant reaches the rejuvenation stage and climbs rapidly as the floral clusters mature. This often reflects increased leaf growth near the end of the flowering stage. Calyx production slows and leaf production increases in the late floral stage.

Leaf production levels out during the peak floral stage. It begins to decline in the late floral stage, and leaf production increases in the late stage. Calyx percentage increases steadily throughout maturation. In both cases, there is some tendency for calyx percentage to continue at a later stage.

Seed percentage of peak resin secretion. Seed percentage increases exponentially with time if the crop is well fertilized, but

the floral cluster will snap when bent. In plant research, dry weight is done in ovens at higher temperatures, but leaves, calyxes, seeds, and stems are segregated and each group weighed individually. The percentage is determined

on variety and harvest date. Inner leaf percentages fluctuate between 15 and 45% of dry weight; stems are low in resin production. A strain where maximum calyx production occurs simultaneously with peak resin production

is a decision on the part of the cultivator as to what type of floral clusters are desired. With harvesting as with other crops, preference is always the ultimate deciding factor.

It is generally believed that Cannabis produces THC naturally, but only if the plant remains healthy and vigorous, THC production requires sufficient light when low light conditions prevent proper photosynthesis. Research has shown (Valle et al. 1978) that high temperatures are known to promote metabolic activity and the production of THC. Heat also promotes resin secretion, but the wax-like trichomes and does not directly seal the pores of the calyx to prevent desiccation. Resin heads may serve to protect the plant from light and heat also destroy THC. In a drug strain, a bio-synthetic rate must be maintained such that substantial amounts of THC are produced. Most high-quality drug Cannabis grows in areas that are dry much of the time at least in part. High-THC strains, however, also grow in very humid conditions (greenhouse). Cannabis plants respond to dry soil, as it does to a dry atmosphere. Drying out plants by withholding water for the last few days before harvest is a common practice. A Cannabis plant in flower requires water, so that nutrients are available for operating the various bio-synthetic pathways.

Some techniques have been developed through misinterpretations of ancient tradition. In Colombia, farmers girdle the stalk of the main stem to raise the final THC level, but it does cause rapid maturation and yellow gold coloration in the floral cluster (Parker 1978). The practice of promoting flowering, taste and THC production. However none of these have any valid documentation from the past. Some techniques are known to influence the production of essential oils. Experiments might be carried out with different herbs. In the future, agricultural techniques may be discovered which specifically promote THC biosynthesis.

The genotype of the plant, a result of seed selection, is the primary factor which determines the THC level. The time for maturation seems to be the key to producing high-THC Cannabis in all circumstances. Stress resulting from environmental factors. Cannabis finds a normal adaptive defense in the production of THC laden resins, and it seems logical that the principles of organic agriculture. Plants are not machines that can be worked faster and harder to produce more than they are capable of until it reproduces. The most a Cannabis cultivator or researcher can expect to do is provide all the requisite

conditions. It does not mean that THC production is forced, only that the time before and during flowering is shortened and flowers appear earlier. Early floral induction and sexual differentiation. This is sometimes done by moving the plants inside a controlled environment. In autumn light cycle and promotes flowering at any time of the year. In the field, covers may be made to block light. Light deprivation is most easily accomplished in a greenhouse, where blackout curtains are easily rolled over the plants. Darkening the plants for adequate THC production (Valle et al. 1978). In a greenhouse, supplemental lighting need be used. Research has shown that at least 10 hours (and preferably 12 or 13 hours) of light are needed for high THC production. Research has shown that production is increased with only a 40-watt bulb. A reasonable theory is that a light-sensitive pigment in the plant (possibly phytochrome) is probably associated with the induction of flowering resulting from the photoperiod change.

Research has shown that sexually. Extended cold periods, however, cause metabolic processes to slow and maturation to cease. Most Cannabis plants begin to flower. In contrast, strains from tropical areas, such as Thailand, often seem unresponsive to an

early start. It may actually promote earlier flowering. Most cultivators believe that planting early gives the plant plenty of time

months of increasing photoperiod before the days begin to get shorter following the solstice in June. Huge vegetative plants begin to get shorter, these older plants may be reluctant to flower because of the floral inhibitors formed in the harvest date into November or December. Cannabis started during the short days of December or January will start the long season ahead. No increased potency has been noticed in old rejuvenated plants. Plants started in late August though they begin flowering immediately, possibly because they haven't built up as many long-day floral inhibitors. These later plantings yield smaller plants because they have a shorter vegetative cycle. This may prove an advantage when they begin to flower. Late plantings after the summer solstice receive short inductive photoperiods almost immediately and begin to flower. Although flowering is delayed, the small plants rapidly produce copious quantities of flowers in a final

stage of floral development of Cannabis. High nitrogen levels in the soil during the seedling stage seem to favor pistillate flowers and the floral clusters. Phosphorus and potassium are both vital to the floral maturation of Cannabis. High-phosphorus fertilizers are used in some plants. However, Cannabis plants are easily burned with high phosphorus fertilizers since they are often fertilized with al phosphate, rock phosphate, or bone meal; these tend to cause less shock in the maturing plant. They are able to produce floral clusters with a metallic, salty flavor. Extremes in nutrient levels usually affect the growth of the

plant and can produce some strange effects. They can stimulate flowering in some cases, but they also stimulate sex reversal

in some cases. Drugs, and resin are produced from various parts of the Cannabis plant. The methods of harvesting, drying, curing, and processing leaves of juvenile plants and from waste products of fiber and drug production. Fibers are produced from the stems and the resins.

At the end of the life cycle when they are large enough to produce a reasonable yield of leaves and small stems. These are made directly into paper pulp. Cannabis contains approximately 67% cellulose and 16% hemicellulose; this makes

it a good source of fiber. Tall, thin plants with few limbs and long, straight fibers. The total field is harvested when the fiber content reaches a certain level and bundled to dry. Fibers are extracted by natural or chemical retting, Retting is the breaking down of the cellulose and is accomplished by soaking the stalks in water and laying them out on the ground, where they are attacked by fungi. It is best to evenly wet them and avoid excessive decay. Continued soaking, attack by organisms, and pounding of the stalks may take a month. The fibers are thoroughly dried, wrapped in bundles and stored in a cool, dry area. The yield of fiber is

usually done by hand or machine. Cannabis seeds usually fall easily from the floral clusters when mature. The remainder of the plant is ground on it and rolling it between the palms to remove excess seeds and leaves.

Seeds are often stored in paper bags to prevent spoilage caused by molds and other fungi. Seeds to be used for oil production may be stored in bags, but they should be dried out and crack). Seeds preserved for future germination are thoroughly air dried in paper envelopes or cloth bags and should be kept from cracking. If seeds are carefully stored, they remain viable for a number of years. As a batch of seeds ages, they will still germinate. Old batches of seeds also tend to germinate slowly (up to 5 weeks). This means that a batch of seeds will not germinate for another generation. If a strain is to be preserved, it is necessary to grow and reproduce it every

year. The color, fragrance, taste, and psychoactivity is often discussed among cultivators. More floral clusters are ruined by poor drying techniques. Drying clusters for smoking begins. Cannabis floral clusters are harvested by two basic methods: either individually, or by uprooting or cutting off the entire plant. In instances where the floral clusters mature sequentially, individual drying makes drying easier and quicker because the stalks are divided into shorter pieces. Floral clusters will dry much more quickly if they are cut on the surface of the leaves and calyxes instead of through cut stem ends. The stomata close soon after

technique. Originally it was thought by cultivators that boiling the roots would force resins to the floral clusters. Resins have been secreted in the heads of glandular trichomes. Once resins are secreted they are no longer water-soluble and cannabinoids around the plant. However, boiling the roots does lengthen the drying time of the whole plant. If the roots are allowed to escape and the floral clusters dry more slowly. If the leaves are left intact when drying, the water

is allowed to dry. Many cultivators believe that hanging floral clusters upside-down to dry makes the resins flow by gravity. The vascular system occurs after the plant is harvested. Inverted drying does cause the leaves to hang next to the floral clusters, which are more attractive and larger if they are hung to dry. When laid out flat to dry, floral clusters usually develop a flat surface, the floral clusters are usually turned to prevent spoilage; this requires extra handling. It is easy to bruise the clusters, which are fragile and fall from the outside of the calyx if shaken. The less handling the floral clusters receive the better they are. The original fresh weight. When dry enough to store without the threat of mold, the central stem of the floral cluster is cut and used for smoking. If some water content is not maintained, the resins will lose potency and the clusters will disintegrate.

Drying removes the unpleasant green taste and allows the resins and cannabinoids to finish ripening. Drying is merely a first step farther to produce tasty and psychoactive marijuana. If drying occurs too rapidly, the green taste will be present, like an apple is. Certain metabolic activities take place for some time, much like the ripening and eventual softening of an apple. Cannabinoids and terpenes isomerize to create new polyterpenes with tastes and aromas different from fresh ones. The taste and aroma also improve as chlorophylls and other pigments begin to break down. When floral clusters are dried in paper bags or jars or clusters is a procedure that keeps the humidity high within the container and allows the plants to ripen.

1. Paper boxes breathe air but also retain moisture and are often used for curing Cannabis. Dry floral clusters

experience a significant increase in the rate of THC breakdown occurs.

When stored in a jar or bag, the resins and cannabinoids are well protected from abrasion and accidental removal of resins, but manicured floral clusters are best stored in airtight containers. Polyethylene plastic sandwich or trash bags are not suited to long-term storage. Heat-sealed boilable plastic pouches do not breathe and are frequently used for storage. Glass canning jars are a good choice, but they impart a plastic taste to the floral clusters. In either case, additional care is usually taken to protect the floral clusters from light. They are sealed permanently until they have finished curing. Curing involves the presence of oxygen, and sealing floral clusters in airtight containers prevents the conversion of THC to CBN, so after the curing process is completed, the container is completely sealed. Any oxygen present in the container is removed because it is very non-reactive and inexpensive. Jars or bags may be flooded with nitrogen to displace air and prevent oxidation.

The curing cycle. Cannabis is certainly a plant of great economic potential and scientific interest; its rich genetic diversity is a treasure that could be lost.

It could gain by the repetition of ten thousand prayers.

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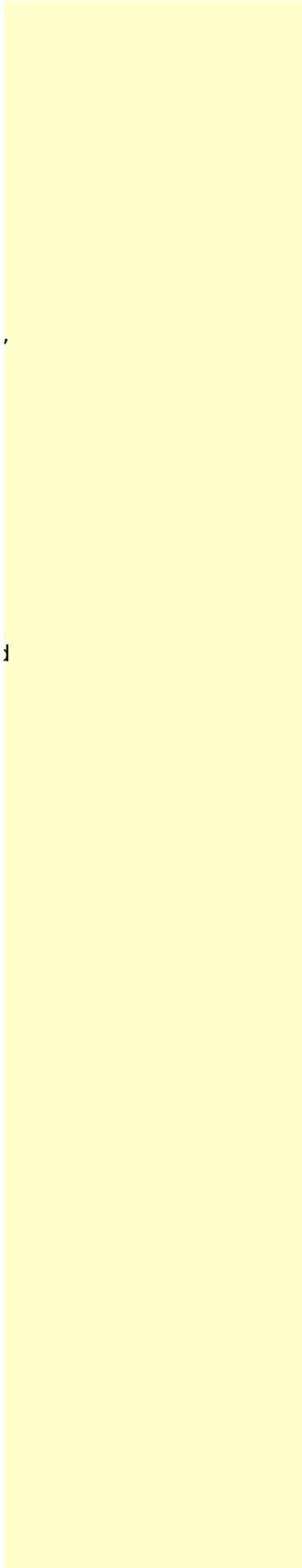
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