Connoiseur's Handbook of Marijuana

created by crushing and boiling the mixture down considerably until it is of a syrupy consistence. It is then strained through a cloth much like cheese cloth, with the vegetable-butter mixture pressed into cakes, and the liquor being drunk.

MYTHS-FACT AND FICTION

Let's talk briefly about some of the myths about grass, and the reality which confronts them.

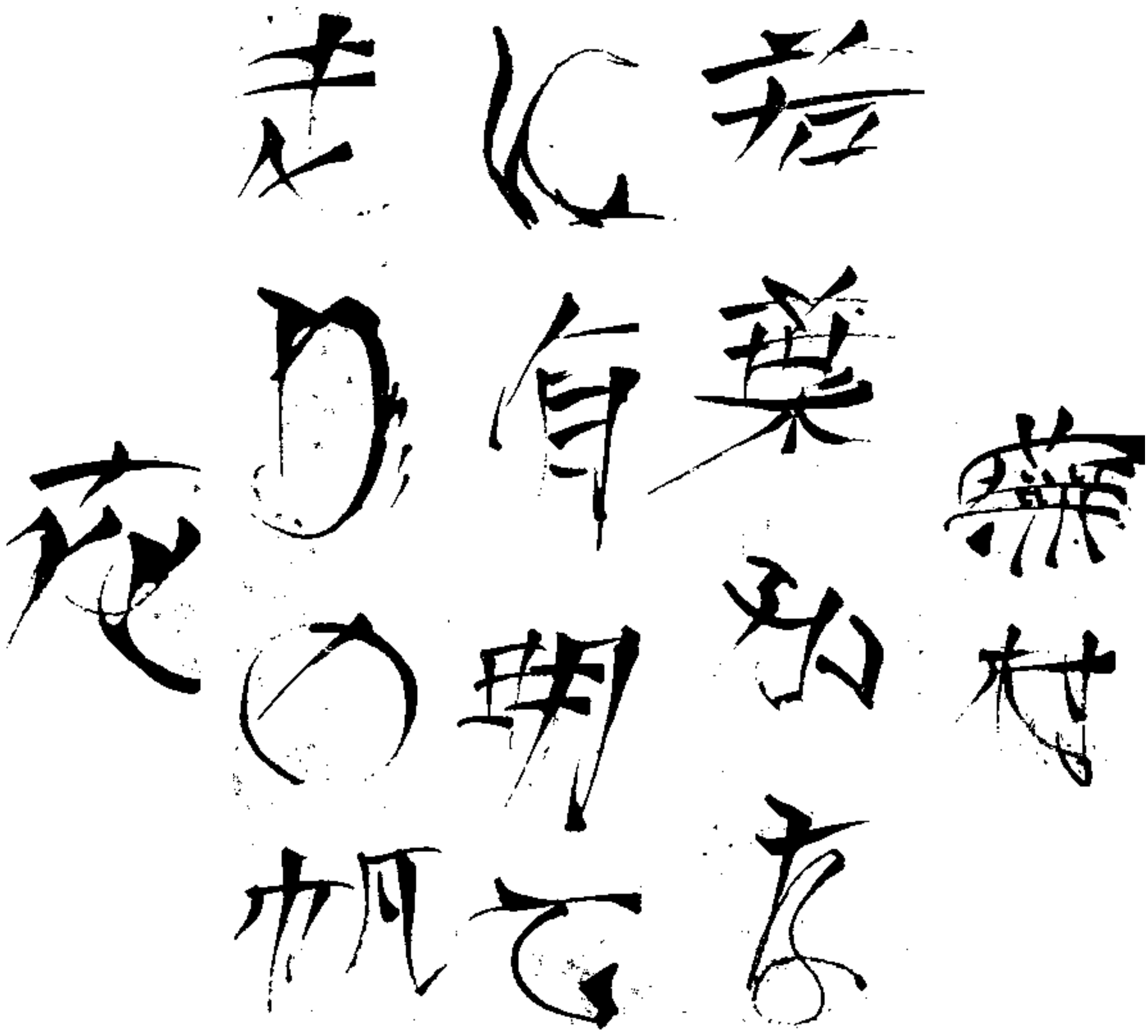
Acapulco Gold, Panama Red and other strains of grass are reputed to be particularly potent because of a fortuitous combination of climate and soils. Actually, soil has nothing to do with potency, except that it contributes to the plant's health, and certain mineral deficiencies do cut down on resin potency (see page 23). Climate has a similar relationship with potency. It is the genetic properties of grass which determine potency, and these genetic properties vary from strain to strain, but can be easily manipulated by cultivators.

Another myth holds that male plants are useless for drugs. This just Ain't so, and we go into the explanation on page II.

Myth number three says that high potency grass can only be grown in certain places in the world, when the truth is that it can be grown anywhere indoors, and in most places outdoors.

There are a couple of downright destructive myths in circulation about some aspects of growing grass. One of these is that the more nitrogen you throw in, the better; but the fact is that an overdose of nitrogen in early life will kill the plants, and too much nitrogen at maturity cuts potency way down by limiting resin secretion. Another myth is that infra-red light is beneficial to Cannabis, when in reality it Starves the plants of energy, causing them to stretch out in an agony toward the light source. Another myth is that soil in which grass is to be grown should be very alkaline. This will kill most plants and weaken the rest, and we go into soils extensively later in the book. Another one is that Cannabis doesn't need much water, the less the better; while in truth Cannabis needs a great deal of water—it's just that it can't stand over-wet soil. Then there is the bit about needing high temperatures and some say even high humidity, which has led a lot of people to build sweatboxes in their closets and bathrooms. Grass doesn't really need temperatures over 75° F, and as for high humidity, It can cause an accumulation of plant poisons which will kill it in short order.

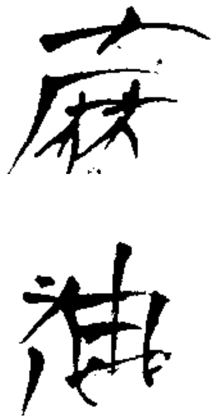
Rather than rambling, we'll deal with most of these myths and some others in the relevant chapters in the book, and go into detail on the whys and wherefores. But isn't it a shame that so many such myths have been in circulation for so long? Makes one wonder how come. We hope, that we've been-careful in checking out the information in this book from all possible angles, and we know that most of the errors in the original sources have been Uncovered and eliminated, but some may remain.



OVERVIEW OF THE PLANT

Cannabis Sativa is a hearty weed which grows well under extreme environmental conditions. It is probably a native of Central Asia, and has been the subject of intense interest for several thousand years of human history. It is a multi-purpose, high-order plant which yields a versatile and useful fiber from the stem; a subtle, aromatic and nourishing oil from the fruit; and a valuable and exciting resin from the leaves.

One of the principal reasons that Cannabis occupies a distinctive niche in the plant kingdom is because of its unusual and almost unique sexual character. Cannabis is dioecious; that is, the male and female organs are normally manifested on separate plants. Each sex exhibits a host of specific behavioral and vegetative variations through a wide range of environmental conditions. The normal sex ratio is about 1:1, give or take a few points either way, but under abnormal conditions, the ratio can go as high as 9.5:1 female. Then again, when the environment becomes really threatening, Cannabis is capable of switching to a predominantly bisexual or hermaphroditic state. Changes such as these may be thought of as the plant's ability to manifest a survival drive under conditions which cut off the possibility of normal reproductive activity. It may be helpful to retain this image when you consider manipulating the sexual state of your plants, because you will be intervening in some potent life forces and such activity should be undertaken only with sympathy and understanding. The mechanics of manipulating sex are deceptively simple, and we'll run them down for you in detail in later chapters.

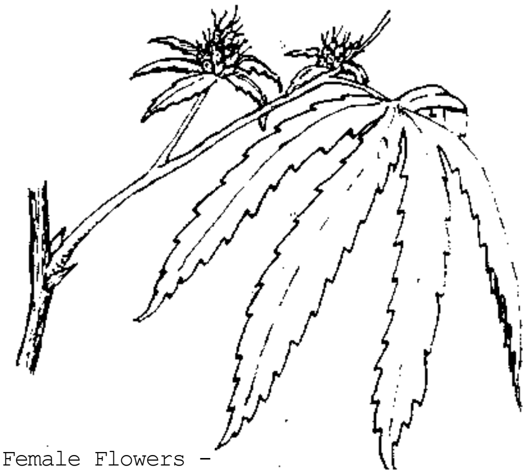


To begin with, many folks have a lot of awfully vague ideas about the difference in appearance between male and female Cannabis. While appearance, particularly before the sex organs are formed, is not a conclusive indication of gender, it can be very helpful in making first estimates of the sexual composition of your crop.

After about the third week of normal growth, some plants will be taller than others. These taller plants will also be more skinny, have fewer leaves, and the branches bearing the leaves will be spaced out along the stem more than in short plants. They will be a bit more pale, and by about the sixth week a little tuft of leaves will have developed at the top, giving the appearance of a shoddy crew-cut. These plants have dominant male tendencies.

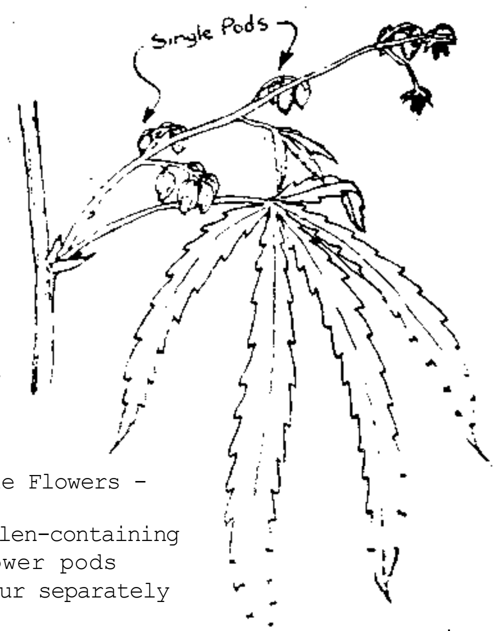
Females, on the other hand, will tend to be squat, rounded in profile (the Middle Eastern ideal), darker green, and more leafy. Their branches will be spaced closer together on the stem, and the stem will be getting thick when she is about in middle life.

Both male and female plants will have certain features which are characteristic of Cannabis. The leaves have serrated edges, and are shaped like tapered spearheads. There are from five to eleven leaves to a bunch, and the most common clusters contain either seven or nine leaves. The leaves are dark green on top, light green-yellow on the bottom, and have fine downy hairs along the lower surface.



Female Flowers -

showing reproductive organs
in association with leaf clusters



Male Flowers -

pollen-containing
flower pods
occur separately

The stem of Cannabis is fluted and hexagonal, with a large, normally hollow central pith cavity. Intercedes——places where branches diverge from the stem—-occur every five to ten inches along the stem in a normal plant. The mature stem is very tough, particularly near the base where it becomes solidified. Stems can reach a height of 25 feet under certain conditions, and become several inches thick.

The root system consists of a main tap root, normally eleven to fourteen inches long, with a layer of very fine lateral roots which spread cut through the subsurface soil a distance of five to seven inches. These lateral roots occur even more markedly in rich organic soils.

Where adequate elbow room is given the growing plants, they may become extremely bushy, with complex branching and lush foliage; but where they are crowded together, the plants may have only a little top knot of leaves. Crowded conditions favor development of males—-other things being equal—-and adequate space favors development of females.

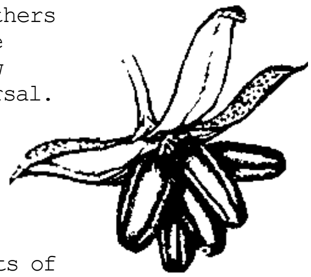
It will be important to remember, whenever you are dealing with sex-related phenomena in Cannabis, that each plant bears within it self the capability to be either a male or female, whatever its apparent identity at the moment. Cannabis hangs onto its sexual role very strongly under some circumstances, and readily abandons gender under others. Too much messing around can ruin a crop as surely as hostile forces in the environment; and as long as you're going to grow grass, you might as well do so with an appreciation of what's involved.

At any rate, let's go on and deal with some of the sexual distinctions which this fascinating plant exhibits.

THE MALE CANNABIS

The slender male plants, while less potent and thus a bit less desirable than the female, have many features which should be of great interest.

The male flowers develop in small, drooping pouches like scrota which are attached near the forks of branches and down near the stem of the plant. These flowers are very rarely associated with the leaf clusters; but when they are, they occur in bunches of three, as contrasted with their normal single state. The male flowers have no petals as such, though the sepals enclosing the pod are often taken for petals. There are five of these enclosing lobes, and they are usually greenish-yellow, occasionally with a red tinge. After the flower opens, five little stamens pop apart and dangle what are called anthers from gossamer threads. It is the anthers which are responsible for dispensing pollen when fertilization time draws nigh, so it's pretty easy to gauge the divine moment by noting whether or not the anthers are swollen and eager-looking. You will be able to tell when the anthers became fully extended. Their surfaces will begin to show little white pollen grains about twelve hours before pollen dispersal. Another sign is that the tiny hairs on the undersides of the leaves will become swollen about their bases due to an accumulation of calcium oxalate crystals.



Male Flower - sepals spread apart to show detail

The males produce less chlorophyll than the females, thus they are able to thrive on less intense light. In line with the survival drive of Cannabis, we will see later that one of the effects of cutting down on the energy levels or photoperiods of your plants will be an increase in the number of male plants.

Males also produce a lower level of auxins in the tissue fluids. Auxins are generally thought to be plant growth stimulators vital to vigor and leafiness. Associated with the male's tissue fluids, one finds a slightly acid ph factor (acidity-alkalinity). This distinction also contributes to the plant's overall survival capability, and the tissue fluids of the plant can adapt to the acidity. Female Cannabis is, by contrast, slightly alkaline in the tissue fluids.

Many writers have picked up on a piece of misinformation which holds male plants to be useless for drug purposes. It is substantially true that males have a much lower potency than females, but that is not the reason that they are pulled up and destroyed by professional growers. They are pulled primarily because if the male is allowed to go to maturity and pollenate the female, she will lose considerable potency because much of her energy will then be turned to nourishing the fertilized seed. What might be gained, then, in terms of overall bulk at harvest time by keeping the male plants will be lost in per-unit potency of female plants. So it becomes a trade-off situation where you have the option of lots of leaves (both male and female plants harvested) with lowered potency per unit of yield, or less yield (destroy the males and keep only females) with a higher per-unit potency. It is up to the individual cultivator to make the decision.

Male plants follow a uniform pattern in blooming and it is a truly symphonic process. The first flower will pop open before sunrise, and this will be located about two-thirds of the way up the plant, nestled against the stem. As the sun rises, blooming begins to radiate from this initial flower outward, progressing at a controlled rate in all directions until the flowers nearest the periphery and on the top-most tuft are reached. Between the seventh and the twelfth hour, the final flowers will appear and the process will stop, with all blooms open and in readiness. At the first breeze, a blue-white cloud of pollen will be released, to drift downwind across the field where the females wait with their pistles poking through the tip of their pods to snag the life-giving dust. It is an act of creative energy, and drains the male of life from that moment on.

Soon after pollen release, the male plants begin to lose their green color and waxy texture. They show signs of death near the base at first, but soon their sheen will decay completely, to be replaced with a green-white tinge over the whole plant. Ihe leaves on the lower portions will shrivel, the plant will give off a dry rustle and release its last puffs of pollen if shaken by the wind or a passing creature.

And the life cycle of the male will be complete in the twelfth week of its existence.

｜なり草の花　茶茶

相の聞處

入

THE FEMALE CANNABIS

Females outlive the males by three to five weeks, and this in part reflects their greater health and vigor during life, and in part is tied to their life cycle, which is more complicated than that of the male.

The female flower is not as obviously complex as the male, but it goes through a greater variety of changes and is the nexus of the reproductive drive in Cannabis. Female flowers look even less like conventional blossoms than do the males. The flower is structurally very simple, consisting of a downy pistle surrounded by specialized leaves with overlapping edges which form a little pod or cup, open and pointed at the top where the tip of the pistle, and its two stylar branches, poke out to snag the life dust. This pistle is the ovary of the female Cannabis, and it looks like an oval, slightly flattened termite egg when you peel back a few of the protective leaves and take a peek.

Female Flower Cluster

The pod containing the pistle does not open at blossom time, and thus it is pretty hard to follow the development processes of your plants without exposing them to trauma. These flowers lie in close association with the leaf clusters and never occur by themselves. Although the female flowers spring up in pairs originally, one of the pair will normally abort at fertilization, which is another example of the marvelous backup systems which nature devises to assist in fulfilling the life drive. The surviving flowers are packed more or less tightly together, and these leaf/flower clusters often reach an impressive size, particularly near the tops of mature females.

Female plants produce large amounts of chlorophyll and seem to be more consistent producers of the plant auxins so necessary to vitality and leafiness in most plants. The tissue fluids of females can be either neutral or slightly alkaline, and this in part accounts for the difference in drug potency which is commonly believed to be characteristic of Cannabis males and females. It has been well established, however, that drug potency in Cannabis is only partly sex-determined, so the attribution of different levels of drug potency to sex differences alone is clearly wrong. Other things being equal, it does appear, however, that the unmodified female plant is more effectively utilized for marijuana. Other things are rarely, if ever, equal and it appears that even plants with modified sexual characteristics are associated with their original sexual identity. The implications of this fact will become clear in discussions of sex modification in Chapters 5 and 7; but for the moment, it is sufficient to say that if a plant starts out to be a male, even if it is later switched to a female, it will never attain the leafiness and vigor of a true female. The reverse holds as well naturally.

Largely because of their greater leaf mass, but also because of their more vigorous water uptake, female plants will outweigh male plants 2:1 at maturity. They will generally have more leaves per cluster, and more clusters of leaves than a male. Because of these heavier vegetative characteristics, the female will have greater energy requirements than the male, and will exert a greater draw upon soil nutrients.

All the time the males are reaching maturity and preparing to release pollen, the females are coming into their fertile period and the flowers are undergoing developmental changes which will prepare them for sustaining the reproductive act. The pods are spreading apart slightly so that the pistle with its stylar branches can protrude. The leaf clusters show a marked drooping, so as not to interfere with the circulation of pollen-bearing breezes. Water intake, which has peaked and is declining slightly, increases once again. Sunlight or light energy becomes critical. Temperature variation can have negative effects on the exposed sex organs. Nutrient requirements undergo some alteration, with calcium and potassium salts constituting the equivalent of ice cream and pickles. The female plant is preparing for her role. After this point is reached—-somewhere in the tenth to the twelfth week under normal conditions—-there is no going back. Attempts to modify sex after this point are against the natural grain, and will fail, or else will result in offspring so warped that the results are the equivalent of failure.

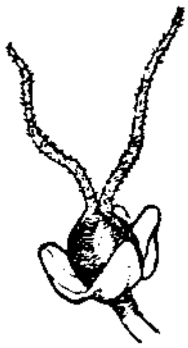
Following the act of pollenation, as previously noted, one of each pair of female flowers will abort. The surviving member is then free to draw upon the sustaining fluids of the plant for energy, and the seed begins to develop.

If good seed is desired from the female, she should be left alone for at least two weeks after blossoming, or else the seed will be immature. Even if it manages to germinate, it will produce feeble plants. Leaving the female in the ground past flowering, however, tends to decrease the drug potency of the plant, as much of its energy turns to producing viable seed. The decision as to when to harvest, therefore, becomes a crucial one. For maximum potency, the female plant should be harvested before the stalk begins to pale and lose its waxy texture; for maximum seed viability, it should be left until the leaves have dropped off and the seeds rattle in their pods. Somewhere in between—-in completely normal circumstances about ten days after female florescence—-seems to be a happy compromise. Of course, the seed requirements of individual cultivators will vary, and many of the possibilities which will be suggested for modifying the growing plant may have already ruined the next generation, so many factors need to be considered.

Sex Abnormalities

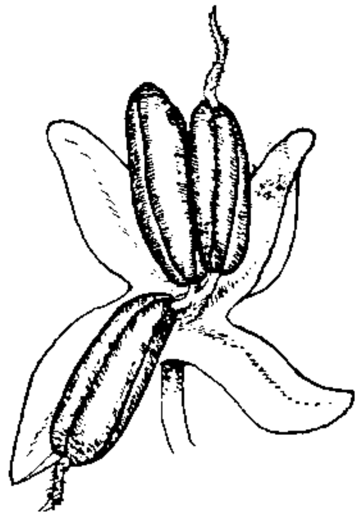
The marvelous survival drives and mechanisms of Cannabis manifest themselves in sex anomalies under conditions hostile to normal growth and development, conditions which threaten life, limb, and offspring.

If such sex anomalies occur on your plants, even though in all other respects they appear normal and even healthy, you can be sure that they are being threatened by some oversight on your part which has led to environmental chaos which is being reflected in the sexual state of the plant.



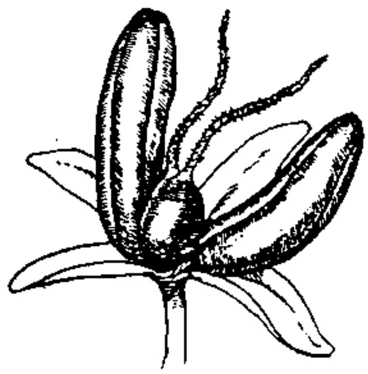
Maleness shows in the under-developed pod of this female flower

Predominantly female flower showing male projection



Male flower showing female stigma protruding from the anthers

Single normal female flower with cut-away pod



Female showing maleness by developing stamens

SOIL, WATER NUTRITION AND ENVIRONMENT

A great deal of the misinformation floating around about the soil and water requirements of grass is the direct result of people not bothering to research carefully what they are in a rush to put them on the market to exploit a general interest in the subject of marijuana. This is especially unfortunate because a lot of carefully compiled information is available, particularly in the agricultural journals of the first few decades of this century. We'll try to synthesize the best of this information here, and count on the bibliography to point the way for folks who want to do more extensive research on their own.

GENERAL SOIL PRINCIPLES

The soil which is to be used should be of as uniform quality as possible. The importance of this fact becomes apparent when you begin to modify certain characteristics of your crop, particularly with indoor growing, and are counting on a consistent sort of outcome. Non-uniform soil quality can jeopardize even the most sophisticated experimental efforts. For indoor work, this means that all soils used should be thoroughly mixed, and for outdoor planting it means you should stick to areas where the soil has been deposited in uniform depth from the same general source.

Uniformity of the soil also is desirable if you contemplate re-using it. Cannabis soaks up a great deal of the nutrients in any soil, and when you re-fertilize you want to be certain that you aren't going to burn some of your plants and starve others because the nutrient level wasn't even to begin with. We have calculated that Cannabis absorbs the equivalent of 1500 kilos of fertilizer for every 100 kilos of fiber obtained from the mature plant. Since fiber yield is about 6.5% of the weight of the mature plant, this means that Cannabis absorbs around one kilo of nutrient per kilo of vegetable mass. This gives an idea of the importance of adequate nutrition.

In a mature plant, the proportions of plant products break down in the following way:

Loss in drying	+/-30%
Leaves, roots and tops	+/-25%
Extraneous stem material	+/-15%
Sticks	+/-15%
Seed and Miscellaneous	+/-10%
Fiber	+/- 5%

This means that one can count on leaves and flowers to constitute from ten to twenty percent of the harvested weight of a crop.

TYPES OF OUTDOOR SOIL

Outdoor soils suited to growing good quality grass should be a rich loam, interlaced with fine sand and low in clay content. Soils having their origin in sedimentary rock are generally considered to be the best bet for stability and nutrition.

This does not mean that folks living in areas where the soil is sandy or poor in nutrients need to get upset because with proper thought and preparation, Cannabis will thrive in most soils. The truly limiting factor is the compaction of the soil, related to clay content. Such soils will resist generation of the fine lateral root system by which Cannabis picks up nutrients, and are generally poor in available organic nutrients. Most disastrously, they promote pooling of water around the roots of the plants, something which Cannabis cannot tolerate.

A simple test will give you an idea of how much clay is present. The soil should be rich and easily crumbled—-a few handfuls selected at random from the field should give the cultivator a pretty good idea as to compactness. The soil should ball together when squeezed in the hands, but crumble easily into fine particles. Soil which compacts too easily and which will not crumble under light pressure (applied by pressing lightly on the ball of soil) is too wet, has too much clay, or has other problems rendering successful cultivation unlikely.

The rich topsoil described above must be sufficiently loose in texture to permit root system development at least two feet down. A good supply of humus (decayed organic matter) is a big help because it not only provides nutrients, but also helps retain and spread out moisture. Cannabis requires substantial amounts of water compared to other crops but, as just mentioned, will not tolerate standing water about its root system. For outdoor soils, the water table should be at least three and not over six feet below the surface.

If you are forced to plant your crop in poor soil due to a lack of alternatives, you can help your plants toward health and happiness by working an organic fertilizer into the soil at least a week before you plant. We'll deal with specifics of fertilizers shortly.

Another alternative is to look for a field where a crop of clover, beans, car sane other nitrogen-fixing plant is growing; and, if such an area is available, turn under a plot of such vegetation several months before planting your Cannabis.

THE OUTDOOR ENVIRONMENT

Certain areas are to be avoided unless there is absolutely no alternative. Soils which contain any concentration of salt should be bypassed. If Cannabis is planted in such areas it will grow (if at all) very short, high on cellulose, very poor on leaves, with low starch and sugar content, and give an extremely poor grade of resin.

Soils which are downwind or downstream from tobacco or tomato fields should be avoided, also, as these plants harbor molds and parasites which are very destructive to Cannabis.

Equally bad are areas with poor drainage, or areas which are likely to be swamped for even short periods. Care should be taken to locate an area which receives at least eight hours of sunlight a day, and which is not exposed to high humidity situations (like fog) in association with temperatures below 50° F.

The soil should be loose enough to support the penetration of growing roots, yet not so loose as to provide an unstable base for the plants in a strong wind. You should check the kind of plant growth that occurs naturally in the area. There is no real need to worry about ground-level weeds, because Cannabis will overshadow them quickly. The thing to lock for is their general health. If they appear poorly nourished, and if it looks as though this is due to a leached soil, then you will probably want to look around for a better area. A lot of animal trails through the area could mean that the seedlings will be placed in unnecessary jeopardy. You will also want to check on the depth of the topsoil. If the weeds don't seem to be able to penetrate more than a few inches down, the soil is not going to support your plants very well.

PLANTING OUTDOORS

The best crop will be carefully planted, using a seed drill. If you don't plan to return to weed and thin the growing crop, then you should use only one seed per hole. If you plan to return in a week or two, you can buy a little insurance If your seed is untested, by using two or three seeds every other hole. The best bet, obviously, is to test the germinating powers of the seed before going into the field. (See chapter on seeds)

Just about any method of sowing that results in the seed being covered by a half inch or more of decent soil will produce some plants. Of course, the more prepared the cultivator, and the more methodical, the better will be the yield of his labors.

Assuring a somewhat systematic approach is your bag the first thing you'll want to do, after finding the appropriate location for your plot, is to determine whether or not any sort of nutrition supplement is going to be needed, If you are using land which also supports other kinds of crops, you may be in luck. Hemp is best grown in rotation with non-exhaustive crops such as wheat or with crops which yield a high return to the soil such as beans or peas--one pound of dry beanstalks contains as much available nitrogen as five pounds of manure. Assuming that your land is not seriously depleted, the following approach works well in most cases.

In the early fall of the year, manure should be worked into the selected plot with a hoe, and beans or another legumenous crop should be planted. After two to two and a half months, the beanstalks should be turned under, and the surface compacted somewhat. Just tramping around in heavy boots is adequate. The plot may then be left for the winter. In the early spring the plot should be weeded, dressed with a potent organic fertilizer such as manure or chicken crap, and will then be ready for planting Cannabis when the weather turns.

INDOOR SOILS

Indoor growers can profit from a greater ability to regulate soil quality, consequently there is no nutritive reason why superior quality Cannabis cannot be grown indoors.

The indoor cultivator has two choices—he can locate, dig and transport high quality loam or he can buy commercial nursery soils. The latter, if certain minimum standards are met, are inexpensive and work well.

Commercial soil for the cultivation of Cannabis should (1) be neutral to slightly alkaline; (2) have substantial humus content—about 15 percent will do nicely (if desired, one can buy soil with low organic content and supplement both humus and nutrient content of this basic soil with a variety of the organic fertilizers to be reviewed later in this chapter); (3) contain at least 15 percent fine sand; and (4) be sterilized using heat rather than chemically sterilized.

One of the most pervasive myths about Cannabis is that harsh soils promote resin production, and rich soils inhibit resin production. The underlying rationale for this myth seems to be that the Plant tries to protect itself from a harsh environment by throwing out resin. In reality, soil quality has little or nothing to do with resin production. Factors which do regulate resin production are discussed throughout this book. What poor soil will do is cut down on the health and vitality of the growing plant and result in skimpy plants at maturity.

Indoor soils should hold moisture but not allow pooling of water. To test for this quality, poke a small hole a few inches deep in freshly watered soil. If, after a few minutes, standing water appears at the bottom of the hole, the soil is probably too compact if you haven't gone too heavy on the water. A pint per cubic foot shouldn't produce pooling in the hole. The same crumbly quality is required of indoor soils as outdoor soils and the same test will do.

Assuming that most indoor growers will be putting the soil in some sort of container, let's review a few general principles of soil depth, compaction and drainage which hold here as they do for outdoor soils.

Soil depth should be at least 12", the more the better after this. Each plant should have at least 15" distance between it and either the sides of the container or another plant's root system. There should be some provision for adequate drainage, otherwise the soil will (1) become highly saline and (2) become water logged. Either condition is fatal to Cannabis.

Indoor soils will salt up rapidly when chemical potash and nitrogen fertilizers are being used, but will eventually increase in acidity no matter what fertilizers are used, or even if none are added at all. For this reason, it is best to change soil each tine new plants are to be grown. When this is not possible, the soil should be thoroughly spaded after the top several inches are scraped off and thrown away. This is extremely important--it gets rid of most of the harmful salts which may have been formed or deposited.

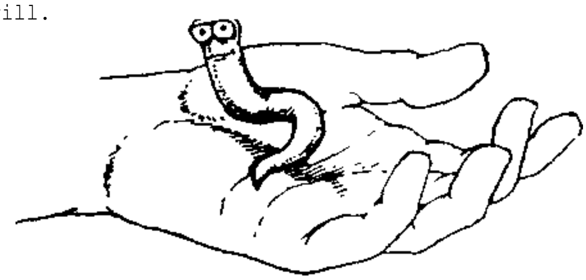
In areas where high mineral content water is used for irrigating the plants, this operation is essential. The soil should be allowed to dry thoroughly, and irradiation with ultra-violet can help destroy any micro-organisms which exist. (New bacteria will, of course, be reintroduced by successive fertilizing). This dried soil should now be thoroughly mixed and subjected to the same tests as the original soil for compactness, moisture retention, and crumbly quality. It may be necessary to add humus once again.

When fertilizers are to be added to an indoor soil, they should be added to the entire lot of soil at the same time and should be thoroughly mixed in. The mixture should then be allowed to stand for at least a week before it is used. This is true of both chemical and organic fertilizers because you have no way of knowing how much of what kind of nutrient is involved, thus you take serious chances on burning plants by not waiting for organic decay to proceed for a week. Organic fertilizers should be added to the soil only before planting--they should never be added to the soil, even in small amounts, once the plants are growing. 'Chemical fertilizers, such as soluble nitrogen can, on the other hand, be added in small amounts during the growth cycle without harmful side effects.

One of the most beneficial agents an indoor grower can use is the common worm. Indoor soils compact severely with repeated watering. Introducing a few earthworms into the prepared soil will aid immeasurably in root development and nutrition uptake of the plants, increasing the vegetation appreciably. Worms are also a good testing device--by and large they react negatively to many of the same things.

たり夏座敷

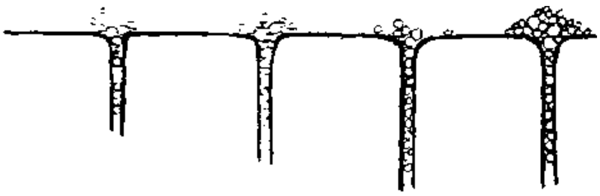
that plants do——too much water, overdoses of chemical fertilizers, highly compact soil, etc. If worms thrive in the beds, the chances are good that plants will.



THE INDOOR ENVIRONMENT

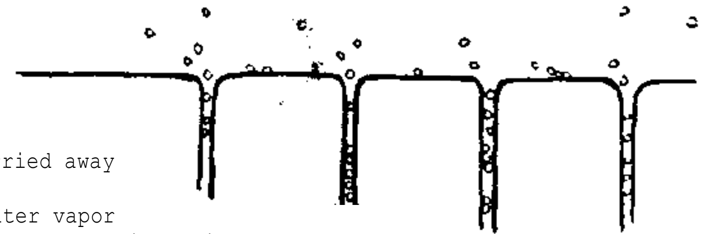
It's depressing to contemplate how many good plants have been ruined by lack of attention to the indoor environment.

A critical factor in the photosynthetic process is the ability of a plant to rid itself of the poisons it manufactures in the course of the organic conversions it goes through. These processes depend upon a steady flow of water; from the soil, through the root cells, transported up the stem, passed through the leaf tissues and discharged into the air as water vapor. The escape velocity of the water vapor molecules from the stoma is very low, consequently discharged water vapor tends to hang around the leaf surfaces, preventing further discharge, until it is swept away by breezes.



Leaf cross-section showing pores

Poison-laden water vapor cannot be discharged without adequate ventilation



Water vapor being carried away

These little hemispheres of water vapor form a deadly shell which can suffocate Cannabis, which depends on a high volume of water passing through its tissues, very quickly. Indoor growers should take great care to provide for constant input of fresh, unsaturated air and for exhaust of saturated air.

Another common source of death and destruction among indoor Cannabis plants is tobacco smoke. It is with a heavy heart, my fellow Americans, that I announce tonight the smoking lamp is not lighted during grass cultivation. If smokers are using the same air supply which the plants must breathe, you must try to filter the air somehow or take great risks with the plants' survival up until the third week, and their health beyond that.

WATER REQUIREMENTS FOR CANNABIS

We've already reviewed the overall soil moisture characteristics which will affect Cannabis. All that remains is to look at the pattern of water uptake. These patterns are important, particularly for the indoor grower, because they give clues as to the critical growth stages where deprivation of water will have very negative effects.

Key points to keep in mind when inspecting this chart are:

1) Air and soil temperatures will be equal(Columns A & D) under normal indoor conditions. Bottom heating will produce the differences noted in Columns B & C. (See pages, 29, 30.)

2) The figures given are per plant, per week.

3) The water uptake figures are given in milliliters, which are equivalent to 1/1000 of a liter; thus, 500 ml=l/2 liter (or 1/2 quart) of water, and so forth.

4) The figures given for the wild strain represent the minimum requirements for a healthy plant. The figures for the commercial strain, grown for fiber, represent about the maximum a plant can handle.

	(A) Air =75°F Soil =75°F.		**(B)**Air =75°F Soil =60°F		**(C)**Air =60°F Soil =75°F		**(D)**Air =60°F Soil =60°F	
Week	Wild	Comm'l	Wild'	Comm'l	Wild	Comm'l	Wild	Comm'l
1	60	210	50	175	80	150	70	60
2	70	200	40	100	80	190	45	100
3	130	290	85	105	85	190	50	120
4	125	380	65	240	105	260	65	180
5	160	650	105	420	110	380	90	240
6	155	560	115	420	125	430	120	260
7	175	730	80	470	170	530	100	430
8	140	650	100	490	200	610	135	430
9	175	730	120	540	140	540	70	530
10	140	850	120	530	155	840	100	670
11	150	850	60	560	90	650	75	450
12	160	670	105	470	125	600	100	420
13	150	770	110	470	90	620	45	480
14	160	750	105	510	105	600	50	510

ENZYMES AND SEX

The action of environmental factors in altering sexual expression and vegetative development in Cannabis should not be considered in isolation from some of the plant mechanisms which interact with environment to produce the changes we've been discussing.

Enzymes play an important role in sex expression. The enzymes adrase (male) and gynase (female) are produced by all Cannabis plants in the seedling stage. How much of each is produced, and how much of each is utilized by the plant seems to be determined by environmental factors, in particular the photoperiod. While both enzymes are produced in every hemp plant, hermaphroditism is rare under normal conditions because the male enzyme has a self-inhibitory quality.

The complex interaction of environment and enzyme may be viewed as a trade-off situation. If environmental conditions are strongly in favor of production of the male—associated andrase, its self-inhibitory powers come into play so that the female-associated enzyme can influence sexual development at least to the point where the plant will be hermaphroditic. This seems to be a self-preservation and reproductivity-retention mechanism, for without it, only male plants would be produced under radical environmental conditions and the plants would not be able to propagate.

Under conditions highly conclusive to the production of the female-associated gynase, a process occurs which has the same outcome from the plant's point of view—-the plants retain the ability to propagate by becoming hermaphroditic.

Under normal conditions, of course, Cannabis has no need to protect itself by going through these genetic gyrations and in the ordinary course of events the cultivator will not have to worry about manipulation of sex in his plants. If, however, the cultivator is interested in producing a high ratio of females to males, deviating from the normal 1:1 relationship, then an awareness of what is happen-ing—-the plant's survival capability is being challenged--should make the cultivator more sensitive to changes in his plants. Most important, the cultivator should not try for high 9:1 or 9.5:1 female ratios unless willing to pay the price of hermaphroditic plants with potential genetic defects in future generations and highly variable drug potency.

DEFICIENCY SIGNS

There are a few good clues which your plants will give you if they are being starved of any of the really essential nutrients. The following discussion should be useful as a guide, but before acting upon leaf analysis, it is highly advisable to check for soil acidity, which car produce many of the below symptoms by limiting nitrify-cation and promoting excess uptake of toxic salts. Use litmus paper to test for acidity, and simply follow the directions on the package. Litmus paper can be easily obtained at many drug stores and always at chemical supply houses and nurseries.

Nitrogen Deficiency

This is the most common problem which users of natural soils will encounter. Nitrogen is absolutely essential for the production of many life-sustaining organic materials in Cannabis, particularly chlorophyll.

Cannabis shows a nitrogen deficiency by a yellowing of the older leaves. The young leaves will remain green, except in severe cases, because in the face of starvation the older leaves give up their nitrogen for the young, and the plant sends whatever nitrogen it can draw from the soil to the youngest leaves first.

Use of organic fertilizers like manure or chicken dung, plus plowing in some nitrogen-fixing plants like beans, will assure that you won't have this problem. Chemical remedies include nitrochalk or nitrate of soda.

Phosphorus Deficiency

Phosphorus is another essential element for plant health, and its function appears closely linked with nitrogen. It is needed for the plant's metabolism of sugar, from which much of its energy is derived.

The mature leaves of Cannabis will show phosphorus deficiency first, and they will appear a dark, dull green, curled up a bit at the edges. The undersides of the leaves, particularly close to the veins, may show a turtle tint. Commercially available triple or super-phosphate will remedy this ailment.

Calcium Deficiency

While calcium is an absolutely necessary mineral, it is used by Cannabis only in minute quantities.

The symptoms of calcium starvation are difficult to detect—-they consist of an inhibition of buds which are in the process of becoming leaf clusters, and a wilting of the tips of the fine lateral roots. Most cultivators of Cannabis won't have to worry, if their soil is of sedimentary origin. Commercial remedies for calcium deficiencies are readily available, or you can work in bone meal and chicken feathers (but not in large quantities) to soil you suspect of being calcium deficient.

Magnesium Deficiency

Magnesium is an integral part of the chlorophyll in all green plants, and serves in other important ways as an activator mechanism.

Symptoms occur first on older leaves, and consist of a yellowing of the tissues around the veins of the leaf. The leaves will develop a general "varicose vein" look very quickly, and the yellowing will then spread over the whole leaf.

Many of the magnesium sulphur compounds available in commercial fertilizers can correct this condition; agricultural epsom salts will be the most easily available.

Iron Deficiency

Cannabis requires only trace amounts of this element, though it is an essential link in the photosynthetic process, as well as in respiration.

Deficiency symptoms look the same as those for magnesium deficiency, but they occur on the younger leaves first. Most plant foods contain enough of this trace element to assure no problems with your grass.

Potassium Deficiency

Relatively large amounts of potassium are needed by Cannabis at certain growth stages, because this element functions as an activator of essential metabolic activities.

Again, the older leaves will show deficiency signs first. There will be a slight yellowing of the leaves initially, followed rapidly by dark spots and the edges of the leaves becoming a bronze-gray. Application of sulfate and muriate of potash will help remedy any such problems.

Sulphur Deficiency

This deficiency is not common, because most soils have plenty of sulfate.

The symptoms usually occur first in the younger leaves, as opposed to the normal pattern for Cannabis, and amount to a slight general yellowing. This condition soon spreads to the rest of the plant. Any commercial sulfate dressing will work well if you have a sulphur problem.

Boron Deficiency

This element is necessary for the development of strong stem tissues in Cannabis, and there is usually enough in the soil to prevent problems.

The symptoms are a bit difficult to detect unless they are of a critical nature. They include a swelling of the stem near the base, and the stem will crack open and be very dry and rotten-appearing on the inside.

Again, most plant foods have enough borate in them to prevent this sort of problem.

Chlorine Deficiency

This disease can be confused with many others, because the symptoms are a general yellowing of the leaves, and a gradual turn in color to bronze or bronze-orange. The one sure indicator is if the tips of the lateral root system become swollen, and if they are much shorter than the normal 5" to 7" radial spread just beneath the soil surface.

This is a very uncommon problem, and will not occur at all if any care is taken in seeing that the major nutrients have been supplied, as the chloride ion is associated with many of the major nutrient compounds.

Zinc Deficiency

This disease will begin to show along about the fifth week in Cannabis, and will result in very small leaves which are wrinkled around the edges and which are faintly yellow along the veins. The distance between nodes on the stern will also be greater than you would expect on a normal plant, in some cases only the top knot of leaves will be viable.

Any plant food containing zinc compounds will do the trick if the problem is caught in time.

Molybdenum Deficiency

Many soils lack trace amount of this element which is essential for Cannabis in nitrogen fixation.

Symptoms are a yellowing of the sections of the leaves between the major veins, and this yellowing occurs first on those leaves near the middle of the plant, progressing rapidly to the younger leaves at the extremities. The younger leaves will, in addition, become severely distorted and twisted. The yellowing may not occur if you have been using ammoniacal nitrogen fertilizers, but the twisted young leaves will be a giveaway sign.

Be sure to use a plant food containing a trace amount of this essential element.

SOME CHEMICAL FERTILIZERS

The use of chemicals instead of organic fertilizers has several advantages under specific conditions. Chemical quantities can be regulated rather closely with established plant requirements. The problem with grass is that very little research has been done on its requirements, with the exception of a great little article by Sister Mary Etienne Tibeau in 1933. Sister Mary writes of her work with her plants with the systematic vision of a fascinated researcher. Her work concentrates particularly on the nutrients required to produce the largest and thickest leaves and the greatest amounts of resin. Sister Mary is every grower's spiritual mother superior.

Luckily for those of you who are not dead set on total organic cultivation, the mineral requirements of hops are very similar to those of Cannabis, and its reaction to nutrient deficiencies are equally similar. Consequently, if you are able to convince the friendly neighborhood flowerman that you have a sick hops vine in your backyard, he may be able to point out a commercial prescription cure. If you don't live in a place where hops are familiar plants, you can refer to the remedies outlined above, and ask for a commercial product which is similar.

Even if your plants aren't putting out sickness vibrations, you might want to consider supplementing their straight soil and organic diet. If you do, the following charts may be helpful in choosing a commercial product; or if you are skilled in basement chemistry, you may want to try to brew up a batch of your own nutrient solution.

EFFECTS OF THE USE OF SUPPLEMENTAL SOLUTIONS
OF ESSENTIAL SALTS ON CANNABIS SATIVA

	Foliage and Resin	Stature and Growth
#1	Production of very large leaves stimulated; calcium oxalate crystals are heavily concentrated; resin production is inhibited if a potassium overdose occurs after the tenth week. Sex ratio 7:3 females. Potassium is very essential in the early stages of life but has substantial negative effects at maturity if too great a concentration is continued.	Potassium yields greatest height; stem is large and thick, very low on fiber, woody and brittle; leaves are thick, healthy, dark green; growth cycle is shortened by about a week.
#2	Foliage is more sparse than with high potassium dosage; older leaves wilt readily. A magnesiurn shortage will inhibit or prevent resin production. Sex ratio 6:4 males. Magnesium is vital to overall health but conservative supplementation is advisable.	Magnesium concentrations give good heignt; stems will be fibrous and hollow, somewhat woody, not as strong as with calcium supplements; leaves will be healthy but pale-green in color and will brown or wilt around the edges and tips.
#3	Healthy plants are produced with somewhat smaller leaves than with the other supplements; foliage is not very thick or abundant; high calcium salt concentration inhibits resin production. Sex ratio 7:3 males. Overdose of calciurm in early life will stunt growth but an adequate supply is essential in the sixth to ninth weeks.	Very strong and fibrous stem which is desirable where heavy winds are common; plants do not grow high; color is dark green and flowers are swollen.
#4	Foliage is abundant, healthy, dark green and leaves are thick; excess nitrogen promotes water loss and can cause wilting; nitrogen deficit at maturity stimulates resin production. Sex ratio as high as 9:1 females. Excess nitrogen will cause plants to grow fast in seedling stage and to appear healthy, but they will die off at the time of sex differentiation.	Plants will be short, squat and very leafy. Nitrogen should not be cut back until after the sixth week.

There are four basic solutions of metallic salts which occur in one form or another in many chemical and chemical-organic fertilizers, or which can be easily put together in a home lab. These solutions are designed specifically for use with Cannabis on an experimental basis. Once you make one of these solutions you should include the solution as a part of your regular watering procedure—the idea is that one 7 liter batch of solution will last about 7 weeks if you use a liter a week in watering your plants.

FOUR BASIC SUPPLEMENTAL SOLUTIONS
OF THE ESSENTIAL SALTS

Formula #1		Formula #2	
HIGH POTASSIUM	RATIO (Parts)*	HIGH MAGNESIUM	RATIO (Parts)*
KNO_3	2	KNO_3	1
KH_2PO_4	2	KH_2PO_4	1
KCL	2.5	$Ca(NO_3)_2$	4
$MgSO_4$	1	$MgCl_2$	3
$Ca(NO_3)_2$	4	$MgSO_4$	4
K_2SO_4	4.5		

Formula #3		Formula #4	
HIGH CALCIUM	RATIO (Parts)*	HIGH NITROGEN	RATIO (Parts)*
$Ca(NO_3)_2$	15	KNO_3	1
KH_2PO_4	1	NH_4NO_3	17
$CaCl_2$	11	$Ca(NO_3)_2$	4
$MgSO_4$	1	KH_2PO_4	1
KNO_3	1	$MgSO_4$	2

***Parts are expressed in**

GRAMS PER 7 LITERS OF SOLUTION

BOTTOM HEATING EFFECTS

In the next chapter we will talk about bottom heating, the process of raising soil temperature above that of the surrounding air; but since this is an environmental manipulation, we'll present this chart here. Before you go through the expense and effort of using this procedure on your plants, be sure to refer back to this chart to get an idea of the relative advantages and disadvantages.

	AIR = 60 F	AIR = 75 F
	A	**B**
SOIL 60 F	Lowest water needs; appx. 40% less than (D). Lowest rate of nutrient uptake occurs between weeks 5 and 7 in the growth cycle. Mean number of leaves on mature plants equal to (D), but female plants are more sparse. Leaf area is substantial; colour and thickness qood. Use of a 16-hour exposure to light daily at this soil-air temperature level produces mainly female plants. Height at maturity is low compared to (B) and (D).	Lowest rate of nutrient uptake occurs in the twelfth week. Lowest mean number of leaves per plant for both males and females. Leaf area is very low, and leaf thickness is considerably less than under all other temp/air conditions. A 15 to 20 hour light exposure will produce a sex ratio of 6:4 females. Height of mature plants substantial.
	C	**D**
SOIL 75 F	Water needs are substantial. Lowest rate of nutrient uptake occurs in the third week. Mean number of leaves per plant is the greatest, but females have fewer leaves per plant than the females in (D). A 15 to 20 hour daily exposure will produce predominantly female plants. Height at maturity is low; a squat, bushy plant results.	The greatest Water needs occur under these conditions. Lowest rate of nutrient uptake occurs in the fifth to seventh weeks. Mean number of leaves per plant is less than (C), but females have 40% more leaves per plant than (C). A 16 hour photoperiod produces a 1:1 sex ratio, less than under other conditions, but normal for Cannabis.

SEEDS, SEEDLINGS GERMINATION AND TRANSPLANTATION

When you consider the amount of time and energy that goes into preparing for cultivation, whether you plan on a large-scale operation or just a couple of plants grown in some little nook, it doesn't make a lot of sense to take a cavalier approach to seed selection. This is particularly true when it is so simple to assure yourself that the seed you're using is of good quality."

THE GOOD SEED

External appearance will give you a good set of clues to the seed's state of health. Viable seed will be well fleshed cut and not be all crinkled up. It will be bright gray, gray-green, or gray-brown and will appear glossy if rubbed between the palms of your hands.

The constituents of Cannabis seed break down thusly:

Constituent	Percentage
Fatty Oils	19.1
Resin	1.6
Saccharin	1.6
Gum Extract	9.0
Albumen	24.7
Woody Fiber	13.3
Loss	.7

This table demonstrates, incidentally, how wasteful it is to smoke or otherwise consume Cannabis seed, which contains only 1.6% resin by weight, an exceedingly small amount.

To test further for seed quality, several methods are suggested. It's a good idea to carry testing beyond a glance at the seed's appearance, because a number of internal conditions affect their germinating ability and these are not always detectable by appearance and the water test.

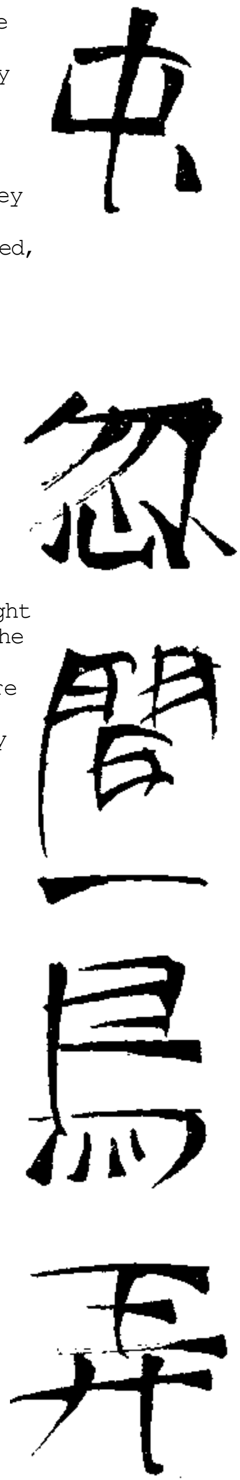
Crack open several seeds selected at random from the batch which will be used. If they have a musty, oily taste, they are pretty old and may well have gone bad. Another test is simply to germinate a group of ten seeds and count up those which fail to sprout. This will give you a rough estimate, by percentage, of what you can expect overall. Anything above 50% is pretty good for a bunch of seeds acquired at random on the streets of North America these days. Considering the traumas which most grass goes through before it reaches the domestic market, it's a wonder that any seeds remain viable, We'll cover this subject in detail later on.

If you have cracked open a few seeds and note that the insides are black, then fermentation has set in there is no chance that they will germinate. Conversely, if they are pale and dusty on the inside, they are overage and will produce feeble plants at best.

Another test is to drop a few seeds onto a red-hot iron. If they burst with a noticeable crack, they were good seeds. In Thrace, seeds were thrown upon red-hot stones, and "their perfumed vapor, so obtained, used for a fume bath which excited from those enjoying it, cries of exultation.” A great idea for your backyard sauna, if you are a profligate sort of soul.

Incidentally, Cannabis seeds are considered excellent bird food, because they are fattening and stimulate egg production, so I'd be very careful with those brownie recipes if I were you, population freaks.

Seeds can provide an important clue for those who are breaking the law by purchasing lids. Since the optimum time for harvesting grass for drug potency is at, or shortly after, female flowering, the greater proportion of seeds in such a plant will be immature. Conversely, if all the seeds in the lid appear to be ripe; that is, bright gray, the chances are good that not only was the plant overage when she was harvested, but she had also probably been pollenated, which will have lowered her effectiveness as a drug. And, of course, if there are very few seeds at all in the proffered lid, the chances are increased that you are being offered leaves from a male plant. At any rate, it would pay to be very suspicious of any grass which doesn't have a ratio of immature (white) to mature (gray) seeds of at least 2:1.



PREPARATION OF SEEDS

Once you are fairly sure of the vitality of your seeds, you should go through a couple of pre-planting steps.

You should soak your seeds overnight in a starting bath of distilled water. Actually, any pure water will do, but if you are city-bound, you would do well to invest in a bottle of store-bought water to avoid the chemicals and crap which might damage the swelling embryo beyond saving.

You can, if you wish, give the seeds a little boost by using additives in the soaking solution. Very little research has been done on the effects of using plant growth stimulants on Cannabis seeds in the starting solution. One standard additive which is available through nurseries contains ammoniacal nitrogen, nitrate nitrogen, phosphoric acid and soluble potash. Use of such compounds is more or less at your own risk; be sure to look at the fertilizer information in the previous chapter, first.

ADDITIVES

There are a couple of general points covering the use of additives with particular significance for Cannabis, if you decide you want to experiment a Little.

(1) Most growth regulators and stimulants in the pregermination and germination stages require that temperature and moisture levels be held constant, usually between 65° and 75° F, and 30-50% relative humidity.

(2) Commercial preparations are manufactured to cover a wide range of plant response levels, and therefore aren't necessarily good for one specific plant. It seems more sensible to design your own growth stimulator, even if it is simply adding little soluble nitrogen than to waste money on commercial products.

(3) Most plants seem to benefit from application of growth stimulants at later stages in their growth cycle. Cannabis Sativa is no exception. Limiting stimulation to a carefully controlled environment and perhaps some nutrients seers to be the best policy at the pre-germination stage.

(4) If you think that your seeds have had a rough time in transit, you should be particularly careful in using stimulants at the early stages of life. Let the plants try to make it on their own, rather than forcing them to exceed capacity in a weakened state.

(5) Particularly after applying stimulants through the starting solution, (but this precaution applies generally) one should exercise care in handling the seeds because they are going to be swollen and tender. Sterilized tweezers are the best instruments for handling the seeds in transfer from the starting solution to the germination beds. The seeds should be picked up with the lightest possible touch, and should be picked up by the sides of the seed rather than the ends. To put pressure on the ends might damage the embryo root permanently.

(6) The seed should be placed in the earth with the pointed end up because as the primary tap root emerges from the pointed end, the natural tendency is to make a turn and grow downward. If it has to twist and turn in order to seek its proper direction, two negative effects will result.

Seed improperly positioned—the pointed end is down. Tap root makes natural bend out of the seed, but then has to reverse itself. Vital seed energy is lost.

First, a great deal of energy stored in the seed which should be going for root extension will be expended in root positioning, resulting in a lowered energy level at this critical growth stage. Second, the plant has to exert a great deal of force, after the tap root is extended, in lifting its head, enclosed by the two halves of the seed pod, above the soil and in forcing the pod off its back so that it can spread out its two embryo leaves to begin the photosynthetic process. Carelessness on your part can exhaust any but the most hearty seedling at this stage, resulting in feeble plant in later life.

(7) Seed should be placed about 1/2" to 3/4″ under the soil surface. As it develops, it should not have to expend large amounts of energy pushing through the soil because it will need the energy later on to stand erect and throw off the seed coat.

STAGES OF SEEDLING GROWTH

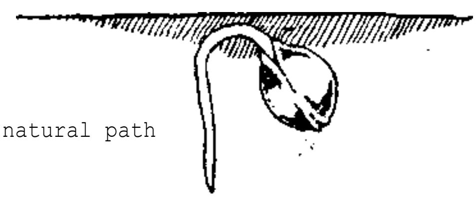
The germinating Cannabis seeds go through several distinct stages, and it may prove worthwhile to pull one or two sprouts each day to check on development according to the following time table. If the seeds do not develop approximately in the sequence and at the tire indicated, something is wrong. You may save yourself weeks of work, a substantial electric bill, and some disappointment by checking on these growth stages.

Stage 1. Upon germination, the primary root emerges from the stylar end of the seed (the pointed end). The seed is split in half, but the halves remain together protecting the emergent leaves. This primary tap root undergoes rapid growth.

Seed properly positioned-

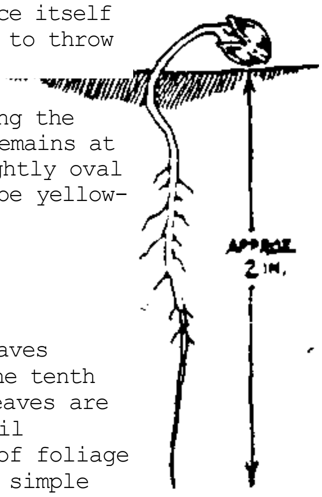
pointed end up

Stage 2. After approximately 48 hours from germination, the tap root should be around 1-1/2 inches long. Root growth normally slows at this point.



Tap root follows natural path

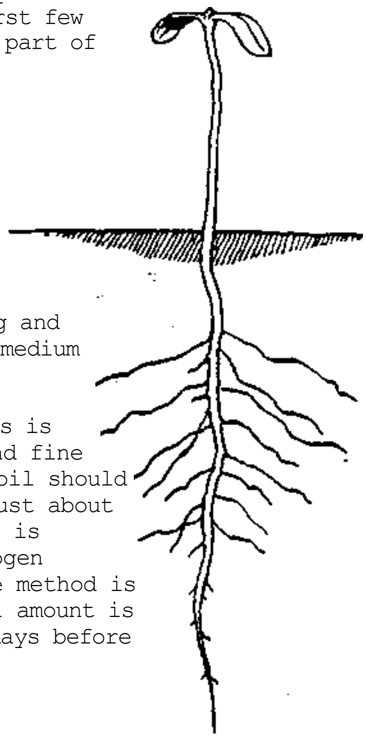
Stage 3. After from 72 to 96 hours, a fine lateral root system should begin developing just below the soil surface. At this point, the seedling will begin to force itself above the soil surface and to exert pressure to throw off the seed coat.



Stage 4. The seedling stem begins to stand erect during the fifth day, and the seed coat falls away or remains at the soil surface. The embryo leaves are slightly oval in shape and are not serrated. They should be yellow-green at this point, and have a moist, waxy appearance.

Stage 5. The stem of the seedling below the embryo leaves lengthens steadily from the fifth to about the tenth day. The first leaf node where the embryo leaves are attached should be 1" to 1-1/2" above the soil surface. During this period the first pair of foliage leaves will appear. This first pair will be simple leaves, slightly oval, and will show serrations. They only last a short tine, and the second and third pairs should appear by the twelfth day.

Stage 6. The embryo leaves, which have functioned as photo-synthetic and food storage organs for the first few weeks, yellow and fall away during the early part of the third week.



Stem stands erect, ambryo leaves spread, and seed pod falls away

GERMINATING BEDS

To assure maximum survival of Cannabis seedlings during and after gemination, care should be exercised in selecting the medium and the environment for germination.

The most effective medium for germinating young Cannabis is fertile soil. The soil should be a mixture of rich humus and fine sand (spagnum moss and aquarium sand will do nicely). The soil should not be acid; in fact, a ph reading of 7.5 to 8.0 would be just about right. A simple litmus test should indicate when the balance is adequate. The soil can be supplemented with a soluble nitrogen fertilizer in a solution strength of about 5%. An alternate method is to work animal manure into the geminating bed soil; a small amount is adequate. In either case, enrichment should take place 5-7 days before planting or use as a germinating bed.

Moisture content in germinating soil is a critical factor. The surface of the germinating soil should be almost dry, and the subsurface soil not so moist that it adheres to the finger. Testing for good moisture is much like testing gingerbread to see if it is done—-as long as any soil sticks to a pencil thrust to the bottom, it is too moist. Care should be taken, however, to see that the germination beds are kept within a range of moisture, neither too wet nor too dry. If too wet, the seeds are likely to rot and ferment; and if too dry, they are apt to sprout weakly, if at all.

Several authors state that germination can be accomplished in many mediums—-even wet paper towels—-but there is substantial evidence that subjecting seedlings to transplant shock twice in their early growth stages is as harmful as would the case be if germination takes place in a non-nutritive and impermanent medium.

Temperature plays an important role in assisting germination. While Cannabis is capable of sprouting and surviving at root temperatures as low as 46° F, an ideal range should start at 65° F and run upwards of 80° F. Many researchers have found that maintaining soil temperatures slightly higher than air temperature in seedling stages promotes rapid growth in Cannabis. This procedure, called bottom heating, is somewhat tricky and not at all necessary for healthy, vital plants; but if you insist on nothing but the best for your little charges, you can invest in the necessary equipment (expensive) which nurseries will probably be able to find for you. An alternative is to strip an electric blanket of its heating wires and lay them out beneath your germinating boxes. Needless to say, care should be taken to avoid shorts and shocks.

If heating devices fail during germination; or, if outdoors, a chill occurs and the seedlings wither and turn yellow, all hope is not lost. Regeneration of apparently dead seedlings is fairly common, and you should wait at least a week before starting all over. The exception to this rule will be when there has been a heavy frost, in which case there just isn't much hope.

GERMINATING EQUIPMENT

Almost any container imagination can devise will do for a germinating box, as long as it meets certain size and depth requirements. Coffee cans, plastic basins, window boxes, jars, bathtubs, etc., all have been used for indoor germination. Outdoor germination most often occurs in a hothouse or quasi-hothouse situation, with plastic film laid over the furrows or a plastic or glass enclosure surrounding the seedlings.

A few tricks to remember which might make gemination a good deal more simple and reliable process for Cannabis grower:

> If the seedlings are to be transplanted at any point, it will be helpful to germinate them in containers making transfer to the planting soil easy and non-traumatic. Germinating the seeds in ice-cube trays or similar devices allows easy transfer

of the seedlings in their original soil. The ball of soil can either be popped out at transplant time; or each depression in the tray can be lined with foil or plastic before the germinating soil is added, making transplantation a matter of lifting out the ball of soil intact and placing it in the receiving soil equally undisturbed. The foil or plastic film can be removed easily prior to placing the seedling in its new home.

Paper cups are good germinating containers too, because you can cut them away and leave a well-shaped ball of soil. But he sure to use one big enough to not cramp the roots of the germinating seedling—at least a 12 ounce cup.

Whatever the construction of the germinating box, it must (1) insulate well and retain heat; (2) allow for adequate ventilation for respiration; (3) provide adequate drainage; (4) allow nourishing light to pass unimpeded; and (5) allow space for initial root growth and development. Either glass or plastic film will do for insulation and light, and ventilation, is easily provided for. Drainage is necessary, or water will tend to pool at the lowest levels of the beds, producing an over-moist environment for the roots of the plant.

PREPARATION FOR TRANSPLANTING

A substantial exposure to risk comes during transplanting for the Cannabis seedlings, rut there are a series of steps which can be taken to minimize the danger and promote healthy adaptation.

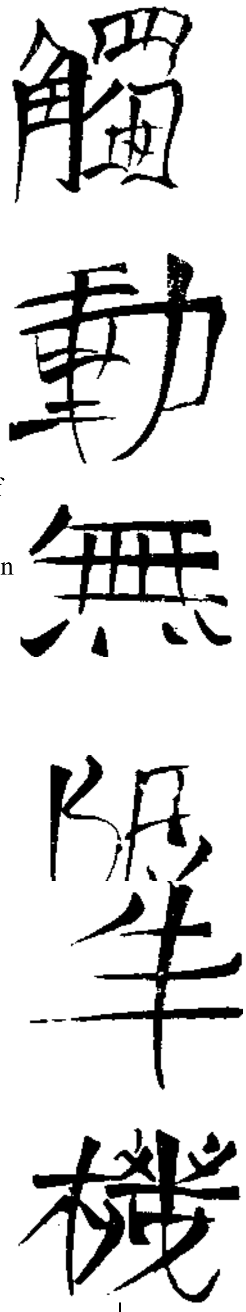
A primary consideration is the receiving soil. It should be as similar to that used in germination and sprouting as possible. It must be fertile, neutral or slightly alkaline, loose and friable, moisture-retentive at the sub-surface levels, well-drained, spaded to a depth of at least 12", and reasonably clean of weeds and mold. A few earthworms introduced into the transplant soil would be very beneficial if they are available.

It is at this point that a number of critical differentiations occur in the plant's environment which determine in large part whether its ultimate usefulness will be for its fiber or for its resin.

One of the most important determinants is the crowding which young plants experience. A general rule ray be stated; for fiber, the closer together the better, and for resin the further apart the better. Plants which are crowded closer than 12-14 inches from one another will produce, other things being equal, rather good fiber and rather sparse leaves. Cultivators after the leaves, rather than the fiber, have to work largely by inference on spacing, but several sources indicate that plants should be spaced at least a foot away from any other if leaves are desired, with a two-foot spacing even better, for those who have the room.

Another factor bearing upon the ultimate use to which the plants are to be put is the lighting which they receive as seedlings. The sprouts should be exposed to at least eight hours of sunlight or its equivalent before and after transplanting. While the specific lighting requirements of cannabis are discussed in a later chapter, it is most important at this early stage that lighting be consistant. Re-during the amount of lighting the sprouts receive immediately after transplanting seems to speed development of the mature plant by about one week. This reduced period of lighting, the lower limit of which is seven hours per day, should be discontinued after the fourth to sixth day of seedling growth and the plants put on the light regimen which you have decided to follow through their lifetime.

When the time comes for transplantation, you should have all your equipment at hand, and have the gemination beds close to the transplant beds so that there will be minimum exposure.



USE GREEN SAFELIGHT FOR TRANSPLANTING

It is really a good idea to perform the transplant under green light of low intensity. If no green light is available, a green filter will do. The green light is the cultivator's equivalent of the photographer's darkroom red. It allows him to see well without danger to the plants, because green light is the least active part of the spectrum for photosynthetic processes in plants, and tends to shut down the major metabolic processes which, if active during transplant, will put a great strain on the seedling.

In a more general sense, any time you perform any operations which entail exposure of the delicate tissues of your plants to light, use green light and you cut your radiation damage risks to almost zero. This is particularly important if you leave the seeds in the starting bath too long and the embryo root has begun to emerge. Seeds in this condition should be gently, but swiftly, placed in earth in the proper heads-up position described earlier.

TRANSPLANTING THE SEEDLING

One of the most traumatic experiences which seedling can undergo is to be transplanted. This is true of Cannabis even though it is a hearty plant in later life. In cases where the cultivator takes the outdoor hit-or-miss route there will be no worry about transplantation. Indoor cultivators, careful outdoor cultivators, and experimenters will all want to germinate their plants under a controlled set of conditions and upon successful arrival of the plants at the seedling stage, transplantation will be necessary.

Several steps can be taken to assure maximum survival.

The soil which is to receive the seedlings should be completely ready; that is, there should be no need to disturb it for a week after the seedlings are planted. It should be fertile, friable and thoroughly spaded. Earthworms should have been introduced at least two days prior to transplant, or their introduction should be delayed several days after transplant if they are to be used.

Transfer should take place under a pale green light, and the place should not be subject to drafts or temperature variation.

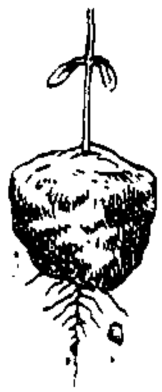
All instruments should have been sterilized, and sterile cotton gloves should be worn, if possible. If not, washing your hands with soap which removes surface oils on the skin should help prevent damage to the seedlings.

Where at all possible, the receptor soil should closely approximate the donor soil.

Overuse of fertilizers at this stage is not recommended, but several commercial preparations for stimulating transplant setting are readily available and work well when directions are followed.

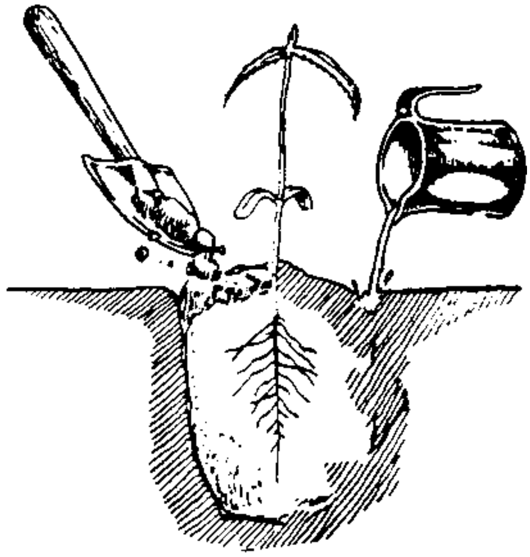
If possible, the seedling should be lifted with a ball of the original soil surrounding the roots, and this placed in a hole in the prepared growing bed. When lifting the seedling, it is best if the ball of soil can be lifted without the necessity for touching the plant in any way. If the plant rust be handled, it is best to grasp it lightly right near the soil level, supporting the plant's weight from above and that of the soil from below. Exposed roots and the upper stem and embryo leave of the seedlings should not be handled.

Seedlings should be placed in an upright position in the receptor beds with their leaves oriented to the principal light source. Phototropic (light-seeking) movement in newly transplanted seedlings can be detrimental to good secure rooting. The hole should be deep enough to allow the young root to extend to full length as it probably will be somewhat cramped from the germinating beds. The root should not be mashed down into a shallow hole, or the plant will not be able to summon energy enough to establish itself. The soil should be gently built up around the seedling to a level equivalent to that of the germinating bed. Piling dirt too high up the stem can be harmful.

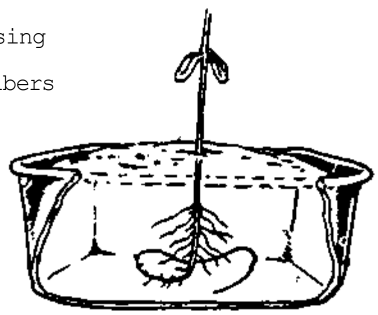


Avoid exposing

the root fibers



Less than 1/2 cup



Don't cramp the roots

The soil in the transplant beds should be dry enough so that when you add water after the transplant is finished, it will be absorbed rather than pooling around the roots. Adding water helps the transplanted seedling by, in effect, bonding the ball of original soil to the new soil, and makes root penetration of the new soil much easier. A teaspoon of water at room temperature will be enough for a transplanted seedling on the first day, provided the soil is fertile and contains enough moist humus to begin with.

Care should be taken during transfer that the seedling is not jolted or bent, and that the stem is not strained by being forced to support any weight. During the transfer roots should be exposed only to green light.

If any form of treatment is undertaken before transplanting is completed--such as Colchicine treatment described elsewhere--special care should be taken to protect the roots either with moist cotton or filter paper, or with a plastic film wrapped gently around the ball of soil to preserve moisture and compactness.

All plants undergo transplant shock; some seem to die and eventually recover, and some die; but the majority of plants transplanted correctly will survive and thrive with no apparent bad effects. If some of the transplanted seedlings yellow, droop, and ever, appear to die, leaving them alone is the best policy, after checking to see that the bending over has not exposed the delicate white flesh of the root.

With proper precautions and adequate soil, moisture and lighting conditions, the cultivator indoors should expect at least a 75% survival rate for transplants while outdoor transplants will have a lower survival rate in a less controlled environment.

SEED STORAGE

While Cannabis is a very tough plant, one whose seeds retain their power to germinate under a wide range of conditions, there is no sense in taking unnecessary chances with next year's crop if some simple precautions will give you the necessary protection.

The chief villain in the destruction of Cannabis seeds is moisture, whether atmospheric or surface film. Assuming dry conditions, Cannabis will not be injured by temperatures up to 98.6°, regardless of whether or not they are exposed to air. If the temperature in the storage vessel rises above this level for even short periods of time, however, the vitality of the seeds will decrease markedly, and prolonged exposure to temperatures over 100° will kill all but the most hearty and lucky seeds.

If the atmosphere where you live, or where you are going to be storing your seeds, is appreciably humid, this upper limit is lowered to 86° F. So if you have no way of keeping the seeds absolutely dry, at least don't allow higher temperatures than this.

The general rule may be stated: as moisture becomes a factor in storage, temperature becomes a factor, and seed vitality loss is directly related to both.

You will come as close as possible to a set of ideal conditions if you can store your seeds in an airtight container, at a temperature of between 80°-85° F.

For very long-term storage, it is a good idea to include some desiccating agent such as a little bag of silica gel taped to the lid of the container on the inside. This will draw off any moisture liberated by the seeds. The gel should not be in contact with the seeds. Neither should you store large quantities of seed together, because they may heat up.

LIGHTING EFFECTS AND GROWTH PATTERNS

INTRODUCTION TO LIGHTING

There are many important differences between types of light used in cultivating plants.

Sunlight; as it comes from the sun's surface, is a continuous radiation spectrum. Sunlight appears white for the same reasons that metals glow white with a clue tinge at high temperatures, and only red-yellow at lower temperatures (the higher an object's temperature, the further its light emission moves toward the short wavelength , very high energy end of the spectrum).

When sunlight hits the outer atmosphere of earth, the random oxygen and ozone molecules floating around up there absorb most of its high-energy ultra-violet light. If too much of this energy light fell on earth, all unprotected life would blow itself apart cell by cell.

Of the sunlight which reaches earth's surface, about half is visible light, and half is infra-red. The infra-red light is not continuous because water vapor and carbon dioxide absorb certain bands.

The processes of photosynthesis require a certain energy level to start them and keep them going. The molecules involved in photosynthesis must absorb enough energy to excite them and loosen than up so that they can enter into reactions with other molecules. This process is the same one which takes place in our eyes, and explains why we have a visible range of light. Too high-energy light (ultra-violet) freaks out the molecules in the eye, gets them so excited that they can't go through their reactions in an orderly fashion; and too low-energy light (infra-red) isn't heavy enough to get the molecules up for interaction. Photosynthesis in plants requires that the plants have energy levels which they can "see"— what is light to our eyes is life to a plant. This is the reason that infra-red light produces such odd changes in plants—-they aren't getting enough energy to go through with their normal processes, so they have to come up with some abnormal processes, and thus some abnormal growth patterns, in order to draw enough energy from the environment to survive. The phenomenon seems analogous to an organism such as man, who, when deprived of life-giving or life-sustaining substances such as air and heat, stretches out toward life in an. agony of death, distending the normal limits of his physical being, his muscles and internal organs all reacting violently to the low energy input.

There are two principal areas of interest in relation to lighting, both relating on a higher level to the amount of energy which light imparts to living, growing plants. The first of these areas is concerned with the profound effects which variation in the exposure period has on plants. The second concern is the varying energy levels available through different light sources.

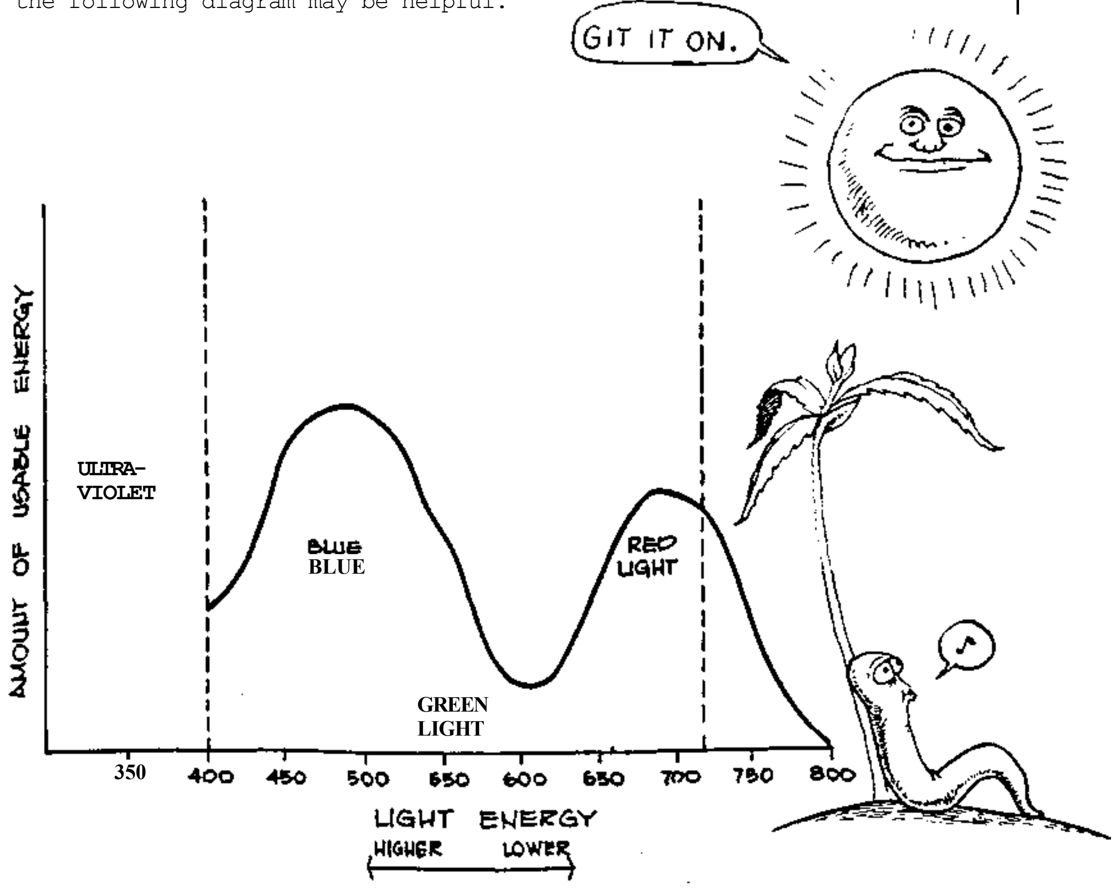
PHOTOPERIODICITY

The number of hours of light which Cannabis receives each day has direct and dramatic bearing on the size and complexity which it will attain in its life, how long it will take to reach maturity, how healthy it will be and how well it can withstand environmental variation, and the quality and configuration of its sexual expression.

These considerations are further broken down into two fundamentally distinct growing states—indoor and outdoor cultivation. We'll deal with sore general lighting period principles and then go into the differences between the two types of cultivation.

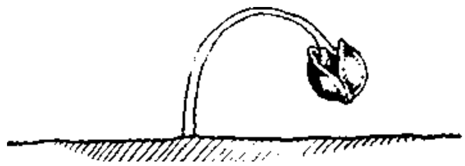
LIGHT SOURCES

Cannabis reacts to the visible spectrum of light, and certain parts of this spectrum are more active than others. To get the concept of spectrum clear, because we'll be dealing with it a lot, the following diagram may be helpful.

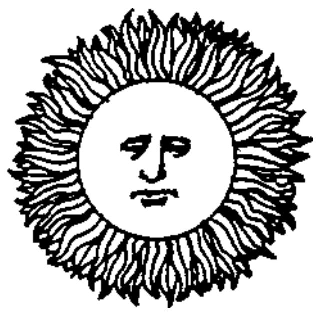


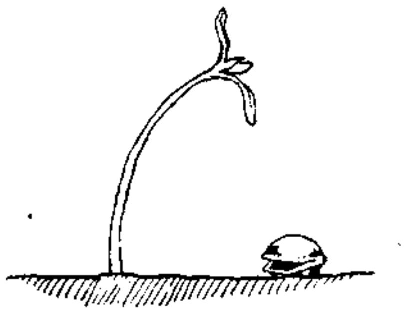
It may be very helpful to keep this spectrum-energy chart in mind throughout the book. The normal light-bulb which is used to provide indoor illumination emits light predominantly in the red to infra-red range. Thus, green light is very low energy with well over half of the emissions being in the almost worthless invisible infrared part of the spectrum. Many plants have been ruined by people who in good faith rave believed that putting a blue filter in front of such incandescent bulbs produces blue light, which they have been told is beneficial to plants. Blue light is high energy light, and plants do need a certain amount of this to go through their photo-synthetic processes efficiently. But what you get 'when you put a blue filter in front of a source which is emitting primarily red light is not blue light—-the filter does not generate light, it only passes the remnants of what is being generated. So what you have here is a very small amount of predominantly green light being passed, and green light is the least active part of the spectrum in supporting photosynthesis. If, because of cost, you want to use regular light bulbs in your growing situation, you should make sure that you have at least one 75 watt bulb, or its equivalent, per plant, and should put some sort of filter between it and the plant which limits the infra-red emissions reaching the plant. This filter will aid in keeping your plants sexually stable.

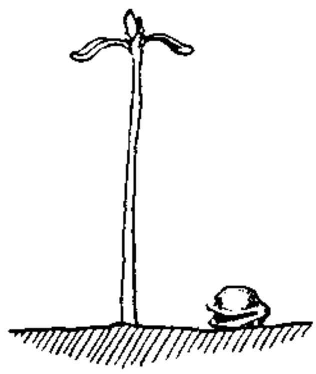
An additional caution—-overexposure to infra-red light at the earliest stages of seedling life will prevent the plant from standing erect. In order to raise itself and spread its embryo leaves, the plant must absorb red light at about 660 on the spectrum. This promotes the growth of longer cells on the inside of the curved portion than on the outsides, pushing the plant erect as though there were extensor muscles at work. Exposure to far-red and infra-red light, however, cancels this effect and the seedling will remain bent over.



Without adequate light, seedling can't muster energy to stand erect







With adequate light,

growth processes proceed normally

Several authors have stated that infra-red is beneficial to Cannabis, and so it would seem, on the surface, that you would not want to filter the infra-red. As we saw earlier, what infra-red does is limit the energy available to the plant producing, in effect, a paroxysm resulting in elongation. If you are worried that your plants are being deprived of infra-red, and not certain that it doesn't have some beneficial effects (some research would tentatively support your viewpoint) then you can supplement your incandescent lighting with short bursts from a flood designed to emit high intensity infra-red, and note the results. In some cases, this may be beneficial, though no one has yet established precisely why it should be. At any rate, this additional trouble and expense is your decision.

Mercury fluorescent lamps are a considerable improvement over the usual light bulbs we've been discussing, though may burn out quickly and are more expensive. Mercury emits a very high energy spectrum, and limits the amount of red and infra-red your plants will receive. An additional advantage is that mercury fluorescent lamps operate at very high intensity, which will give you a long-day effect without the necessity of burning them for sixteen, or twenty hours at a clip. We'll get into the details of long-day effects in the indoor growing section later on in this chapter.

The most useful artificial light source which is readily available for indoor cultivation is the wide-spectrum, gas-discharge lamp, many varieties of which are marketed under various trade names. Perhaps the best known is the Gro-Lux lamp, which, though it is pretty expensive does a good job of providing plants with the energy.

let's take a little side trip into the whole relationship between wavelength and photosynthesis which may be helpful in understanding what the plants, all green plants, but particularly Cannabis, are doing with the energy they draw from the sun.

The controlling processes in photosynthesis begin at the atomic level, with the nucleus of the atom and its electron ring. Each orbit around the nucleus of an atom has a variety of potential energy levels at which electrons can move and still remain, in orbit. If the electrons exceed the energy limits of their orbits they are forced to leave—-to move into an orbit further from the nucleus and therefore an orbit which requires more energy to complete. This movement is the famous quantum leap which we have been using for years to describe an exponential increase in energy required to move from one plane to another. Knowledge, among other things, seems to operate according to this principle—-you can acquire vast amounts of knowledge and still remain on the same plane, but there comes a point where the cumulative knowledge in your head—-the cumulative creative energy you're trying to deal with—-requires a leap into another plane. Once you've made that first leap, you realize that, while knowledge is a cumulative process, it is not a progressive phenomenon. You do not move from plane to plane in a smooth, harmonious progression merely by storing up knowledge. You move from level to level, but always within the same orbit or plane, until you reach a point where you can no longer contain the creative energy you have been accumulating and remain within the same plane. So you make the quantum leap. And find yourself starting all over again, gathering energy on another level, always with successive levels above you, levels which are accessible only through the accumulation of vast amounts of knowledge, until once again the leap is within your ability.

The life process of photosynthesis in plants proceeds in this way, by quantum leaps of the atomic particles into a higher, more energetic plane. Following this leap, the electrons lose energy, their orbits decay, and the quantum leap occurs in reverse, liberating energy is the fall from the outer orbits to the inner orbits occurs. It is this energy, made possible by decay in the orbits of the excited electrons back to their original plane, which drives the engines of life. This is the conversion process which is essential to all life on earth. Without the ability to perform this leap and the subsequent energy-liberating decay of electron orbits, all life would disappear and the earth would be stone and sand.

So you are very close to some very essential things when you are manipulating the light your plants receive, and there is no replacement for knowledge and understanding in dealing with these processes. You are moving close to life itself, to the process if not the meaning, so watch your step.

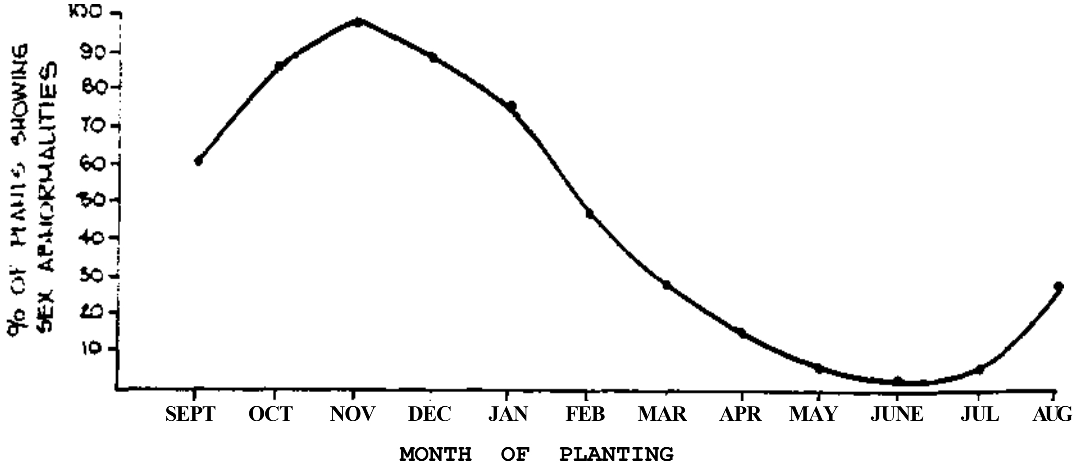
FOR OUTDOOR CULTIVATION

We'll use, as a reference point, a line drawn between Washington, D.C., Louisville, Kansas City, Colorado Springs and San Francisco. Along this line the hours of sunlight available throughout the year break down approximately as follows:

June:	**Sunrise 4:30-5:00 a.m.** **Sunset 7:00-7:30 p.m.**	
	Hours of Sun light=approx.	**14**
September:	**Sunrise 6:00-6:30 a.m.** **Sunset 5:45-6:15 p.m.**	
	Hours of Sun light=approx.	**12**
December:	**Sunrise 7:00-7:30 a.m.** **Sunset 4:30-5:00 p.m.**	
	Hours of Sun light=approx.	**9**
March:	**Sunrise 5:45-6:15 a.m.** **Sunset 5:45-6:15 p.m.**	
	Hours of Sunlight=approx.	**12**

This breakdown is deliberately very loose, and does not take cloud cover into account. Therefore, the amount of effective sunlight will vary considerably. Nevertheless, some generalizations are possible which help greatly in determining the optimum planting times for Cannabis along this line, and if you are located either far north or far south of this line you will be able to adjust to fit your own seasonal picture.

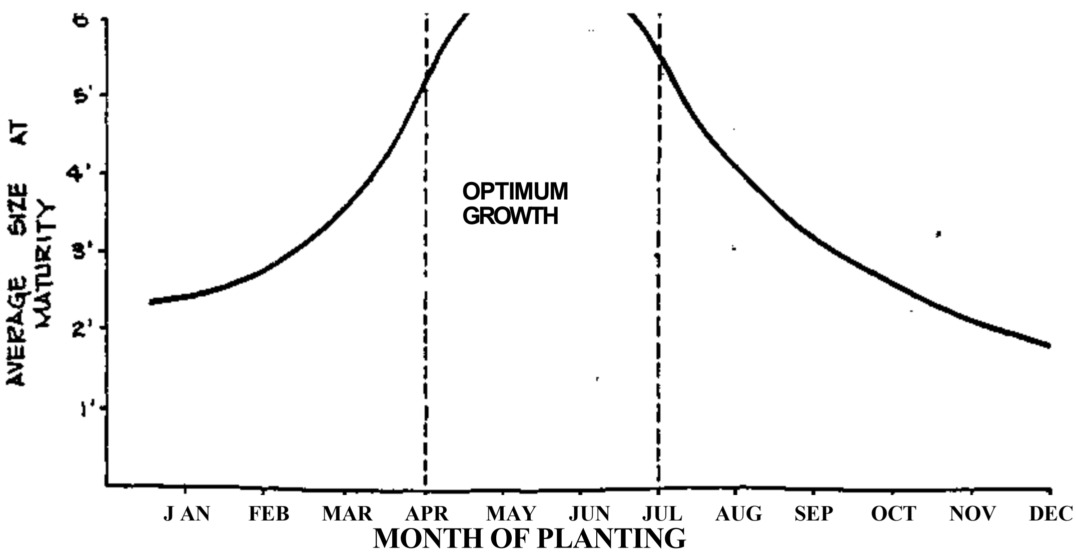
First of all, there is an important curve to consider which shows the effects of the timing of out-door planting on sexual expression in Cannabis.



As was pointed out in an earlier section, Cannabis has the potential to become either male, female, or hermaphroditic in response to threats from the environment. In this case, the chart represents the plant's response to the energy levels available from the environment. It becomes immediately clear, upon inspection of the chart, that the ideal times for planting along the D.C.-San Francisco axis, fall between early May and early August. This takes into account only day length, of course, and when other factors are figured in, it becomes clear that May is the best planting month for all-around good performance of the plants.

This condition will hold, incidentally, in any situation where you depend only on sunlight for energy for your plants, whether they are growing in a field or under greenhouse glass.

There are other effects of outdoor sunlight day-length which are worth noting briefly. If, in place of the curve on the sex-reversal chart, you substituted a chart showing size at maturity, you would find the relationship looks like this: **WASH DC- SF AXIS**

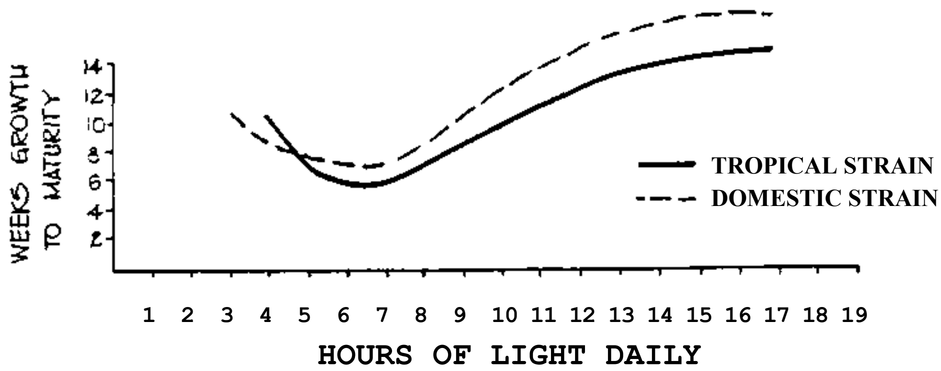


EFFECTS OF LIGHTING TIME

Daylength	Effects
2-3 hours	Very poor chances for survival; radically stunted growth; very little vegetation; weakness; seeds are worthless even if produced; death can be expected within a few weeks.
4-5 hours	Rapid initial growth for some plants; growth tapers off after a few weeks; large portion of seeds sterile; very little vegetation; mature height is stunted; plants are weak and pale; resin production is low; sexual character confused; leaf index low; leaf mass light; branches opposite and alternating; low female survival rate.
6-10 hours	Growth period lengthened, especially in artificial light; good vegetative development of most plants; sex ratios exceed 1:1 female, with 15-100% more females than males; sexual expression less confused, but flowering somewhat inhibited; seeds are viable; stem elongates and thickens; internodes spaced out: branches predominantly opposite; resin production increases.
11-15 hours	Height at maturity increases; flowering is delayed considerably; seeds are viable; resin production is high; stem is strong; sex ratio dips a bit; sex expression is clear; growth period may be shorter than 6-10 hours in some strains; branches usually alternate; leaf index increases.
16+ hours	Height not increased further; excellent flower and leaf mass; strong production of resin; female survivorship lowered a bit, and sex ratio appears at 1.5:1 female; seeds have slightly lowered vitality; internodes occur between 7-10" along stem; leaf index high.

As was mentioned above, a great many of the effects of altering the energy input will be regulated by the nature of the plant's hereditary character. This character is in part determined by the origin of the particular strain which you are using for seed. If your seed is first generation; that is, if it has come from somewhere else, you will find a good deal of variation in its resposes to photo-period. After three generations under your care, you will be able to predict, rather accurately, how your plants will react to photoperiod.

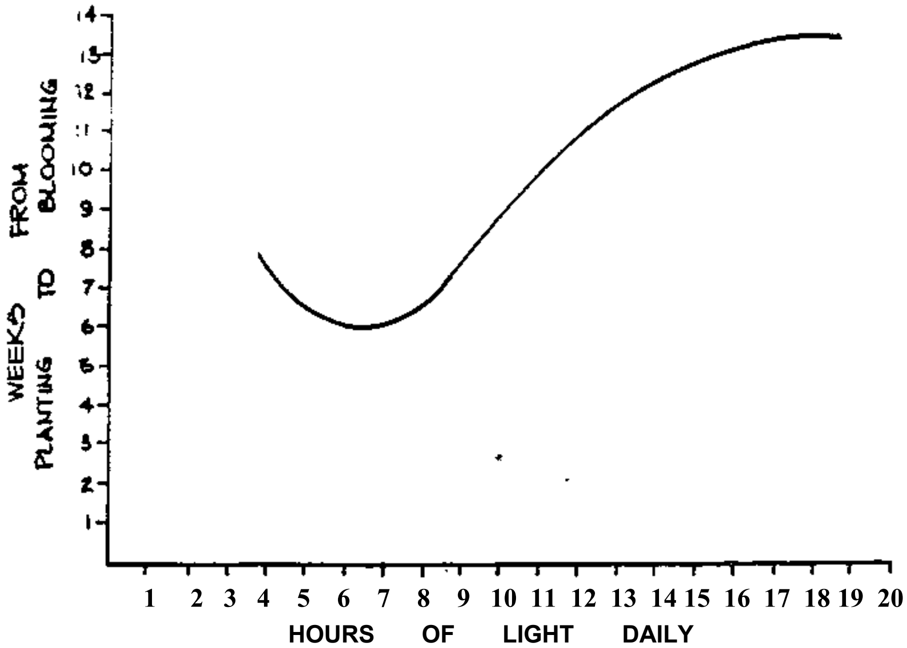
The major source of hereditary variation in response to photo-period is whether the seed comes from a long-day strain or a short-day strain of Cannabis. The only concern that will affect most cultivators is that the point of diminishing return for increased hours of light per day is reached sooner with short-day strains than with the long-day varieties. This shows up clearly in the growth cycles of the two types of plants illustrated in the following chart.



As you can see, the break-even point for the two strains occurs at about 7 hours of light per day, with increasing differences after this point showing less return per hour of light expended for the short-day than for the long-day plant. One could draw similar charts for each of the variable illustrated in the table detailing the effects of day length, but this variation just isn't that critical. The only time you would have to worry about short vs. long day differences is if you were going to have to limit the light your plants were getting. In that case, you would be far better off using seeds which came from an area where short days were the rule rather than the exception. Luckily, most of us won't have to hassle with this problem.

Another remote possibility for problems which might arise involves the use of growth stimulants such as gibberellins in combination with long exposure periods. The rule here is that long-day strains will benefit from the combination of stimulants and long exposure, but the effect with short-day strains seems to be a mutual cancellation of the effects, leaving you right back with the same growth pattern you would have had without the use of either. If you plan to use gibberellins, then, make sure you have a long-day plant strain first; otherwise, there will be very little gained.

The last important relationship between growth activity in Cannabis and the amount of light which it receives is shown in the following chart. Keep in mind that blooming marks sexual maturity, and that height has very little to do with maturity. Thus, you will see in comparing this chart with others in this chapter, that while you can get a mature plant relatively quickly by using short photo-periods, it will be very short of stature and with sparse leaves.



We have been presenting a lot of information in the form of charts, graphs and tables, and hopefully we have clarified some complex relationships. It is important to remember that a graph or chart represents a pretty ideal state, and it further assures that all other conditions are being held constant. In real life, of course, this will not be the case——conditions will vary simultaneously with one another, and the effects of this variation on the growing plant will be difficult to predict from any one table or chart.

So, it is helpful if you approach cultivation of grass in a frame of mind where you are able to see and deal with the necessary tradeoff situations you will encounter. Keep flexible in your interpretation of the charts, using them as guides and not as absolute predictors of the results you are going to get.

HARVESTING AND DRYING

If you've given normal care to your crop of Cannabis, by the time harvest cones you will have put a lot of thought and energy into the plants, and they will be ready to give back what has been invested.

A little care in drying your plants will assure that they will retain the potency and vigor which is present at the moment that they are severed from their roots.

It almost seems too elementary to point this out, but the object of drying is to remove enough moisture from the leaves so that molds can't survive, enzymes can't go to work, and the processes of organic decay, which thrive on water, cannot set in as far as the resin is concerned.

The two factors over which you will want to have some control during drying are (1) the flow of air around the drying plants, and (2) the temperature and moisture content of that air.

Moisture being removed from the plant tissues must be converted to water vapor and then pass from the interior cells of the leaf on through the skin and the stomata and out into the air. The air which is to take up this water vapor should be circulating freely so that it doesn't get saturated and thus resist further uptake. If this happens, the leaves will not dry evenly and thoroughly. A second thing to watch for is that the temperature isn't too high in the drying chamber.

If it is, the water vapor near the surface will boil off quickly, creating a dry gap between the surface of the leaf and the moist interior, causing the skin tissues to shrivel up and resist any further water passage. The water will then be trapped permanently in the interior of the leaf, and the resin content will deteriorate far more rapidly than if it were not exposed to moisture.

When you have decided to build a dryer, there are a few basic sorts of computations it will be helpful to make.

Under normal atmospheric pressure, a drying room with 200 cubic feet of air at 32 F can only hold about an ounce of water vapor. Raise the temperature and you raise the water carrying capacity of the air. For a 200 cubic foot room, the temperature/water curve looks like this:

TEMP.	WATER
32 F	1 oz.
70 F	3.5 oz.
100 F	9 oz.
150 F	33 oz.
200 F	95 oz.
212 F	120 oz.

For a 100 cubic foot drying room, divide by half; for a 400 cubic foot room, multiply by two, and so on. This chart assumes that the air will be perfectly dry to begin with, which except in special cases will probably not be true. You can expect your grass to contain about 25-35% water by weight when it is harvested, so this should form a pretty good basis for estimating how much water you are going to have to draw off. You can figure on about double the capacity of the room's air at one of the above temperatures if you replace the air on the room twice an hour, three times its capacity at temperature if the air flow is 600 cubic feet per hour, and beyond that the air will be passing through too quickly to absorb what is coming off the plants, so the calculations get screwed up a bit. But since we are building a dryer and not a wind tunnel, there isn't much need to worry about replacing air that fast.

While you probably won't be passing more than 600 cubic feet per hour through a 20" cubic foot capacity room, it is important to get good air circulation within the room, so that all the leaves have an equal chance to discharge moisture. This means distributing the air and keeping it moving. If it gets saturated passing through the first few trays, it will probably cool and precipitate out some of its moisture on those trays near the vent ducts; and you'll wind up with soggy trays on top, and dry trays on bottom.

You will probably want to base your calculations on how much time to allow your plants for drying on a drying temperature of between 120° and 140° F. Stick with temperatures near the 120° F level in the beginning of the process. If your vents, both intake and exhaust, are big enough to give good circulation without losing temperature too rapidly, you won't have to worry about saturation problems. In the drying chamber we'll look at shortly, the 200 cubic foot model, two square feet of vent space at either end should be plenty, but since conditions like humidity will vary from place to place, it is a good idea to plan on experimenting a little with vent size. There will also be substantial differences in things like leaf thickness and surface area between crops, and these will help in making each drying box an individualized contraption. You can do test runs in
Your dryer with any green leafy material, checking the trays for uniform drying and changing the vents around to suit your requirements.

Your calculations will look something like this:

I have 100 pounds of grass, good heavy leaves arc they look pretty thick, so figure closer to 35% water content. This gives me approximately 35 pounds of water to be drawn off. Setting the temperature in my 200 cubic foot dryer at 120° F, I can run 600 cubic feet of air an hour through and expect to draw off maybe 45-50 ounces of water an hour, figuring for a fair amount of humidity in the air already. That means about three pounds of water an hour, so along about the tenth hour I better start checking to see how they're coming. Probably it will take closer to fifteen hours, though, because of the leaves' thickness.

Anyway, that's one way of gauging your time in drying, and gives you a rough estimate of how long you should leave your plants in the dryer to get them dry enough for storage.

All this assumes that you are not going to hang your crop out in the sunshine to dry, which probably won't happen unless you are really far out in the country, over the river and through the woods. One other consideration, before we run down the dryer plans—if you put the whole plant in the dryer at first, after the leaves begin to show surface dryness, you should sever the leaves from the branches, or at least cut the branches off of the stem. There is a lot of moisture in the stem of the plant, and if it remains attached it will delay the drying process a very long time. Conversely, if you're drying only the leaves, cut your time estimates by about 40% from the examples given above, to compensate for the water which is isolated in the stem and thus irrelevant to the drying process.

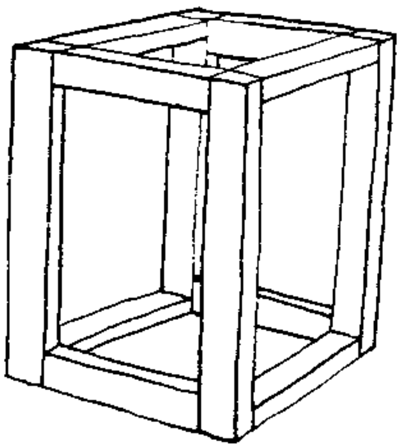
CONSTRUCTION OF THE DRYING BOX

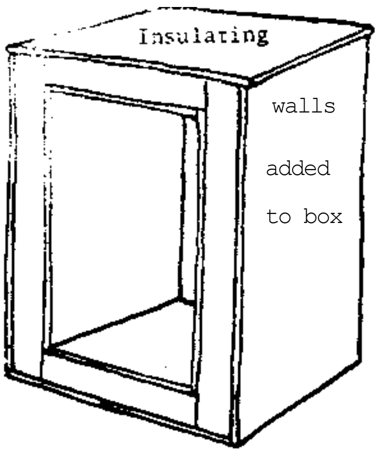
The Department of Agriculture is a true friend, particularly when it comes to giving really helpful advice on how to do some very groovy things with very little bread. In Farmers Bulletin #1231, Drying Crude Drugs, we are given details for construction of a shed which is designed for drying drugs, and it works particularly well for Cannabis, though USDA didn't point that out specifically. Some-were in pentagonland, however, there is at least one head on the side of the angels.

There are, of course, multiple uses for this little shed, and no herb gatherer should be without one. In the same bulletin we are given plans for a thousand pound capacity dryer, but we'll go on the assumption that very few Cannabis cultivators are going to be this ambitious.

The first step in construction is to lay out and nail together an upright rectangular frame of two by fours. The base of the box should be square so that the trays, also square, will get equal air flow over all surface areas. If the box were deeper than wide, uneven drying would probably develop near the back. USDA recommends trays which measure 3' x 3', so the inside dimensions of the box would have to be about 3'1" x 3'1". The upright frame should then be covered inside and out with an insulating material, so that you have smooth walls with an insulating space between. You can fill this space or not, depending on what can be salvaged or bought in, your area.

Frame for drying box



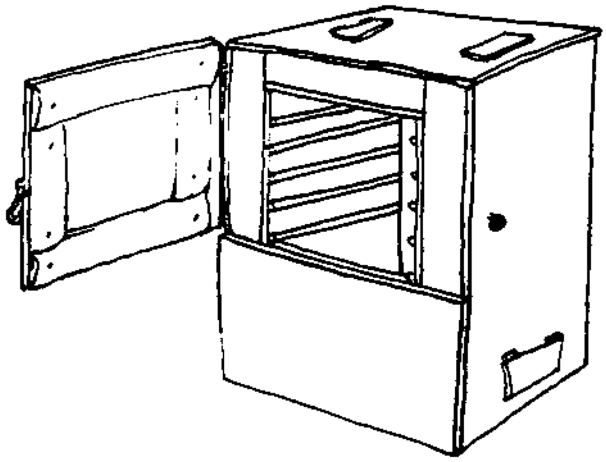


Cleats of wood or aluminum are then nailed on the inside walls to serve as runners for the trays. The positioning of these runners will depend on how many trays you want to have in the box, but the bottom tray shouldn't be too close to the heat source on the floor.

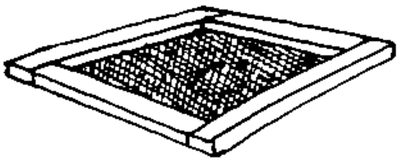
on one side of the box you should have a hinged, sealing door which can be opened to slide the trays in and cut for inspection without opening up a whole side. You can install a plastic panel in one of the sides if you are fussy, but it will probably fog up in the drying process.

The trays should be made out of strip lumber approximately 1" x 2" which is nailed together in a frame with outside dimensions of 3' x 3' as mentioned. To this frame you then staple a wire mesh, one-quarter inch mesh is recommended. After the mesh is in place, you will want to attach strips of lathe across the bottom of the tray, front to back, to help the mesh support the weight of the drugs.

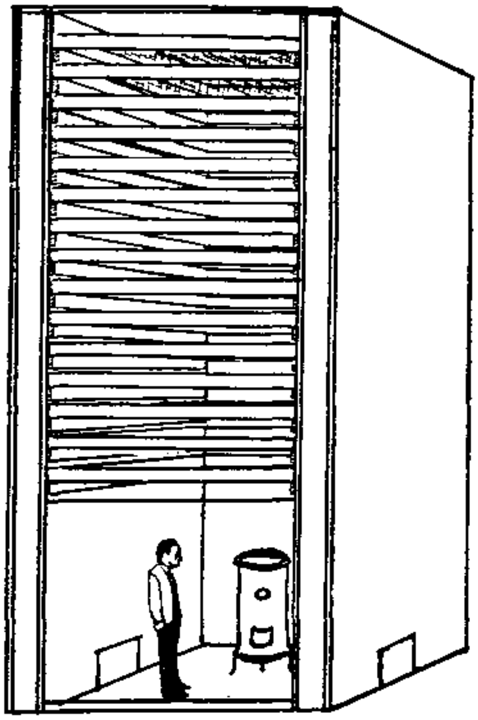
The vents will be located at floor level and in the roof of the box, and they should be adjustable. Putting louvered windows in would be a gas, but pretty expensive. A simple adjustable trap door arrangement will work just as well.



Finished small-capacity drying box



Detail of tray



The government's idea of what a drug dryer should look like

The heat source will sit on the floor, and can be anything you want, from a wood stove to an electric heater. If you can use a heat source which operates on a thermostat, so much the better for control of the drying process. You should place a baffle between the heat source and the first tray so that direct heat doesn't reach the drugs.

This dryer should be used indoors in cold and/or damp weather, unless it is adequately insulated.

The drying trays can also be used as sorting and cleaning trays, and you will find that placing a sheet on the floor under the dried leaves and giving each tray a good jostling, starting with the bottom tray, will separate almost all of the seeds and small twiggy stuff.

MAKING A GOOD PLANT BETTER

HOW TO GROW SUPERGRASS

We've run down **a** great many factors having to do with the health and vitality of Cannabis, and we've been pointing out various ways you can stimulate your plants to produce maximum leaf mass and resin production. The issue of real interest, once you have the ability to grow tall, leafy and healthy grass, becomes how to assure that the plant will produce a drug of uniform quality and high potency. There's an awful lot of pure bullshit associated with this problem. Many people believe that drug potency has something to do with climate, soil, harvesting technique and the like. The real dope, as far as a scientific explanation is concerned, is that drug potency in Cannabis Sativa is directly related to the genetic properties of the plant. These genetic properties can be easily manipulated, and there is no reason on earth why the very best grass can't be grown as easily in Anchorage as in Guererro, nor is there any reason that Missouri mediocre can’t become Ozark outasight.

ONLY SECOND AND SUBSEQUENT GENERATION PLANTS ARE SAFE TO USE

Changes in genetic makeup of a living organism can, under positive conditions, be transmitted to its surviving offspring. One of the many simple changes which can be transmitted in the plant kingdom is an alteration in the number of chromosomes in the cells. Doubling or tripling the numbers of chromosome sets in a cell induces a change known as polyploidy. Plants with two complete sets of chromosomes are known as diploid strains, with three sets as triploid strains with four sets as tetraploid strains, and so on. One of the most dramatic changes which takes place as a plant moves from the normal diploid state to the polyploid state is an increase in the plant's overall strength and vitality. Associated with this change is an increase in the quality of foliage, a richer color, better leaves, fruits, flowers, and all around good looks.

Under normal conditions, Cannabis is a diploid plant. This may be thought of as an equilibrium state in a large population of plants growing in the wild, with ready access to the genetic material of many other normal plants. Occasionally, under certain conditions, a strain of Cannabis develops which is polyploid. This is the reason that exceptionally potent grass is associate with these places—areas like the State of Guererro in Mexico, the hills of Panama, parts of the Middle East, and so on. This fact has led, in turn, to the erroneous conclusion that there are certain factors— soil, climate, etc.—associated with these places which cause the superior potency, and has caused a lot of people to despair of growing superior grass because they couldn't duplicate these growing conditions. It is time that this mistaken notion was laid to rest.

In the early Forties this country was hard at work trying to produce a Cannabis strain which would yield a superior quality fiber without any of that "undesirable drug, Marijuana." The Axis powers had cut off our supply of hemp from overseas, and our Navy didn't have anything to pull on while chanting yo-heave-ho, which left a lot of sailors feeling pretty silly. The chemical companies hadn't come up with their miracle fibers yet, and so mankind was still dependent upon the natural order for the war effort.

In Washington, a man named H.E. Warmke was hard at work under Government contract trying to produce a plant which would tie up ships without turning on the troops, and he kept reporting failure. He was messing around with the genetic makeup of a diploid strain of Cannabis, trying to make rope, and he kept increasing the potency of the stuff. Poor Government, what to do?

H.E. Warmke disappeared from the hemp scene after his last report in 1943, leaving cultivators a legacy which, until now, has been buried in an obscure and unlikely little place. He should now become a folk hero, because H.E. Warmke has given us a method of inducing chromosome alterations in Cannabis which will lift the normal diploid out of its genetic rut and into the rarefied state of polyploidy.

In the third and fourth decades of this century, rather extensive work was done here and in Europe on the alkaloid Colchicine, which is found in the seeds and corms of saffron. It is a toxic substance often used for treatment of the gout. The use of Colchicine to induce polyploidy has become standard practice in the plant breeding Industry, and many of the contemporary ornamental plants owe their luxuriousness and vitality to the presence of double sets of chromosomes induced through Colchicine treatment.

Colchicine acts only on plant cells which are in the process of division, so to be effective, it must be applied to those regions where there is a high proportion of dividing cells. There are three areas of interest to cultivators of Cannabis—the germinating seed, the rapidly sprouting seedling, and the growing tip of branches and Stems. H.E. Warmke reported failure—-he grew very potent Cannabis, potent far beyond the range of the normal diploid female, with the use of Colchicine to induce a polyploid state.

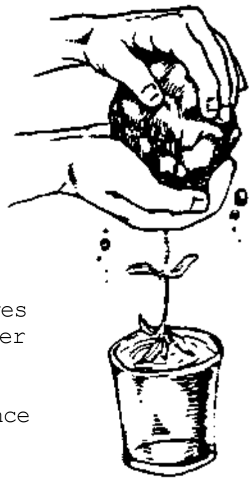
But let's put in a warning right here: COLCHICINE IS A HIGHLY POISONOUS SUBSTANCE. IT CAN KILL YOU. NO RESEARCH IS AVAILABLE ON THE EFFECTS OF SMOKING OR INGESTING FIRST GENERA-TION CANNABIS WHICH HAS BECOME POLYPLOID THROUGH COLCHICINE TREATMENT. IT IS NOT KNOWN WHETHER COLCHCINE IS METABOLIZED OR NOT. SO ONLY SUCCESSIVE GENERATIONS OF CANNABIS—GENERATIONS NUMBER TWO ON OUT—-SHOULD BE CONSIDERED SAFE. In addition, great care should be exercised in handling Colchicine. It should not come in contact with the skin, the eyes, or anything else.

You will probably need a prescription to obtain Colchicine, unless you have a pipeline to a biology lab.

One way of treating Cannabis with Colchicine is to add Colchicine to the starting solution in which you soak your seeds before putting them in the germination beds. Use a strength between 0.05 and 0.15% Colchicine in distilled water. Many of the plants will fail to germinate. This is the effect of Colchicine. Those plants which do germinate and survive will be polyploid Cannabis. The problem with using Colchicine at this period of the plant's life is that the embryo is going to have a very tenuous grasp on life anyway, and the jolt from this poison will finish off an inordinate number of them.

A second, somewhat more satisfactory, but more complicated method of treatment involves plants which are two to three weeks old. Plants chosen for the treatment should be very healthy. If you plan to give the treatment at this stage, it will be best if you carbine the treatment with transplantation. This means that the plants will have to stay in their germinating beds longer than usual, and so the beds should be large enough to handle the root systems which will be developing.

Proceed with transplantation in the normal manner; but, because the transplant won't be finished as quickly as usual, the roots and ball of soil should be protected from light, heat and drying out. Holding the ball of soil gently, invert the plant and immerse the growing tips and topmost sets of leaves in a solution of .05-.15% Colchicine. Hold the plant in the solution for a minute or less, and then proceed with the transplant. Make sure that none of the solution dribbles down to get onto the roots. This will kill the plant for sure. Many of the seedlings will die anyway, but those which survive will be polyploid. So will their offspring.



Proper way to hold seedling for

Colchicine dip

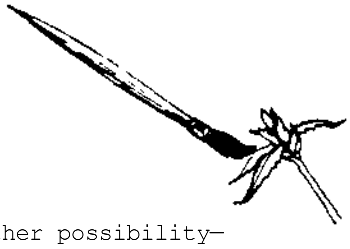
There is a third method for treating Cannabis which involves waiting until the plants are at least 10" high, but anytime after that is all right, too. The only thing with this method is that the whole plant won't be polyploid, only the treated portions. The benefit derived is that the plant as a whole has a good chance of survival.

Treating the plant with this approach can involve several alternative operations. The easiest is to place a little container of the .05-.15% Colchicine solution next to the plant, bend the growing tip or the tip of one of the little branches over and tie it down gently so that it is immersed in the solution. An hour or so at a time is adequate, but plants are going to vary in their health and so there are no absolute limits. Be prepared to lose a few plants, and experiment a little. This operation should be repeated several times, leaving a couple of hours for recovery between dips, and then discontinued to allow the plant to recover. Those parts which have been immersed will wither and appear to die, but sate will regenerate and will have become polyploid.

Treat the plant very gently

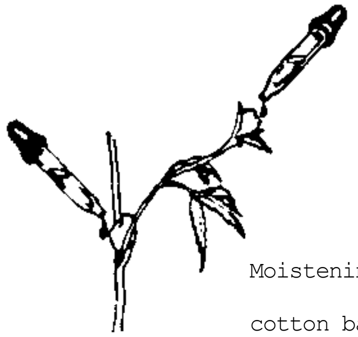
while dipping and tying

Another way of going about essentially the same thing is to lodge little balls of cotton between the youngest leaves at the growing tip and at the nodes and moisten the cotton occasionally with some of the Colchicine solution. This operation can be kept going for several days, after which the cotton should be removed and treatment discontinued.



Another possibility—

brush on some Colchicine



Moistening the

cotton balls

The first noticeable results of Colchicine treatment will be, as mentioned, immediate growth retardation lasting anywhere from days to weeks. The higher the strength of the solution and the lower the overall health of the plants, the higher an attrition rate can be expected. No matter what, sane of the plants will not rake it. As the survivors recover and grow, the parts which develop will usually be disfigured and abnormal in appearance. As growth continues, however, the defective tissue is sloughed off or left behind and the new branch and leaf tissues will become relatively homogeneous, and sane should have become polyploid.

You will be able to distinguish polyploid areas from diploid because they will be thicker with more, darker green leaves, larger flowers and seeds (ultimately) and they are more hairy (though Hemp, does not exhibit markedly increased hairiness as a rule).

There is a relatively simple plant breeding technique which night be used by serious cultivators of Cannabis in establishing a polyploid variety. After Cannabis treated with Colchicine has resumed growth and polyploid stems become distinguished from diploid, buds which are in the axils of polyploid leaves can be forced into growth and will produce an entire branch with polyploid characteristics.

The suggested procedure would be to take a treated and fully recovered immature female Cannabis plant, locate the buds in question and cut off the end of the shoot from that leaf outward. The bud will then be forced into growth, and flowers and seeds produced by that shoot upon maturity of the plant will be polyploid in character. Offspring produced from those seeds will, then, bee largely or wholly polyploid and therefore higher in drug content and potency.

So there you have it, courtesy of the U.S. Government! BUT PLEASE REMEMBER, ONLY SECOND AND SUBSEQUENT GENERATION PLANTS ARE SAFE TO USE, BECAUSE FIRST GENERATION MAY CONTAIN ENOUGH LETHAL COLCHICINE TO KILL! PLANTS TREATED WITH THIS STUFF ALSO SHOULD NOT BE GROW WHERE ANY PERSON OR ANIMAL CAN GET TO THEM!

PLEASE BE CAREFUL!

PRODUCING AN UNRECOGNIZABLE HYBRID

In the course of its investigations in the early 40's, which we've just mentioned, aimed at producing a hemp plant which was long on fiber and short on the active drug principle in marijuana, the U.S. Government also sponsored extensive research into methods of altering the vegetative characteristics of Cannabis Sativa. This research effort covered much old ground, in most cases repeating the genetic manipulation experiments of the twenties, out there was a good deal of original and innovative work done as well

Perhaps the most significant work done on alterations of appearance was sponsored jointly by a private foundation in Washington and a major eastern university, in work done for the government as part of the war effort in searching for the strong fiber/no drug hemp plant strain. These research efforts resulted in some spectacularly unsuccessful plants, which were hybrids as potent as "good drug quality Cannabis Sativa" but which were botanically of an altogether different genus. The report states that Reciprocal grafts were made, at ground level, between...hemp and hops, (Humulus Lupulus). Those combinations in which hemp stems were grafted onto hops roots failed, but the combination of hops stems on hemp roots were successful and permitted assays to be made, Hops leaves from these unions were found to contain as much drug as leaves from intact hemp plants, even though leaves from intact hops plants were completely nontoxic." H.E.Warmke was right in there once again.

There are many reasons why cultivators might wish to grow hybrid hops/hemp, and we won't indulge in speculation on these reasons. If you hanker to grow some of these freaky plants, however, there are a series of relatively simple steps which may be undertaken with good chances of success in creating the hemp/hops hybrid.

Grafting is not a fundamentally difficult operation in most cases, though certain conditions should prevail to assure success. The primary consideration is whether or not the scion (the plant part to be grafted) and the stock (the plant part to receive the graft) are closely related, preferably within the same botanical family. Hops and Cannabis are closely related plants, though *in* appearance they are quite distinct, and so there are no problems with this form of incompatability. This botanical similarity is not in itself enough to assure success, however, because botanical classifications are based largely on the reproductive characteristics of plants, and not on the total range of compatable conditions needed for solid and viable grafts.

A second potential hangup in grafting plants is the biochemical similarity or dissimilarity of the scion and stock donors. Again, Cannabis and Hops Share quite similar biochemical constituents, particularly those of the tissue fluids and the organic composition of the mature plant.

A final requisite pre-condition to successful grafting is that the fluid-carrying tissues achieve close, uniform contact at the graft, or at least that they can be locked in close enough contact in the graft that the essential plant fluids cam circulate. So not only should the gross structures match up, but the fluid carrying tissues should be closely related in structure, and this condition is adequately met in the hemp/hops graft union, provided the graft takes place at certain points in the growth cycle of scion and stock. These points will be covered later in the chapter.

Grafters attempting the hops/hemp union should attempt to get shoots from polyploid hops—the same rationale applies for the hybrid plants as applied for potency in grass. Two polyploid strains of hops available commercially are Brewer's Gold and Bullion Hop.

PREPARATION OF THE SCION AND STOCK

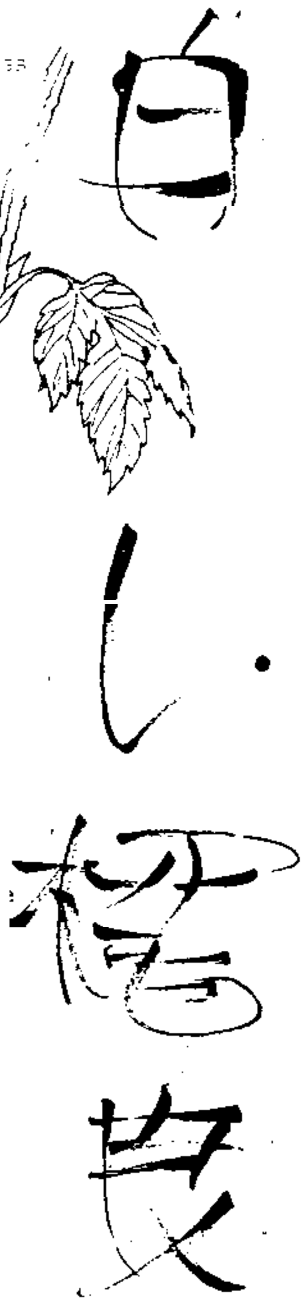
The graft which is suggested to cultivators by the experimental results described earlier is between the roots of Cannabis Sativa and the stem or shoot of Humulus Lupulus. As is the case with many drug plants, the active principle in grass sears to be manufactured in or controlled by mechanisms found in the root. The method commonly known as wedge-grafting seems to be most suitable for this particular combination of plants, and several methods will be dealt with so that cultivators will have a choice of approaches to their task. These variations are known, respectively, as the straight wedge, or cleft, graft; the wedge graft in the cotyledon stage; and the growing point wedge graft. These methods and others are thoroughly and competently discussed in many books on the subject, and perhaps the best of the lot is the book by Garner (1958) which is cited in the bibliography and which should be reviewed if available.

WEDGE GRAFT

Simple wedge-grafting is the most straightforward approach available to those who want to perform the hops/hemp operation. The scion of hops is prepared by selecting a shoot which is vigorous, polyploid if possible, and which is the same diameter at its base as the Cannabis stock is at the point where the stem is to be severed. The Cannabis stock should be, for this method, about five to six weeks old and it should be a well-established and healthy plant. Cultivators who have been supplementing their young Cannabis plants with stimulants or powerful organic or synthetic nutrient solutions should be especially careful that the root system of the plants chosen for stock are strong and well-founded in the soil. The hops scion may be obtained either by growing hops plants from seed; or cutting; or may, in some cases, be purchased from a reputable nursery.

The Cannabis stock is prepared by splitting it at the top, where the plant has been severed about an inch and a half above ground level, lengthwise for about one-half to three-quarters of an inch, using a thin, sharp blade.

After the Cannabis stock has been prepared as shown, the scion of hops is inserted so that there is a good match between the fluid carrying tissues. The scion is then tied in place with raffia, a thick, flat rubber band, or any similar flat tying material. flat is desirable because it distributes the binding force equally over the union, encouraging circulation of fluids and uniform healing of the wound. There should be a minute portion of the raw tissue of the scion hops protruding just above the top of the stock when the graft is tied off.



Hops scion is formed by cutting the basal end

in the form of a wedge. Use a sharp, thin blade.

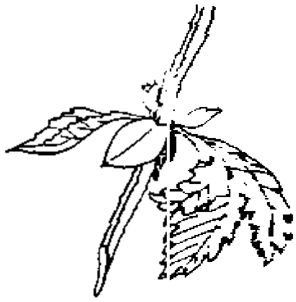
This graft requires the use of a sealing agent. Commercial graft sealing agents should be totally satisfactory, or the really purist cultivator can concoct his own from any one of several recipes avaiable at nurseries where the waxes, tallows and pitches are sold. Many cultivators find that crude petroleum jelly works very well as a graft sealing agent, but this should be used only when the tying material is not rubber, because rubber deteriorates and will break before the union is strong if it is exposed to crude petroleum jelly. Jelly, however, has the advantage of being cheap, plentiful and easily available.

COTYLEDON WEDGE GRAFT

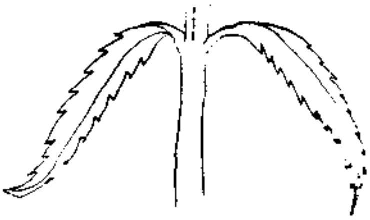
The second grafting method we'll cover is the wedge graft at the cotyledon stage, which has several advantages over the method just outlined, and which may appeal to some cultivators. This graft is normally successful over a wider range of plants than the simple wedge and has shown good experimental results when used with a hemp stock and hops scion.

When the Cannabis seedling has developed its first pair of true leaves, sometime during the second week under normal conditions, the cultivator may initiate grafting procedures or may wait until the second pair of leaves develops a few days later. For the cotyledon wedge-graft, one should wait no longer than this point.

B



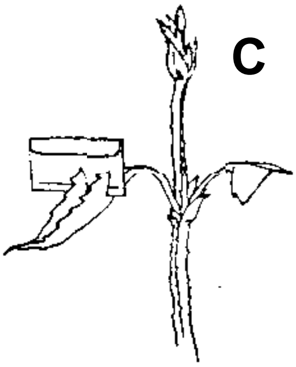
A



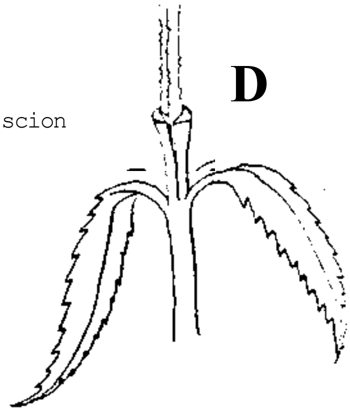
Preparation of the Cannabis seedling stock consists of severing the stem just above the first pair of true leaves. The stem is then split, using a thin, sharp blade, down between these leaves about one quarter to three-eights of an inch. The split should be made so that each leaf is attached to one half of the stem (A).

The hops scion should come from a plant or a sprout of approximately the same age as the Cannabis stock. The scion should be cut off at the ground and shaped into a wedge just below the cotyledons (B). The prepared scion is then inserted into the split Cannabis stock and tied with raffia, a thin rubber strip, or sterile surgical cotton.

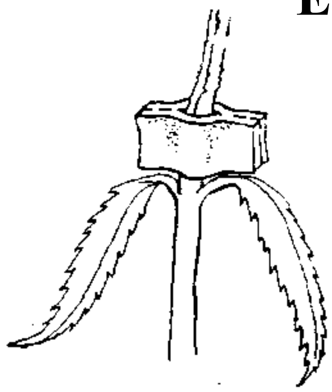
C



D



E



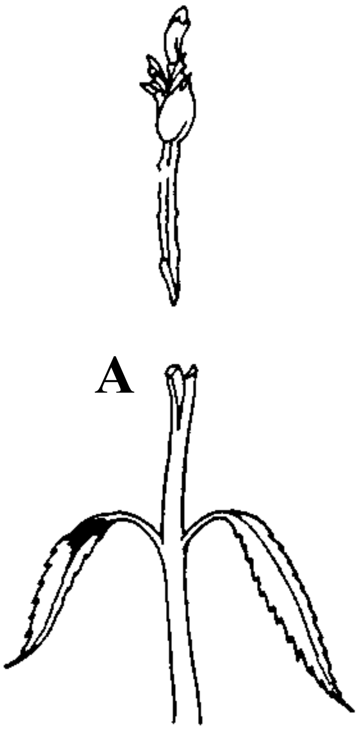
If the scion hops plant is not readily available in an early enough stage; and it becomes necessary to use a more mature seedling, the scion leaves should be trimmed to prevent as much water loss as possible (C) . Care should also be taken that the grafted plants are not overexposed to nitrogen at this point under these conditions, as excess nitrogen promotes water loss, particularly in the early growth stages of both hops and hemp. The trimmed scion should then be shaped into a wedge (D), tied with any of the materials already discussed or, better yet in this instance, secured with self-sealing rubber (E) which is available through all nursery supply outlets.

Whichever scion/stock combination is used for the cotyledon graft, the plant should be placed in some sort of a glass or plastic case which protects it from exposure to over-dryness, temperature changes and fungal or bacterial infestation until the union has healed, which should take about a week to set firmly. This protection is much more vital if the cotyledon graft approach is used than if the simple wedge graft is employed.

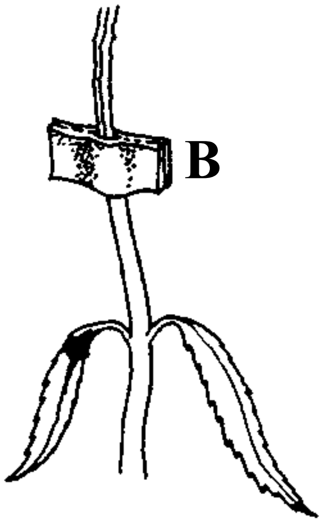
GROWING POINT WEDGE GRAFT

This is the third successful approach which can be used in making the hemp/hops combination plant. The method is very similar to the cotyledon wedge-graft in many respects. The hops scion should be as young as possible, as in cotyledon grafting, and preparation of the scion is exactly the same. The Cannabis stock, which should be in its fifth to seventh week of life, healthy and well-rooted, should be cut off at the growing tip and cleared of all but the first and second sets of leaves (A) The severed end of the Cannabis stock should then be split about a half inch, and the formed hops scion inserted and fixed in the same fashion as the cotyledon wedge graft (B). A sleeve of very thin plastic is then fitted as in (C) and the grafted plant allowed to recover for **a** week, after which the plastic can be removed.

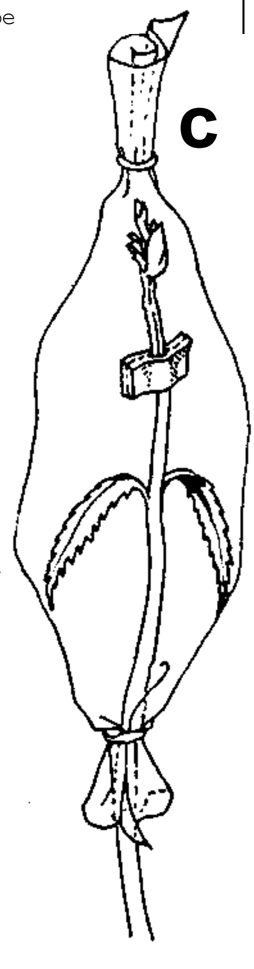
A



B



C



All of these grafting operations will, if successful, produce a plant which will look like hops, which is fact it will be. The leaves, however, will have taken up the active principle manufactured by the Cannabis root stock and the hops resin will be as potent as that of high quality grass.

Rather then go into a whole dissertation on the cultivation of hops, we'll just make some brief comments. Hops is very similar to Cannabis in its soil requirements, water needs, response to photo-period and in almost all other aspects of cultivation technique. Because of this fortunate coincidence, you may treat secretgrass just as you would Cannabis, with one significant exception.

Hops is a vine-like climbing plant which reaches lengths of twenty to thirty feet as a matter of course. It needs supports on which to climb, and there are a variety of arbor arrangements which hops growers use. There are as many designs for stringing an arbor as there are hops growers, and design is not an essential concern for those of you planning to experiment with the grafting plants. The only real guideline to keep in mind is that the higher the arbor, and the less crowded the hops vines, the more leaves they will want to produce.

There are some very good descriptions and layouts of various sorts of arbor-arrangements for growing hops in the Gamer book noted in the bibliography. This book should be available through any decent library.

The government relies heavily on a procedure called the Duquesnois test to establish the presence of the active principle of grass in vegetable matter suspected of being marijuana. This test was first reported in the Journal of the Egyptian Medical Society in 1938 and is used pretty much cookbook fashion in most places. It is basically a color-change test, and the presence of Cannabinol and/or Cannabidiol reacts with the test solution of acetalehyde, vanillin-HCl to change the liquid from a clear solution to a clear blue which becomes somewhat opaque and darker on standing. Since secretgrass will contain these active principles, the Duquenois test will react to it as if it were grass. That's not the whole issue, however, because the government often uses other tests to establish whether or not grass is grass, and these won't work with secretgrass. For one thing, Cannabis Sativa has some characteristic leaf structures which can be readily identified through a microscope. Structures such as the tiny hairs on the underside of the leaves, and the characteristic resin ducts of Cannabis show up clearly in these examinations. These structures will not be present in the hops/hemp plant, which will be vegetatively indistinguishable from Humulus Lupulus. The only structures on the original grafted plant identifiable as Cannabis Sativa would be the root. It is very difficult to establish beyond reasonable doubt that grass is grass by the root alone, because its structure and appearance is by no means unique. Needless to say, second generation hybrid secretgrass will be impossible to identify on the basis of vegetative structures alone. Whch brings us back around to the infamous test of one Duquesnois, lately of Cairo and points west.

The test is considered positive—-the killer weed is present—- when the solution turns blue after the suspect material has been added. Any prosecuting agency must specify the material it is getting hysterical about, and it would seem that the wide range of stuff that reacts with the Duquenois solution would make this job very difficult. The test shouldn't be able to discriminate effectively between high grade hash and low grade canary food containing sterilized hemp seed, because it is used to confirm or deny the presence of the active principle, not its concentration, and hemp seed does contain resin—- 1.6% by weight. It would be interesting to see whether the government was able to prove in certain cases that the substance some free soul was busted for possessing was not concentrated bird food for his far out parakeet.

The Duquesnois test does not appear to discriminate between Cannabinol and Cannabidiol, the one containing the active principle of marijuana and the other containing no such thing. Structures very similar to each substance, however, occur widely in the vegetable world, partially hydrogenated cannabinols, isomers of cannabidiol, or unsaturated molecules resembling cannabidiol.

Other speculative trips:

(?) Who says what blue is,

and how blue is blue?

(?) What if other plants or substances turn the Duquesnois solution a pretty shade of blue?

BIBLIOGRAPHY

This bibliography is intended to serve as a guide for more detailed reading in the subjects discussed in this book. Readers who are mainly interested in reading on the contemporary drug scene won't find much, but those turned on to a historic view will probably find many of the references cited pretty interesting. Principal consideration, however, is given to the usefulness of a book or article in relation to cultivation.

Code for the bibliography:

* - not reviewed

** - reviewed and found wanting

*** - of interest and value

**** - essential for cultivators and grass freaks

(1) E. Anson; (in) Journal of the Dublany Agricultural Experi-mental Station, Vol. II, No. 2, 1913; pp 50-68 **

(2) Attice, J.; A Case of Poisoning by Cannabis Indica, British Medical Journal, London, 1896; p 948 **

(3) Arutinyantz, S.M.; Chemical Investigation of Indian Hemp, St. Petersburg, 1881 *

(4) Auide, J.; Studies in Therapeutics; Cannabis Indica, Thera-peutics Gazette, Detroit, 1890; Vol. 6, pp 523-526 ***

(5) George Avery and Elizabeth Johnson; Hormones and Horticulture, New York, 1947; pp 282-300 ****

(6) L.H. Bailey; Cyclopedia of American Agriculture, Vol. II, London, 1907; pp 377-380 ***

(7) Banal; Note Sur Les Extraits de Cannabis Indica, Montpelier Med, 1890; Vol. 15, pp 461-465 ***

(8) Battaglia, B.; Sul hascisch et sua azione nell' organismo umano, Psichiatria, 1887; Naples, #5, pp 1-38 ****

(9) Beane, F.D.; An Experience with Cannabis Indica, Buffalo Medicine and Science Journal, 1883-84; Vol. 23, pp 445-451 ***

(10) Bentlif, P.B.; A Case of Poisoning by Extract of Cannabis Indica, Clinical Sketches, London, 1896 *

(11) Bertherand, E.; A propos de la prohibition due haschisch en Turquie, Journal of Medicine and Pharmacy of Algeria, Algiers 1896 *

(12) Berthier; Le Haschisch Administre comme hyrmotique Bulletin of the Society of Medical Practicioners, Paris, 1867 *

(13) Birch, E.; The Use of Indian Hemp in the Treatment of Chronic Chloral and Chronic Opium Poisoning, Lancet, London, 1889 ***

(14) Borthvick & Scolly; Photoperiodic Responses in Hemp; Botannical Gazette, 1954; Vol. 116, p 14 ***

(15) Browne, E.G.; A Chapter from the History of Cannabis Indica, St. Bartholomews Hospital Journal, London, 1896-97; Vol. IV, pp 81-86 ***

(16) Buchward, A.; Veber Cannabis Praparate, Breslau; 1885 *

(17) Bureau of Plant Industry; The Cultivation of Hemp in the United States, Cir. #57, 1910 ***

(18) Burgess, A.H.; Hops-Botany, Cultivation and Utilisation, New York, 1964 ****

(19) Burroughs, H.; Le Chanvre Indien (Cannabis Indica), Lyons, St. Etienne, 1896 *

(20) Vers Charles and A. Jenkins; A Fungous Disease of Hemp, (in) Journal of Agricultural Research, USDA, Vol. III, No. 1, Oct., 1914; pp 81-85 ***

(21) Christison, A.; On the Natural History, Action, and Uses of Indian Hemp, Monthly Journal of the Medical Society, London & Edinburgh; 1851, Vol. 13 ***

(22) Comfort, L.; An Overdose of Cannabis Indica, Milwaukee Journal 1895; Vol. III, p 370 *

(23) Cook, A.B.; Poisoning by Cannabis Indica; Two Drams of Herrings English Extract of Indian Harp being taken without Suicidal Intent, The American Practitioner, Louisville, Ky.; 1884, Vol. XXX, pp 25-30 **

(24) DeCourtive, E.; Haschish - Etude Historique et Physiologique Paris, 1848 ****

(25) Dewey, Lyster; The Hemp Industry in the United States, (in) USDA Yearbook, Vol. 118, 1901, pp 541-555, illus. **

(26) Charles Dodge; Cultivation of Hemp and Jute, (in) Fiber Investigations #8, USDA, 1898, pp5-23 **

(27) Charles Dodge; Culture of Hemp in Europe,(in) Fiber Investigations #11, USDA, 1898; pp5-28 **

(28) Charles Dodge; Fiber Investigations #9, USDA, 1897, pp 106-110 ***

(29) Charles Dodge; Hemp Culture (in) USDA Yearbook, 1895, Vol. 74, pp 215-22 ***

(30) Charles Dodge; The Hemp Industry in France (in) Fiber Investigations #1, USDA, 1892, pp 27-31; 64-74 **

(31) G. D'Ippolito; (in) State Agricultural Bulletin of Italy, Vol. 45, No. 4, 1912; pp 302-320 ***

(32) C. D'Lima; Indian Hemp Fiber (in] Agricultural Journal of India, Vol. II, No. 1, 1916; pp 31-41 **

(33) J.W.T. Duvel, The Vitality and Germination of Seeds, PhD dissertation, Univ. of Michigan, 1902 ****

(34) Edes, R.T.; Cannabis Indica, Boston Medical & Scientific Journal, 1893 *

(35) J.V. Eyre et al; (in) Journal of the Royal Agricultural Society of England, Vol. 74, 1913; pp 127-172 **

(36) Fisher, H.; Case of Cannabis Poisoning, Cincinnati Lancet-Clinic, 1896, Vol. 37, p 405 **

(37) Fishlowitz, G.G.; Poisoning by Cannabis Indica, Medical Record, New York, 1896, Vol. 50, p 280 **

(38) Fristedt, R.F.; Hemp from a Medical View, Upsala, 1869-70 *

(39) Robert Garner, The Grafters Handbook, New York, 1958 ****

(40) W. Garner and H. Allard; Effect of the Relative Length of Day and Night and Other Factors of the Environment of Growth and Reproduction in Plants (in) Journal of Agricultural Research, USDA, Vol. 18, 1928, pp 553-606 ****

(41) W. Garner and H. Allard, Flowering and Fruiting of Plants as Controlled by the Length of Day, (in) USDA Yearbook, 1920, pp 377-400 ****

(42) W. Garner and H. Allard, Further Studies in Photoperiodism, (in) Journal of Agricultural Research, USDA, 1923, pp **871-920**, illustrated ****

(43) Geiser, M.; Poisoning by Cannabis Indica, Medical Record, New York, 1896, Vol. 50, p 519 *

(44) N. Gill and K. Vear, Agricultural Botany, London, 1958, pp 204-205 ***

(45) Giraud, J.; L'art de faire varier les effects du hachich, Encephale, Paris, 1881, pp 418-425 *

(46) Thomas Githens, Drug Plants of Africa, Philadelphia, 1949 ***

(47) Gley, E., & Richet, C; Notes Sur le hachich, Bulletin of the Society of Psychology and Physiology, Paris, 1886, pp 1-13 **

(48) Godard, E.; Egypte et Palestine, Paris, 1867, pp 343-357 ***

(49) Robert Gould (ed); Symposium of Gibberellins, No. 28, Advances in Chemistry Series, Washington, D.C., 1961 ***

(50) Grimaux, E., Du hachisch, ou chanvre indien, Paris, 1865 *

(51) Hamaker, W.; A Case of Overdose of Cannabis Indica, Therapeutics Gazette, Detroit, 1891, Vol. 7, p 808 **

(52) Hare, H.; Clinical and Physiological Notes on the Action of Cannabis Indica, Therapeutics Gazette, Detroit, 1887, Vol. 3, pp 225-228 ***

(53) G. Havas, (cited in) Agricultural Botany, USDA, Vol. 36, *1917* ***

(54) Herman Hayward, The Structure of Economic Plants , New York, 1938, pp 214-245 ****

(55) Alice Henkel, Weeds Used in Medicine, Bureau of Plant Industry, USDA, 1904, Farmers Bulletin #188 ***

(56) Alice Henkel, Wild medicinal Plants of the United States, Bureau of Plant Industry, USDA, 1906, Bulletin #188 ***

(57) Heslop-Harrison; Auxin and Sexuality in Cannabis Sativa, 1956, Physiology of Plants, Vol. 9, p 588 ***

(58) Heslop-Harrison; The Experimental Modification of Sex Expression in Flowering Plants, Biological Reviews, 1957, Vol. 32, p 38***

(59) Heslop-Harrison; The Sexuality of Flowers, 1957, New Biology, Vol. 23, p 9 ****

(60) Heslop-Harrison; Growth Substances and Flower Morphogenis, 1959, Journal of theLinnaenSociety, London; Vol. 56, p 269 *

(61) Heslop-Harrison; The Modification of Sex Expression in Cannabis Sativa by Carbon Monoxide; 1957, Proceedings of the Royal Society of Edinburgh (Sec. B) Vol. 66, p 424 ****

(62) Heslop-Harrison; Leaf-shape Changes Associated with Flowering and Sex Differentiation in Cannabis Sativa; 1958, Proceedings of the Royal Irish Academy (Sec. B) Vol. 59, p 257 *

(63) Heslop-Harrison; Effects of Gibberellic Acid on Flowering and the Secondary Sexual Difference in Stature in Cannabis Sativa, 1961; Proc. of the Royal Academy (Sec. B) , Vol. 61, p 219 *

(64) Heslop-Harrison & Woods; Temperature - Induced Meristic and other Variation in Cannabis Sativa; 1959; Journal of the Linnaer Society of London, Vol. 55, p 290 *

(65) Heslop-Harrison; Cannabis Sativa; 1969 (in) Evan's The Induction of Flowering, Cornell Univ. Press, pp 205-226 ****

(66) Hirata, K., Sex Determination in Hemp, Journal of Genetics, Vol. XIX, 1927-28, pp 65-79 ***

(67) Hungerford, M., An Overdose of Haseesh, Popular Science Monthly, New York, 1883-84, Vol. 24, pp 509-515 **

(68) Ireland, T. , Insanity from the Abuse of Indian Hemp, Alienist and Neurologist, St. Louis, Mo. , 1893, Vol. XIV pp 622-630 ***

(69) L. Johnson, A Manual of the Medical Botany of North America, New York, 1884, pp 245- 46 ***

(70) Jones, H.L., Note on Cannabis Indica as a Narcotic, Practicioner, London, 1885, Vol. XXXV; p 251 *

(71) L.F. Kebler, Habit Forming Agents, Famers Bulletin #393, Bureau of Plant Industry, USDA, pp 3-19 ***

(72) Kelly, W., Cannabis Indica, British Medical Journal, London, 1883, p 128l **

(73) R.H. Kirby, Vegetable Fibers, New York, 1963, pp 45-61 ****

(74) Henry Kraemer, Botany and Pharmacognesy, Philadelphia, 1902, pp 226-227; 275; 351-353 ***

(75) Lailler, A., Therapeutigue: du chanure indien, Ann. Med.-Psychologie, Paris, 1890, Vol. XII, pp 78-83 *

(76) Lallemand, C.F., Le Hachych, Paris, 1843 ****

(77) Lapin, L., Ein Beitrag zur Kenntniss der Cannabis Indica, 8, Jurjew, 1894 *

(78) Lees, M.C., Cannabis Sativa sen Indica: Indian Hemp, British Medical Journal, London, 1888, Vol. XI; pp 95-98 ***

(79) MacKensie, S., On Some Classes of Cases in which Indian Hemp is of Special Service, Med. Weekly, Paris, 1894, Vol. II p 457 ***

(80) Marshall, C.R., The Active Principle of Indian Hemp, Lancet, London, 1897, pp 235-239 ***

(81) MaHinson, J.B., Cannabis Indica as an Anodyne and Hypnotic, St. Louis Medical and Scientific Journal, 1891, LXI, pp 265-71 *

(82) McPhee, Hugh, The Influence of Environment on Sex in Hemp, Cannabis Sativa L., (in) Journal of Agricultural Research, Vol. XXVIII, No. 11, USDA, 1924, pp 1067-1083 ****

(83) Nelson, Clarence, Growth Responses of Hemp to Differential Soil and Air Temperatures, (In) Journal or Plant Physiology, 1936, pp 294-309, illustrated. ****

(84) Oertel, T.E., Observations on the Effect of Cannabis Indica in Large Doses, American Medical-Surgical Bulletin, New York, 1895, Vol. 8, pp 365-68 ***

(85) Oliver, J., On the Action of Cannabis Indica, British Medical Journal, London, 1883 *

(86) O'Shaughnessy, W.B., On the Preparations of the Indian Hemp, Gunjah (Cannabis Indica) , Their effects on the animal system in health, and their utility in treatment of tetanus and other convulsive disorders. Calcutta, 1839 *

(87) Prentiss, D.W., Case of intoxication from a comparatively small dose of Cannabis Indica, therapeutic Gazette, Detroit, 1892, Vol. VIII, p 104 **

(88) Pritchard, F., Change of Sex in Hemp, (in) Journal of Heredity, Vol. 7, 1916, pp 325-29 ***

(89) Ramnnek, G., (in) Journal of Experimental Agronomy, (USSR), Vol, II, no. 6, 1910, pp 865-66 *

(90) Renz, G.A., My Experiment with Cannabis Indica, Northwestern Lancet, St. Paul, Minn., 1885-86, Vol. V., p 203 *

(91) Reynolds, J.R., On the therapeutic uses and toxic effects of Cannabis Indica, Lancet, London, 1890, p 637 **

(92) Richet, C. Poisons of the intelligence: Hasheesh, Popular Science Monthly, N.Y., 1878, pp 428-86 ***

(93) Robertson, R., Toxic synptoms from the Tincture of Indian Hemp in Official Doses, Medical Times and Gazette, London, p 817-19

(94) Rochebrune, A., Toxicologie Africaine, Paris, 1897 **

(95) Rosevear, John, Pot, A Handbook of Marijuana, New York 1967 **

(96) Ochse, Soule and Dijkman, Tropical and Sub—Tropical Agriculture, Vol. 2, 1966, pp 1161-65 **

(97) Schaffner, J., Complete Reversal of Sex in Hemp, Science, Vol. 50, 1919, pp 311-13 ****

(98) Schaffner, J., The Influence of Environment on Sexual Expression in Hemp, (in) Botanical Gazette, 1921, pp 197-219 ****

(99) Schnaffer, J., Influence of the relative length of daylight on the reversal of sex in hemp, Ecology, 1923, Vol. IV., pp 323-34 ****

(100) Schnaffrier, J., Rejuvenations in Hemp, Ecology, 1927, pp 315-25 ****

(101) Schaffner, J., Further Experiments in Rejuvenation, American Journal of Botany, Jan., 1928, pp 77-85 ****

(102) Schaffner, J., Sex Reversal and Photopericdivity, American Journal of Botany, June, 1931, pp 424-30 ****

(103) Sinnott, Edmund, Plant Morphogenesis, New York, 1960, pp 221; 317; 399; 430 ***

(104) Stockberger, W.W., Drug plants Under Cultivation, Farmers Bulletin # 663, Bureau of Plant Industry, USDA, 1915 ***

(105) Stockberger, W.W., (in) Production of Drug-Plant Crops in the United States, Bureau of Plant Industry, USDA Yearbook, 1917, pp 169-176 **

(106) Suckling, W., On the Therapeutic Value of Indian Hemp, British Medical Journal, London, 1891, p 12 **

(107) Talley, Paul, Carbohydrate-Nitrogen Ratios with Respect to the Sexual Expression of Hemp, (in) Journal of plant Physiology, 1934, pp 731-748 ****

(108) Sister Mary Etienne Tibeau, Time Factor in Utilization of Mineral Nutrients by Hemp, (in) Journal of Plant Physiology, 1933, pp 731-747 ****

(109) Toth, L., Grimault et Compagnie cigarettes indiennes au Cannabis Indica, Budapest, 1881 *

(110) Tukey, H.B., Plant Regulators in Agriculture, New York, 1954 ***

(111) Van Der Veen, R., and Meijer, G., Light and Plant Growth, London, 1959, pp 41, 52, 65, 78-9, 83-92, 119-154 ****

(112) Walsh, J.H.T., Hemp Drugs and Insanity, Journal of Mental Science, London, 1894, Vol, XL, pp 21-36 *

(113) Warden and Waddeil, The Active Principle of Indian Hemp, Indian Medical Gazette, Calcutta, 1884, Vol. XIX pp259, 354 **

(114) Warmke, H. and H. Davidson, Polyploidy Investigations (in) Carnegie Institute of Washington Yearbook, No. 41, 1941-43 ****

(115) Warmke, H., and H. Davidson, Polyploidy Investigations (in) Carnegie Institute of Washington Yearbook, No. 42, 1941-43 ****

(116) Warmke, H. and H. Davidson, Polyploidy Investigations, (in) Carnegie Institute of Washington Yearbook, No. 43, 1943-44 ****

(117) Wood, H.C., On the Medical Activity of the Hemp Plant as Grown in North America, Proceedings of the American Philosophical Society, Philadelphia, 1869, Vol. XI, pp 227-33 ***

APPENDIX:

DETECTING OPIATE-ADULTERATION

While this book contains most, if not all, of the technical knowledge which anyone would need to grow grass, a considerable number of people who will read it do not intend to join the ranks of cultivators of the killer weed. It's probably fair to say, however, that most such non-agrarian folks have and do, from time to time, indulge in just a teeny toke. Among friends.

For these gentle protestors, with only a battered constitution between them and the long arms, this next section is specifically intended. Just as in the supermarket vegetable section, you can never tell where your grass is coming from, what its been through, and what's been added unless you grow your own.

People who can't or won't sow a seed can still take a few precautions to guard against adulteration of their grass—-an increasingly serious problem. The most common adulterants are the opiates, and there are some very simple tests—-using inexpensive chemicals and very few implements—-with which one can test grass for specific kinds of opiate adulterations. Before running through the tests, let's distinguish among the many varieties of the opiate family.

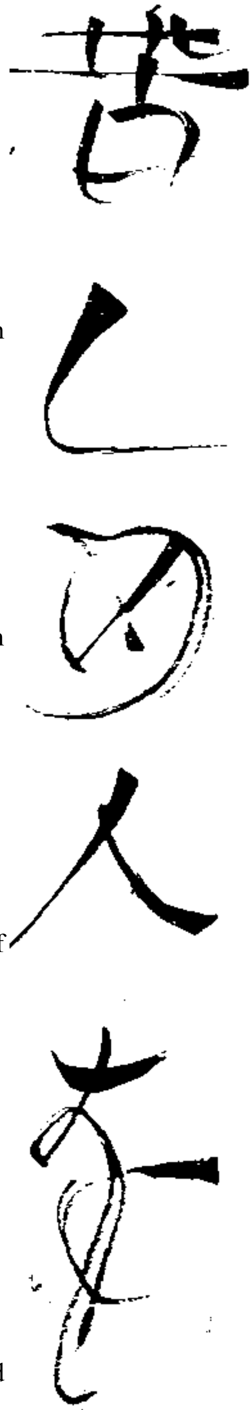
COLLECTION AND PREPARATION OF CRUDE OPIUM

Opium varies considerably in quality and physical/chemical properties with the climate in which it is grown and the methods used in its preparation. Methods of collection of the raw material for the drug do not vary much from country to country.

After the heat of the day is past, around 3 or 4 P.M., the plant's seed capsules are incised using a three or four-bladed knife. Cuts are made to a depth of precisely 1/12". This incision in the outer skin is enough to start the milky latex flowing. Each plant undergoes several incisings at intervals of two to three days; extremely fruitful plants can be milked up to ten times before they are drained of their juices and die.

During the temperate nights, the milky juice coagulates on the sides of the seed capsule and on the upper parts of the stem, from which it is scraped each morning and placed into pottery vessels. Upon settling in these vessels, the coagulated material separates into two parts. The upper portion of the mass becomes a wet, somewhat granular pinkish tapioca-like substance and the lower portion becomes a dark brown fluid called passewa. The firm upper mass is separated and placed in the shade, were it air-cures for from three to four weeks. During the curing the mass sets and changes color gradually to a soft dark brown, deepening in color with age and temperature/humidity conditions until it finally becomes raw opium of commerce.

Opiates are a valuable medicinal drug series, and opium itself is used mainly for its sedative, pain-suppressant qualities. When taken internally in medicinal doses, opium acts first as a stimulant then successively as a narcotic, pain-reliever and antispasmodic. In small dosages, it is primarily a stimulant, whereas in large dosages its effects are blended and it is a powerful, occasionally lethal poison. Opium is most useful in combatting various forms of mucus inflammation and irritation—catarrh, bronchorrhoea, diarrhoea etc. It is also frequently prescribed in diabetes, fevers, colic, vomiting, dysentry and other amoebic and organic disorders.



Crude or raw opium comes in the form of a thick, soft but firm, chestnut to dark brown mass which may be cut into angular chunks with a knife, but which is also pliable enough to be molded with the fingers. It is very malleable and plastic when fresh, becoming brittle with age. It has a characteristic narcotic, but pleasant odor and a persistant, bitter and acrid taste. It normally feels greasy to the touch, and globules of oil usually form on a cut surface, particularly where the raw opium has been oil-processed. Raw opium is graded by aroma, color, touch, texture, specific gravity, consistency and degree of adulteration. The grading scale corre-sponds with that of gold, with 24 carat opium being pure, raw, first-class drug.

Opium can be tested for quality either by the experienced estimator or by the scientific analyst. The experienced estimator has several reliable methods of gauging the quality of opium after determining that the material offered for sale is in fact opium.

Consistency of the drug can be fairly accurately determined by feel, but some of the more subtle adulterants can only be detected through measurements of specific gravity. The color of a sample is tested by pressing a small piece between two pieces of glass and looking at a powerful light source. The texture of high quality opium is waxy, and a smooth shiny surface can be produced by rubbing. This texture can be either granular or homogeneous, however, depending on how the drug has been processed; but normally the darker varieties will be more homogeneous and taffy-like and the lighter varieties more granular. When a piece of raw opium is drawn out between the fingers, the granular variety should break, leaving an angular surface long before the strand becomes thin; while the homogeneous varieties should draw out into long, thin strings with out breaking. Actual morphia content analysis requires fairly rigorous scientific testing, and normally only those engaged in the legal market where the drug is being purchased for medicines are concerned about the morphia content. There are, however, several general principles which govern probable morphia content which enter into the consideration of the price of the raw drug regardless of its intended ultimate destination.

Morphia content varies widely from one point of origin to another. Opium from poppies grown in hill country normally contains more morphia than opium from poppies grown on the plains. Opium which is fresh contains more morphia than opium which is old, other things being equal. Opium which has been quickly dried has more morphia than opium which has taken a long time drying.

While this section will be concerned primarily with the use of the opiates in adulterating grass, the opiates themselves often undergo interesting adulterations.

The relatively high price for illicit opium, coupled with a consistantly strong and increasing demand based on the needs of millions of addicts, has resulted in a widespread practice of adulterating the drug as it passes through the hands of middlemen. The chief adulterants are powdered poppy trash, dried fruits, turpentine, gums, ground stone, lead oxides, clay, sand, soot, manure, grain flours, betel nut, butter, fruit and milk sugars, charcoal, a paste of sesame seed and beans, licorice, mucilage, and various other vegetable pulps, pastes, and extracts. The grosser adulterants can be detected by smell, feel, and sight; but many of the more subtle adulterants are undetectable without resort to elaborate tests.

TESTING FOR OPIUM-ADULTERATION

While grass is adulterated with many grades of opium, the most commonly used is the low-grade Passewa, the dregs of the manufacturing of raw opium. Both grass and tobacco are adulterated with Passewa in many countries, but in America only the grass freak needs to get uptight about opiates, if he chooses to.

The symptoms of an opiate hit are somewhat different from those of organic grass—a feeling of heavy lassitude, a warmth and tingling in the extremities, a giddy feeling verging on nausea when you move up and around which disappears if you sit or lie down, a fullness in the head and particularly the ears, and a dull hangoverish feeling for the next day or so. Symptoms such as these are pretty idiosyncratic, but anyone experiencing them when smoking unfamiliar grass might realistically become suspicious. In that case, there are several tests for opium he might want to perform.

One useful and easily performed test consists of washing the suspected grass thoroughly in a bowl of water. The resin won't go into the solution, but after vigorous rubbing and pounding and splashing about in the bowl the opium or Passewa, if any, will dissolve in water.

A small amount of this solution is then placed in a test tube and a few drops of a ferric chloride are added. If solution opium is present a red color will appear, and the depth of the red will give a rough indication of the proportion of opium present in the material—the deeper the color, the more opium.

This red color can be produced by other adulterants, however, and further confirmatory tests are required. Using the same test tube of solution as before, add one drop of hydrochloric acid to the already red solution. Upon heating over a low flame, if the red color disappears, the substance either was not opium or there is very little opium present. If the red color holds, the assurance that the substance is opium grows stronger. A further test is necessary, however, because adulterants could still be affecting the solution.

Taking another test tube of the original, clear solution, a little lead acetate is added. If the test solution contains opium, a white precipitate will appear. This precipitate will, however, disappear readily if a few drops of nitric acid are added to the test solution.

If positive reactions are experienced in the above series of tests, the substance may be assured to be opium. Several other tests are available, and are regularly used by both police and dealers.

To a solution of .5% selenious acid in sulphuric acid, add a crushed sample of the material suspected of containing opium. If opium is present, the solution will turn blue, gradually changing through green to an organic brown.

Taking a dry crushed sample of the suspected substance, stir in a few drops of potassium hydroxide. Then add a few drops of ether. Moisten a strip of untreated fiber paper with the ether-potassium hydroxide solution and let it dry. Repeat several times. After three cycles, expose the paper to steam. If it turns red, opium is present.

Adulteration of grass with the more sophisticated, complex and more highly toxic forms of opiate drugs is not too common, primarily because the economics of such a practice are prohibitive. While Passewa is a cheap by-product of processing crude opium, the opiate drugs further down the line are expensive and relatively scarce. Only under special conditions would anyone have to be concerned that grass was adulterated with morphine, codeine, or heroin.

The tests for the presence of these drugs, and a brief description of their properties, are included in this book because knowing how to test for the opiates may, in some cases, come in handy as a survival skill in a society and subculture where survival is often severely threatened.

OPIUM DERIVATIVES—MORPHINE

Morphine is probably the most important alkaloidoid of opium, though the negative sides of its sister alkaloid heroin are more widely felt. It was the first alkaloid isolated from opium, and is a widely used medicine. It is administered both by ingestion and hypodermic, and acts as an anodyne, sedative, hypnotic and diaphoretic. It is extremely poisonous. For non-addicts, swallowing two to three grains is usually fatal. For non-addicts, hypodermic injections of 1/6 grain pure morphine for adult males and 1/10 grain for adult females are the maximum safe dosages. People addicted to opiates can, of course, tolerate amounts far in excess of these dosages, but that doesn't mean that such amounts represent safe limits, only that under special conditions—-addiction—-the limits are moved outward a bit.

Pure morphine appears in the form of small, white to clear, odorless shining rhombic crystals; in fine, needle-like prisms; or as a crystalline powder. It will not deteriorate when exposed to air under normal room conditions. It has a specific gravity of 1.32, an alkaline ph reaction, and a very bitter taste. It unites readily with acids to form salts, most of which dissolve easily in water. Morphine is soluable in fixed as well as volatile oils; in fixed caustic alkali solutions; in lime water; and is somewhat soluable in caustic ammonia. It is very slightly soluable in cold water; more soluable in boiling water; quite soluable in cold alcohol; and very soluable in boiling alcohol. One gram of pure morphine needs 3340 cc of cold water to go completely into solution; 1220 cc of chloroform; 1075 cc of boiling water; 210 cc of cold alcohol; and 98 cc of boiling alcohol. A saturated water solution of morphine will test very slightly acid with litmus paper. Morphine is insoluable in benzine and almost insoluable in ether. It commonly appears as a hydrochloride, a sulphate, and an acetate.

Morphine hydrochloride is prepared by dissolving morphine in water with a little bit of hydrochloric acid, then evaporating the solution until crystals of morphine appear. Morphine hydrochloride is quite odorless, will not dissolve in chloroform or ether. One gram of morphine hydrochloride will dissolve in 17.55 cc of water or 52 cc of alcohol at 25° C, or .5 cc of boiling water or 46 cc of alcohol at 60° C. Morphine hydrochloride is sold as a white to colorless microcrystalline powder, in white shining needle-like crystals, or as a packed, crystal line cube. It has a very bitter taste verging on horrible.

Morphine sulphate is perhaps the most common form of the drug. Its preparation is similar to that of morphine hydrochloride except that sulphuric acid is substituted for hydrochloric. Morphine sulphate is insoluable in ether and chloroform, but one gram dissolves readily in 15.5 cc of water or 565 cc of alcohol at 25° C; or in .7 cc water at 80° C; or 240 cc alcohol at 60° C. Morphine sulphate sold in solution normally has a strength of one grain to one fluid ounce.

Acetate of Morphia is prepared by treating an aqueous solution of morphine with acetic acid. It is distinguished from the other morphine preparations by a faint odor of acetone—like nail polish remover.

There are many tests for the presence of morphine compounds, but they share a common fault in that the substance being tested should be as close to pure morphine as possible in order for the tests to be fully reliable. In cases where grass is suspect, the testing will be complicated by the presence of many of the organic compounds which are integral to grass. Some of the more reliable tests which would be of some use in such cases are:

> Mix the suspected material with approximately six times its weight of pure sugar, then add a few drops of concentrated sulphuric acid. If the substance is morphine, the mixture will show a red color at once, the color gradually changing to green and finally to a brownish yellow. If the suspected substance is already in solution, dissolve as much white sugar as possible in a test tube of the solution, then add a few drops of sulphuric acid, plus a drop or two of bromine water. The solution will turn red, then green, then brown-yellow if morphine is present.