

BETTER TOBACCO PLANTS

(BY IMPROVED METHODS)

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North Carolina tobacco growers need better tobacco plants, a larger supply of plants in most years that will permit grading of the plants, and plants that are produced early enough to allow the setting of the crop at the proper time.

Growers can choose between the continued use of temporary plant bed sites or the development of permanent sites. The latter plan calls for disease control, a good water supply close to the beds, the use of natural or artificial wind breaks, and the seeding of a legume crop on the plant bed during the summer.

This publication is divided into four parts. 1. A discussion of the permanent plant bed program and also the temporary bed plan. 2. Care of the beds, with a discussion of such important points as preparation of the bed, fertilization, seeding, covering the bed, and the like. 3. Control of plant bed insects. 4. Blue mold control.

Regardless of what type of bed is used, control of insects and of blue mold is necessary to give early, healthy plants that will permit the grading of plants and the setting of the crop at the proper time.

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Permanent Bed Plan

With the permanent plant bed, the same location may be improved and used year after year. The soil must be sterilized by chemicals, steam, or burning. A disease-free water supply, convenient to the beds, is needed. Natural or artificial wind breaks should be utilized to protect the beds from cold winds. The site should be sown to crotalaria, velvet beans, soybeans, or cow peas in summer.

TYPE OF SOIL. In selecting a permanent site, deep loamy soils that warm up quickly are most desirable. However, the success or failure of chemicals for soil sterilization can very well depend on the use of light sandy soils. Where soil sterilization and permanent sites are used, more emphasis should be given to the exposure of the area to the sun, convenience of water supply, windbreaks, and proper drainage than to the type of soil.

Soils can be conditioned by the heavy application of well-rotted animal manures or heavy growths of crotalaria, velvet beans, soybeans, or cowpeas. Such manures must be incorporated into the soil 4 weeks before sterilization. This practice will condition and fluff up tight soils and increase the water holding capacity of sandy soils. Plants can be removed with a good root system.

WATER SUPPLY. An established clean water supply convenient to the bed is one of the very much needed improvements throughout North Carolina. This is particularly true of permanent plant bed sites. Wells, pumps, springs, or piped water supply is the safest. If a grower is sure that branches, ditches, or small ponds originate on the farm and do not drain soils contaminated with soil-borne tobacco diseases, they can be used as a source of water.

Where large areas are sown to beds, a grower may find a small gasoline engine and suction pump both convenient and economical for watering beds. Some convenient established water supply is practical for many farms.

WINDBREAKS. Cold winds and shade are serious handicaps to the early and rapid growth of plants. Every advantage should be taken of natural windbreaks. Long buildings, thick trees and high hills on the north and northwest side of the beds are excellent. Care must be taken to see that the trees or other windbreaks on the northwest side are not close enough to shade the bed.

Artificial windbreaks may be constructed from scrap lumber, old discarded tin roofing, poles or other similar materials. Growers may use temporary windbreaks while a quick growing shrub or bamboo is planted. Quick growing privet hedge is excellent.

DRAINAGE. A well-drained upper surface and subsurface soil is essential. However, dry thirsty locations are to be avoided, because a plentiful supply of moisture is essential to plant growth. The air is excluded in a water-logged soil, causing the lower roots of the plant to cease functioning and decay. Excess moisture may also cause the development of fungi to the extent that "damping off" takes place. Extremely steep slopes or ridging may cause the seed to be washed off the bed or puddled. Beds on steep slopes should be lengthwise across the hill rather than up and down the hill.

SHADE. It has already been pointed out that shading from windbreaks should be avoided since it slows up the early growth and development of the plants. Blue mold is also more active in shady beds and the plants will be tender. Some trees as a windbreak to the north or north-west are desirable, but should not be close enough to shade the bed before very late in the evening.

SLOPE. Early growth of plants is greatly influenced by a southern slope. Two or three times as many early plants (first pulling) will normally be produced on 5 per cent southern slope than on a 5 per cent northern slope. With increased light, the soil temperature and available plant food is increased with a corresponding increase in growth. Beds running east and west should not be ridged high in the middle since the ridge will tend to shade the northern half of the bed.

Temporary Bed

Until growers are thoroughly familiar with soil sterilization and have proven that chemicals will work on their soil type or have adopted steam sterilization, greater attention must be given to practices used in growing plants on temporary sites. Some growers may find it practical or encounter problems that will necessitate rotating the plant bed from place to place.

Besides insect control and blue mold in the plant bed, the chief points to remember are: 1. A loamy soil of high fertility. 2. At least a 5 per cent slope to the south. 3. A well drained soil, but not one that is thirsty. 4. A bed that is not shaded. 5. Windbreaks for protection.

6. Weed control with 1 pound of Cyanamid per square yard. For weed and disease control, use 1 pound of Uraman and $\frac{1}{2}$ pound of Cyanamid per square yard of bed. Apply chemicals 90 days before seeding.

7. Do not use water on the beds or in transplanters that comes from streams draining tobacco-diseased soil. Locate bed near water supply.

Soil Sterilization

Growers using Uramon and Cyanamid for the first time are urged to treat only a small percentage of their yardage until they learn how to apply the chemicals and make them work on their soil. These chemicals are not generally recommended on heavy clay soils in the Piedmont or on dark organic soils of the Coastal Plain because they have not always worked on these soils. In a few cases both Uramon and Cyanamid have caused a toxic effect to tobacco plants. Most failures, however, can be traced to improper application of the chemicals.

Cyanamid will control weeds but not tobacco diseases in the soil. Uramon will aid in killing weeds and will also kill such soil borne diseases as block root rot, black shank, root knot, and Granville wilt.

When the chemicals are used alone, or in combination, they should be applied to the plant bed 90 days in advance of seeding. October is best.

DISEASE AND WEED CONTROL. Use 1 pound of Uramon and $\frac{1}{2}$ pound of Cyanamid per square yard of plant bed. Where there have been toxic effects, change the rate to one-half pound of Uramon and one-half pound of Cyanamid per square yard.

After the soil has been well disced, pulverized, and smoothed so as to break up small clods, mark the bed into small plots. This will make it easier to get the same quantity of chemicals on all parts of the bed.

After 100 pounds of Uramon and 50 pounds of Cyanamid have been mixed, spread 100 pounds, or two-thirds of the mixture, over the 100 square yards of bed evenly by hand. Work chemicals in the first 3 to 4 inches of the soil with a light drag harrow or hand rake, but no deeper. A peanut weeder may be used or a disc harrow, with the disc set at a very slight angle, depending on firmness of the soil.

Broadcast the remaining 50 pounds of chemicals on bed and scratch into the upper 1 inch of topsoil with a hand rake so as to get it no deeper than this.

The chemicals need moisture to become active. If the soil is drying out, give the bed a good watering soon after application.

Uramon alone is being tested for soil sterilization at the rate of 1 pound per square yard.

WEED CONTROL. Use 1 pound of Cyanamid per square yard. Apply three-fourths pound per square yard to the first 3 to 4 inches of top soil. Then put the remaining one-fourth pound in the top 1 inch of the soil, using the same implements previously suggested. Do this job very carefully for best results, and at time of fertilization and seeding, rake in the fertilizer very lightly with a garden rake. Do not bring up any fresh weed seed to the soil surface or allow any seed to blow on the bed.

In the past beds have been burned in an attempt to kill weed seeds and sterilize the soil. On some farms beds have been sterilized with steam.

Preparation and Care of Plant Beds

If green manure or well-rotted stable manure is used on the permanent plant bed, it should be disced into the first 5 inches of the soil at least 4 weeks before soil sterilization.

If beds are to be put on new ground, clear away the trash, stumps, and shrubs. The soil can be pulverized to a depth of 5 inches with a disc harrow, coulter type plow, or a four-footed weeder type cultivator. A turning plow is not recommended. The soil should be well pulverized.

FERTILIZATION. Use 150 pounds of 4-9-3 per 100 square yards for average soils and 200 pounds for soils of low fertility. If Cyanamid and Uramon are used for sterilization, the amount of fertilizer may be reduced one-half on fertile soils.

Apply the fertilizer evenly over the bed and work lightly into the first one inch of topsoil. About 1 ½ inches should be the maximum under any conditions. Fresh weed seed should not be brought to the surface of the bed.

If any such organic nitrogenous materials as cottonseed meal, tankage, or dried blood are used, they should be applied several weeks before seeding so as to prevent damping off of plants.

When needed, use from 2 to 5 pounds of nitrogen topdressing in 50 gallons of water per 100 square yards of plant bed. The material can be placed in a sack and suspended in the barrel of water until it dissolves. Water the bed after the topdressing is applied with 50 gallons of water per 100 square yards of bed.

Plants should be topdressed while they are under blue mold attack. The topdressing can be used before or after the attack.

Excessive applications of topdressing are to be avoided.

SEEDING. One tablespoonful of good, clean seed is sufficient for 100 square yards of bed area. Lack of sufficient watering at the time the seed are germinating and trying to get through the crusty ground is responsible for many poor stands.

To obtain an even distribution of seed, it is necessary to divide the seed into equal halves for 100 square yards of bed area. Mix each half in a quantity of dry sand, ashes, cottonseed meal or fertilizer. Mix the seed and carrier thoroughly. This can be done by pouring the mixture back and forth from one container to another. Broadcast one-half of the mixture lengthwise the bed and the other half crosswise or at right angles to the first sowing. A better job can be done by going over the bed several times in seeding.

The seed are not covered, but firming the bed is one of the most important operations. This assists in bringing the moisture all the way to the surface, and provides a smooth level surface so that uniform germination will take place. Rolling the soil with a light roller is the most desirable method, but the operation may be accomplished by tamping with a board nailed to a short pole, or tramping with the feet.

Soils with considerable clay, and those that tend to crust may be benefited by lightly whipping the seed in with a dogwood bush rather than packing. Beds should be packed when in good physical condition and not when wet, since the soil would stick to the packer, thereby displacing the seed and cause crusting of the surface.

At this point, beds may be boxed in or covered lightly with straw and left without side boards or poles.

BED COVERING. Cloth with about 24 x 28 threads per inch is best. If the cloth is boiled for 30 minutes between seasons, it may be used a number of times.

The bed may be covered lightly with a uniform application of well-threshed wheat straw, about 15 to 20 pounds per 100 square yards. Heavy applications of straw are not desired. The straw is never removed from the bed and the canvas is placed directly on the straw and pegged to the ground around the edges. The straw acts as a mulch and keeps the cloth from sticking to the ground after rains.

If the sides are to be boxed in with boards or poles, a good insect tight job should be done. Otherwise, there seems to be little justification for the cost of the boards and this operation. The dirt can be packed against the boards or poles to aid in making tight the sides. After rains, surface drainage may be aided by opening holes along the sides. The side boards should not be higher than 6 to 8 inches.

For permanent bed locations, growers may prefer concrete blocks or some other such material. Where permanent sides are established, beds should be wide enough and open at the ends to permit the use of a disc and other equipment.

Wickets or sticks made from hardwood switches may be stuck in the ground here and there over the bed. Bottles or tin cans may be inverted or capped over stakes driven into the ground. Galvanized smooth wire may be stretched across the bed and fastened to the side boards, about every 12 to 15 feet. Rusty wire must not be used as it will cause the cloth to split.

DRAINAGE. When heavy rainfall occurs, seed beds on low moist soils are likely to become water-logged if not properly drained by ditching. As soon as the bed has been sown, it should be completely surrounded by a ditch one foot or more in depth, depending on how wet-natured the soil is and the width of the bed. If the bed is on a slope, the ditch on the upper side is of the most importance. The ditch will have to be deeper for wide beds. On high dry soil, the ditch should not be too deep as this will cause excessive drying.

PROTECTION OF BED. If local indications and weather reports indicate excessive low temperatures, the plants may be protected from freezing or frost by spreading a heavy coating of straw over the regular canvas or covering the bed with additional canvas or sacks. These materials should be removed as soon as the weather warms up or as soon as danger is passed.

TRANSPLANTING. Plants pulled from moist beds have much better root systems than those drawn from dry and hard soils. It is, therefore, advisable to water dry beds before drawing the plants. Walking in the plant beds during weeding and pulling the plants kills many small plants and packs the ground very hard. This is another point in favor of narrow beds so that boards can be laid across the beds during these operations.

As soon as the desired plants have been pulled, the beds should be watered. This settles the soil and washes the dirt from the plants left, and improves the quality and rate of growth of those to be pulled later.

BETWEEN SEASONS. Seed beds to be used more than one year must be kept free from insects, diseases, and weeds between seasons. When transplanting has been completed, all the remaining plants on the bed should be destroyed and the bed sown to velvet beans or crotalaria. Soybeans or cowpeas may be used if nematode is not giving trouble or where soil sterilization is used. About August 1, this growth of legumes should be disced into the soil. An application of animal manure may be made at this time, if it is free of lespedeza seed. All this should be done before sterilization.

STORING SEED. Growers who save their own seed should select a relatively large number of seed plants and mix the seed produced together so as to maintain the vigor and uniformity, characteristic of the variety. Some benefit has been obtained by cutting the seed heads after harvest time and placing the cut stem in water to keep the seed from drying out too fast. When the seed have been threshed out and cleaned, they should be stored thoroughly dry. The seed will keep well if stored in a cool dry place away from bright sunlight. If properly stored, seed may germinate better the second or third year than the first year.

Tobacco seed go through a dormant period and the germination will be better after the first 60 days. Seed that are stored in a refrigerator at approximately 40° F. are good for ten or more years.

Insect Pests

Residues from insecticidal treatments on tobacco are objectionable from several standpoints and should be guarded through cautious and judicious use or application. Especially is this true of lead and arsenic residues. Workers are cautioned to wash the hands thoroughly after handling poisonous insecticides or young tobacco plants that have been dusted in the plant bed with Paris green and lead arsenate dust mixture.

The recommendations given herein are applicable to all tobacco areas in North Carolina unless otherwise stated.

CAUTION: Do not allow the following to come into contact with plants as damage by burning may result: Bait for mole cricket, cutworms, grasshoppers, and green June beetle larvae.

TOBACCO FLEA BEETLE. Sterilize the beds before planting by burning or steaming and construct an "Insect Tight" plant bed. For information on proper plant bed construction, write the Extension Entomologist for free booklet. After transplanting, pull all plants from the bed and thoroughly disc the soil. This practice will prevent beetles from breeding and their subsequent migration to the fields. The following materials may be used.

Rotenone. Dust a mixture containing 1 per cent rotenone prepared with cube or derris. Apply with a rotary, hand-operated duster at the rate of $\frac{1}{2}$ pound to each 100 square yards. Repeat about every 4 days until infestation has been checked. Dust can be applied through the cloth cover provided cover is dry and not resting on plants.

Cryolite. Dust a cryolite dust containing 70 to 80 per cent sodium fluoaluminate with a rotary, hand-operated duster at the rate of 1 pound to each 100 square yards. Repeat application at weekly intervals.

Arsenical dusts. Use 1 pound of Paris green to 5 pounds of lead arsenate and apply with a rotary, hand-operated duster at the rate of $\frac{1}{2}$ pound to each 100 square yards of bed. Repeat application every 7 to 10 days. When cover is removed for "hardening-off" of the plants, this dust is recommended because, in addition to being toxic to the beetle, it also acts as a repellent.

MOLE CRICKETS. These insects occasionally damage tobacco in the seedbeds by uprooting the seedlings, cutting off the roots and eating into the underground parts of the plant.

Poison Bait

Corn meal or cottonseed meal.....	5 pounds
Wheat bran or shorts.....	5 pounds
Sodium fluosilicate.....	$\frac{3}{4}$ pound
Moisten slightly with molasses and water 1-100.....	2 quarts

The corn meal or cottonseed meal, wheat bran or shorts, and sodium fluosilicate should be thoroughly mixed while dry. Then add the molasses and water. This bait should be applied within 48 hours after mixing at the rate of 3 to 4 pounds to each 100 square yards. Scatter the bait in pathways around edge of bed and where stand is sparse. Care must be exercised to prevent the bait from touching the young plants. Best results will be obtained if the bait is applied late in the afternoon.

SLUGS (Snails). These insects are usually black, or dark brown, and resemble a snail without a shell. Their presence in the plant bed can easily be detected by the slimy trail left by the slug. They damage the plant by eating the leaves. For their control use hydrated or air-slaked lime. When damage is confined to margins of bed, apply the dust in a band 3 to 4 inches wide and $\frac{1}{2}$ inch thick along margin just inside the

bed walls. When damage is well distributed over entire bed, apply with duster at the rate of 4 pounds to each 100 square yards. Apply in late afternoon when plants and soil are dry to prevent burning.

CUTWORMS. The cutworm damages plant by cutting off the tobacco at the surface of the ground and may be controlled by the use of the following bait:

Poison Bait

Wheat bran (free of shorts)	50 pounds
Sodium fluosilicate or Paris green	1 pound
Water	To moisten

When preparing the bait, mix the wheat bran and sodium fluosilicate, or Paris green, thoroughly before adding the water. Moisten the bait so that when a handful is pressed together it will fall apart with a crumbly consistency. Apply the bait in the late afternoon at the rate of 4 pounds to each 100 square yards underneath and between the plants being careful that the bait is not touching the plants.

GRASSHOPPERS.

Poison Bait

Wheat bran (free of shorts)	50 pounds
Sodium fluosilicate	2 ½ pounds
Cheap syrup	3 quarts
Water	To moisten

Mix the wheat bran and sodium fluosilicate thoroughly before adding the syrup and water. Apply the bait in a narrow strip just inside and outside of the plant bed walls and to bare spots over the bed, being careful that the bait does not touch the plants. The bait should be applied early in the morning on a bright warm day.

GREEN JUNE BEETLE LARVAE (White Grub Worm). Plant bed sites should be selected in the fall of the year on land that is free of June beetle larvae. If it is suspected that larvae are present, Paris green may be applied in the fall on the intended plant bed site at the rate of 1 pound to each 100 square yards.

If larvae are found in the plant bed, use the following bait: wheat middlings 25 pounds, Paris green 1 pound, water to moisten (2 ½ to 3 gallons). The wheat middlings and Paris green should be thoroughly mixed before the water is added. Apply by hand at the rate of 10 to 12 pounds to each 100 square yards of bed, being careful that the bait is not touching the young plants.

MIDGE LARVAE. Midge larvae may be controlled with naphthalene flakes. Remove the cover and broadcast naphthalene flakes at the rate of 1½ to 2 pounds to each 100 square yards of bed and replace the cover. Apply once each week until the infestation is under control.

Blue Mold Control

Fermate spray and fermate dust give good control of the blue mold disease. Applications of either spray or dust should be begun before the plants become infected with blue mold. It is best to begin the program when the plants are about the size of a dime.

Make two applications of spray or dust a week and, if the material is washed off by rain, another application should be made immediately. If blue mold appears in the bed, the amount of spray may be increased and the dustings increased to three a week.

SPRAY. It generally requires about 1½ to 2 pounds of fermate to treat 100 square yards of bed for the entire season.

Two pounds of the material will make 50 gallons of spray. Measure out the desired amount of water in the pump tank. Measure the required amount of fermate and put in a half-gallon fruit jar, adding enough water to make the jar about two-thirds full. Shake vigorously for about 5 minutes and then pour the mixture in the pump tank, and stir well.

For the first four applications of spray, use about 3 to 3½ gallons per 100 square yards of bed. Increase the application to 4 gallons for the fifth and sixth applications, and to 5 to 6 gallons for the seventh and any other applications that may be needed. One or two applications, even after transplanting begins, will be beneficial, if there is any blue mold in the bed.

The spray forms a protective coating on the plants and good spraying is essential. A pump that gives 150 pounds of pressure or more is needed. The three types that give best results are (1) the barrel, (2) the bucket, and (3) the wheel barrow. At least 25 feet of hose and about 6 to 8 feet of half-inch pipe, with a nozzle on the end, is needed.

Although a good job cannot be done with a small pressure tank sprayer, a small yardage may be treated with this type of equipment. Some blue mold may appear on the bed, but continue spraying.

If the canvas is tight and not on the ground, the first two or three applications of spray with the better equipment may be made through the canvas. The nozzle should be held about 5 inches above the canvas. However, it is best to take the canvas off the bed. When spraying, wave the nozzle back and forth over the plants so as to get good coverage of both sides of the leaves.

DUST. A dust containing 15 to 20 per cent fermate, with pyrophyllite as the diluent, will generally give comparable results to the fermate spray, if used properly.

The dust formula is $7\frac{1}{2}$ pounds of fermate to $4\frac{1}{2}$ pounds of Pyrox (pyrophyllite), or other inert material. This makes a 15 per cent dust. Apply the mixture early in the morning twice a week, when the air is still and the plants are moist with dew. Use a rotary hand duster or pump-type duster.

Use about 1 to $1\frac{1}{2}$ pounds of the mixture per 100 square yards of bed for the first four dustings. The fifth and sixth dustings will require about 2 to $2\frac{1}{2}$ pounds. For the seventh and later dustings, when the plants are large, use about 3 to $3\frac{1}{2}$ pounds per 100 square yards. If the dust is washed off by rain, repeat the application. If blue mold appears in the bed, increase the dustings to three applications per week.

Copper Oxide Spray

This spray, when used twice per week and begun before blue mold shows up, has proven effective.

The formula is 8 ounces of yellow cuprocide, 8 to 12 ounces of vatsol O. T. C. or 4 to 6 ounces vatsol K, two quarts of cottonseed oil, and 50 gallons of water. This mixture should be used at the same rate per 100 square yards as for fermate spray.

Para Baco

Para Baco, or P. D. B., may be used even after blue mold shows up in the bed. Use 3 pounds of crystals per 100 square yards ordinarily, but only 2 pounds in warm weather. Sprinkle the crystals on the canvas and cover over with a heavy muslin sheet during the night. The sheet muslin must be removed early in the morning as the sun warms up the air. Treat 3 nights in succession, then skip three nights.

By removing the cloth from the bed during the day, the rate of plant growth can largely be controlled, if there is danger of plants getting too large before transplanting time.