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MANAGEMENT OF TOBACCO PLANT BEDS

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Management of Tobacco Plant Beds

By E. J. KINNEY

Success in producing tobacco of high quality depends to no small extent upon having strong, healthy plants ready for transplanting at a comparatively early date. Sturdy plants aid greatly in getting a good stand. They are not easily killed by dry, hot weather, and recover quickly from the effects of transplanting. Early transplanting has several advantages. Moisture conditions usually are more favorable for transplanting in late spring and early summer than later in the summer. Early-set tobacco is injured less frequently by drouth than late-set tobacco, because it matures before the period when drouth is most likely to occur. Early maturity resulting from early transplanting makes it possible to harvest tobacco when the weather is likely to be warm and clear, conditions favorable for producing well-cured leaf. This applies particularly to air-cured tobacco for the successful curing of which suitable weather is all-important, but early maturity is desirable also for fire-cured tobacco because the plants have time to develop fully and become thoroly ripe before harvesting. Finally, early tobacco is least likely to be affected seriously by wildfire, angular leaf-spot and other diseases which attack the leaf.

SELECTING THE SITE

The first requirement for the production of a good bed of plants is a rich, well-drained plot of land well supplied with organic matter. In sections of western Kentucky where there is still considerable woodland, the favorite place for making the tobacco plant-bed is in a clearing in the woods. Such a location provides almost ideal conditions; the bed is protected from the cold winds of early spring, and the soil is of a character to produce the most rapid growth and the best plants. Old fence rows, and pasture lands that have been in grass for a number of years are very desirable. In the White

Burley region, sod land is used almost exclusively. The superiority of soil of the kind mentioned is due chiefly to the large amount of organic matter present. Organic matter prevents crusting or baking of the surface, which is detrimental to germination of the seed and to the growth of the young plants. It is a simple matter to furnish an abundance of plant food for the growth of plants on any soil, but it is not easy to get the desired physical condition.

The general practice followed in Kentucky, of changing the site of the plant bed each year, is a wise one for the average grower. It is the easiest way to provide good soil conditions for plant growth and to avoid diseases which may originate in the plant-bed, particularly black root-rot. The usual methods of sterilizing the plant-bed are not effective in destroying disease organisms, and a bed used for two or more years in succession may become badly infested with root-rot and probably other diseases. Even steam sterilization, as ordinarily done, does not destroy black root-rot completely. However, thoro steam sterilization combined with the use of root-rot-resistant varieties of tobacco makes the continuous use of a bed fairly safe, as far as disease control is concerned. A permanent location for the bed has obvious advantages. It can be in a place convenient for frequent inspection and to the water supply. Also, it is practical to enclose the site with a good fence for protection. Instead of using a single bed, it is better to have a site large enough for two or three beds, so they can be used in rotation. This makes it easier to keep the soil in good condition. A good system of management for a permanent bed is as follows: As soon as the plants have been removed, manure the bed heavily and plow. Use well-rotted manure, if possible. Sow the ground in cowpeas. These should be plowed under in late fall. This should keep the soil well supplied with organic matter.

PREPARATION OF SEED BED

Plant beds should be plowed in the fall, if possible. Fall-plowed land mellows during the winter and is in good condition for making a seed bed in the spring. It is particularly desirable – in fact almost necessary – that stiff sod land be fall-plowed. If plowing is delayed until spring, the grass may sprout and give considerable trouble. In addition, it is difficult to get the seed bed into good condition and firm enough to hold moisture well. Where manure is to be used on a plant-bed, except a permanent bed, it should be

applied preferably in the fall, after the ground is plowed, and worked into the soil thoroly. Only fairly-well rotted manure is suitable for the plant-bed.

STERILIZATION OF THE SOIL BY BURNING

Tobacco plants are so small when they first appear that they cannot stand much competition from weeds. If weeds come up very thickly in the bed, it is a slow and tedious job to remove them and difficult to avoid injuring the young tobacco plants. It has long been the practice in all southern tobacco-growing districts to burn brush, poles, etc., on the bed after preparing the soil for seeding. This destroys weed seeds near the surface and prevents the beds becoming badly infested with weeds before the tobacco plants have become established. Burning is also of some value in destroying disease organisms and insects near the surface of the ground.

In burning, the best results are obtained by first laying poles on the bed and putting the brush and other wood on the poles so as to allow a free circulation of air at the bottom of the heap. The driest brush or wood should be laid on first, followed by the heavier wood. After the fuel is in place, fire should be started in the under layers of brush or dry wood at several places along the bed. A rather brisk breeze parallel to the bed is a decided help in maintaining a hot fire. Hot fires cannot be maintained where the layer of fuel is very thin. If only a limited supply of wood is available, it should be put in piles large enough to burn well, rather than spread over the entire bed. After burning a time on one place, the fires are dragged along, until all the bed has been burned. A better way is to fasten together two or three pieces of old woven wire fence, about 50 feet long, and lay this on the bed. Wood is piled on one end and a brisk fire is maintained. When one portion of the bed is sufficiently burned, a team is hitched to the other end of the fencing and the fire pulled into a new position. This is repeated until the entire bed is burned.

The bed should always be leveled and made ready for seeding before burning, so that it need only be raked lightly after burning is completed. Weed seeds are destroyed to only a slight depth, and if the ground is stirred to any considerable depth, live seeds will be brought to the surface.

STEAM STERILIZATION

In some parts of Kentucky, where most of the timber has been removed, it is difficult to obtain sufficient wood to burn beds properly. As a result, other methods of sterilization have been developed, particularly sterilization with steam. In fact, steaming beds is now a common practice among the larger growers in both the Burley and dark tobacco districts. It is much more effective than burning and not much more expensive if a value is attached to the labor required to prepare and collect the fuel necessary for burning a bed. It is seldom necessary to weed a well-steamed bed, and the plants usually grow more rapidly than in a burned bed. It is more effective in destroying disease organisms than burning. Steaming is a rather slow operation and in wet springs, when the ground can be worked only at brief intervals, it may be difficult to get the bed steamed in good season. To avoid this possibility, fall steaming is recommended. It is just as effective as spring steaming in controlling weeds and is satisfactory in every way.

The necessary equipment for steaming consists of a boiler, a shallow wooden or sheet-iron pan, and steam hose or iron pipe with connections for conveying the steam from the boiler to the pan. The average steam tractor of 20 to 25 horse power, used in custom threshing, furnishes sufficient steam for a pan 9 x 12 feet. With a smaller boiler, the size of the pan must be reduced accordingly so that a steam pressure of at least 80 pounds may be maintained in the boiler. It is scarcely practical to use a boiler that will not furnish enough steam for a pan with an area of 50 square feet, as with a smaller pan the work is very slow. In some localities owners of steam tractors do custom steaming.

To construct a steam-tight wooden pan, make a frame of 2 by 4 inch material. For the cover, use a good grade of 7/8-inch flooring. Coat the grooves with white lead and nail the boards securely to the frame, nailing both in the tongue and in the center. Force the boards together closely. Two or three pieces of plank are then laid across the cover boards on the outside, and the ends securely nailed to the frame. The box is then inverted and the cover boards nailed to the planks. Finally, heavy rings about three inches in diameter are fastened to each end of the frame on top. The box is lifted by bars thrust thru these rings. To prevent steam escaping between the frame and the surface of the ground, a knife-edge joint is pro-

vided by fastening heavy hoop iron about three inches wide to the bottom of the frame on the outside so as to project an inch or more below the frame. To make a tight connection, a strip of felt is put under the hoop iron.

The sheet-iron pans now used in Kentucky differ from the wooden pans only in having a top made of a heavy grade of sheet-iron instead of flooring. This gives a much lighter pan, more easily moved. The pieces of sheet iron used in making the top should be soldered together carefully but the edges should not be crimped. Tight joints are obtained by using strips of felt under the sheet iron where it is nailed to the frame. Generally 8d nails are used and they should be spaced about three inches apart. To brace the frame and prevent the top sagging, a piece of 2 x 6 inch plank is laid across the middle of the pan on the outside and nailed securely to the frame. The top is fastened to this by nailing from the inside. The cost is about the same as that of the all-wooden pan. Either of these pans should last many years if cared for properly and repaired occasionally.

Practically all plant-bed steaming in Kentucky is done with steam tractors or other types of portable boilers which can be moved along the bed as steaming progresses. Where the boilers can be kept close to the bed, a 25- or 30-foot length of heavy steam hose is used to carry steam to the pan. This is attached to a short pipe connected with the boiler and the other end is laid on the bed so it extends two or three feet under the pan when the latter is in place. A trench is made to carry the hose under the edge of the pan. Sometimes a nipple is set in one end of the frame near the middle for a hose attachment. This is made of a 6- to 8-inch length of threaded ¾-inch pipe. A hole the proper size is bored in the frame and the pipe inserted, allowing about three inches to project on the outside. It is held in place by lock nuts. Heavy leather washers are used under the nuts to make the connections tight.

Where a stationary boiler is used, enough ¾-inch pipe must be provided to carry steam to all parts of the bed. Generally 10-foot lengths are used, a length being added each time the pan is moved.

After the pan is in position, soil is banked around the edges to prevent escape of steam. It is generally necessary also to place weights of some kind on a sheet iron pan since a heavy steam pressure may lift it. Heavy posts are convenient for this use. Thirty minutes' steaming with a steam pressure of 80 to 125 pounds in the

boiler, is recommended for thoro sterilization. However, if the soil is fairly dry and the steam pressure is kept high, 20 minutes' steaming may be sufficient. At the Kentucky Experiment Station it was found that after 30 minutes' steaming at the proper pressure, temperatures in the surface two or three inches of soil average about 200°F. At a depth of 6 inches the temperature varied from 100° to 120°F., depending upon the amount of moisture in the soil. Whether or not steaming is effective may be determined by burying a small potato 3 or 4 inches deep in the soil before placing the pan. It should be thoroly cooked when the pan is removed. After moving the pan, the steamed area is covered with tarpaulin or mats of some kind to retain the heat. *This is very important.* Enough covers should be provided to permit keeping the soil covered for at least an hour. Each time the pan is moved it should be set so as to overlap slightly on the area just steamed. This avoids having unsteamed strips in the bed.

PLANT-BED BURNERS

In some parts of the state, furnaces known as plant-bed burners are used quite extensively for sterilizing plant beds. A fire box is made by constructing a frame of angle iron 9 feet long, 3 feet wide and about 18 inches high and riveting to the sides and one end of this frame a very heavy grade of sheet iron. On top is set a sheet iron pan about 6 to 8 inches deep and 3 feet wide. The pan is a few inches shorter than the fire box thus leaving an opening for a flue at the closed end of the furnace. The flue is made the full width of the frame and is usually about 18 inches high. The front end (closed end) is supported by a pair of wheels carried on a device which permits lowering the burner to the ground when in use and raising it for moving. The rear end is supported by short legs and handles are provided for lifting from the ground while moving.

To operate, the burner is placed across the bed and a fire started in the fire box. Soil from a space 3 feet wide on both sides of the box, and to a depth of 3 to 4 inches is shoveled into the pan which is then covered by a close-fitting sheet-iron cover. A brisk fire is maintained until the temperature of the soil reaches 180 to 200°F. A thermometer should always be used to determine the temperature. Then the fire may be allowed to die down but the soil should be left in the pan 15 to 20 minutes longer, after which it is

shoveled back in place. Heating is accomplished largely by the steam formed from the moisture in the layer of soil at the bottom of the pan. The area under the furnace is burned thoroly in heating the soil in the pans; hence at each setting of the burner a space 9 feet square is sterilized. Two men, with good wood, can prepare about 100 feet of bed 9 feet wide per day.

The plant-bed burner sterilizes much more effectively than the ordinary method of burning if the work is done carefully, and uses only about a third as much wood. The wood must be dry, however, and of fairly good quality.

OTHER METHODS OF STERILIZATION

Crude oil has been tried to a limited extent for burning plant beds. It is said to give good results only when the soil is quite dry. Old rubber tires have been used successfully as fuel for burning. Solutions of various chemicals have been tried. Some of these have proved effective in disease control but none has been found that destroys weed seeds.

WET SOIL CANNOT BE STERILIZED PROPERLY

It is never advisable to attempt to sterilize plant beds when the soil is wet, regardless of the method followed. Heat penetrates wet soil very little; consequently poor sterilization is obtained. In addition soils burned or steamed when wet may become so hard that the tobacco plants do not grow well.

SIZE OF PLANT BED REQUIRED

In the White Burley district at least 200 square feet of bed should be allowed for each acre of tobacco set and most growers prefer to have twice as much. Only about half as much bed is required for dark tobacco since less than half as many plants per acre are set as with Burley. In the Burley district most beds are made 12 feet wide altho some prefer a 9-foot width. In dark tobacco districts the width varies from 9 to 24 feet. Narrow beds are more convenient for weeding and pulling plants.

FERTILIZING THE PLANT BED

In order to assure an abundance of available plant food for the growth of the young plants, it is advisable to use some commercial plant food on the bed even if it is believed that the soil is very fertile. Its use may produce earlier and stronger plants. If not need-

ed, the fertilizer will do no harm, and the cost of application is so small as to be negligible. Fertilizers containing a rather high percentage of nitrogen should be used for tobacco beds as, for example, a 4-8-4 or a 6-8-6 analysis. The ashes provide an abundance of potash where beds are burned with wood, and this element may be omitted from the fertilizer. A 6-10-0 analysis is desirable for a burned bed. Potash adds little to the cost, however, and it is frequently difficult to purchase locally fertilizers that contain no potash. Commercial fertilizers often are applied to plant beds at a rate of 10 pounds or more to each hundred square feet of bed, which is equivalent to over two tons an acre. Such heavy applications are not needed in Kentucky and may cause injury. From 3 to 4 pounds per hundred square feet is ample for any soil in the state likely to be used for a tobacco bed. The fertilizer should be spread evenly *after the bed is sterilized* and raked into the soil lightly.

Sometimes tobacco plants fail to make a satisfactory growth even on beds that received a heavy initial application of fertilizer. This is most likely to occur when rainfall is very heavy in early spring and is usually due to the leaching of nitrates out of the surface soil. Under such conditions an application of nitrate of soda or other soluable nitrogen fertilizer generally stimulates the plants to a vigorous growth and in late years "nitrating" plant beds has become a common practice. However, it is not advisable to apply nitrate if the plants are making a normal growth since an overabundance of available nitrogen tends to make the plants brittle and tender, and less likely to live when transplanted. It is best to apply the fertilizer in solution. Ten pounds of nitrate of soda to a barrel of water is the strength of solution most frequently used. Five gallons of this solution are sufficient for 200 to 300 square feet of bed.* Usually one application is sufficient. The solution should be applied evenly with a sprinkling can. This should be followed by enough clear water to wash all solution from the leaves of the plants. Two gallons of water to each gallon of solution used is a safe quantity to prevent burning the plants. It is best to remove the tobacco cotton when applying the nitrate solution.

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* One hundred square feet of bed equals approximately
11 ft. of bed 9 ft. wide
8 ft. of bed 12 ft. wide
4 ft. of bed 24 ft. wide.

SOWING THE SEED

Tobacco beds should be seeded as early as seasonal conditions permit. In some seasons it is possible to sow in February, but March seeding is more common. There is little danger in early seeding, however, for the small tobacco plant is very hardy and is seldom injured under its cloth protection, even when the ground freezes. Seeding later than April 1 is not desirable, as stated previously. It is a mistake to work the ground and burn the bed when wet, in order to seed early.

The proper amount of seed is approximately half a level teaspoonful of sound, recleaned seed per hundred square feet of bed. To beginners in tobacco growing this may seem to be a very light seeding, but it is ample. To sow more is likely to give such a thick stand that the plants cannot grow strong and stocky. Some Burley growers sow only 1/3 teaspoonful per hundred square feet of bed. An ounce of tobacco seed contains about twelve teaspoonfuls, sufficient to sow 2,000 to 2,400 square feet of bed.

It is difficult to distribute tobacco seed evenly unless mixed with some material to give bulk. Screened wood ashes, air-slaked lime or commercial fertilizers are used for this purpose. The use of slightly moist sand at the rate of a peck or more with each ounce of seed, makes it possible to sow seed in windy weather. An even distribution of the seed is particularly desirable but seldom secured. The best way to get an even distribution is to sow the bed over several times, using a portion of the seed each time.

Tobacco seed should be covered very lightly. The old practice of tramping the bed after sowing, to cover the seed well and firm the soil so it will hold moisture, has not been improved upon. A roller does fairly well, but is not so good as the feet.

As soon as the seed is sown, tobacco cloth should be spread over the bed. Putting the cloth on the bed immediately keeps the surface from drying and, if heavy rains occur, prevents packing of the soil. It used to be the custom to box plant beds with boards, poles or even good-sized logs, and to fasten the cotton to this frame. Now most growers in the Burley district pin the edges of the tobacco cloth to the ground by the use of wire pins. Generally a wire supported by stakes about a foot high is stretched tightly the long way of the bed, near the middle, to hold the cotton off the ground. Sometimes, however, wickets made of wire and resembling croquet wickets are used to hold up the cloth covering. When insects are

not troublesome, boxing beds does not seem to be of particular advantage except to keep the tobacco cotton from rotting so rapidly. Boxing is of great value, however, in keeping insects out of plant beds, especially fleabeetles which are troublesome in many tobacco districts.

INSECT ENEMIES

A number of insects are particularly fond of tobacco plants, but the most troublesome are cutworms and fleabeetles. Cutworms often get into the bed while the plants are still small, and, if not detected, may quickly destroy most of the plants. It is an excellent plan to visit the plant bed every few days to be sure insects are not causing damage. Perhaps the best way to destroy cutworms in tobacco beds, especially when the plants are small, is to use a poison bran bait. This is made by mixing together 25 pounds of wheat bran and 1 pound of paris green, and adding sufficient water to make a thick mash. The addition of 2 quarts of molasses is recommended by some entomologists. The tobacco cotton should be lifted and the bait sown thinly over the bed late in the evening. Usually it is very effective.

The fleabeetle is becoming increasingly troublesome in Kentucky, both in the plant bed and in the field. In North Carolina, where this insect is a very serious pest, the Experiment Station recommends the use of trap beds for its control. These are narrow beds built along both sides of the main bed. The main bed should be carefully boxed and canvased so the beetles will have difficulty in gaining entrance. The trap beds, however, should permit them to enter easily. The plants in the latter are kept dusted with an insecticide. The beetles feeding on these plants are destroyed and prevented from injuring the plants in the main bed or from migrating to the field when the tobacco is transplanted.

Results of experiments on the control of tobacco-bed insects conducted by the Division of Entomology and Botany, Kentucky Experiment Station, have recently been published (Kentucky Experiment Station Circular No. 47, 1937, Control of Insects Commonly Affecting Tobacco Plant Beds, H. H. Jewett.) Growers who have had injury in their plant beds from flea beetles or other insects should send for this publication. Boxing the bed tightly and covering carefully with a good grade of tobacco cotton was found to be a very effective means of preventing severe infestation with flea bee-

tles. To make a tight cover, the edges of the tobacco cotton were drawn over the tops of the boxing boards and fastened to the sides. Earth was banked along the lower edges of the boards. A good grade of 6-inch boxing was used costing about $2.50 per hundred lineal feet. The cost of boxing a bed 300 feet long is approximately $15.00 at this price for the lumber, and the boards should last five years or longer if kept under cover when not in use. Three dollars a year is a small sum to pay for protection from insects. Barium fluosilicate proved to be the most effective insecticide for destroying the beetles. It should be diluted with about 20 percent by weight of some light material such as sterilized tobacco dust or infusorial earth and dusted over the plants at the rate of ½ pound to each 100 square yards of bed (100 feet of 9-foot bed or 75 feet of 12-foot bed).

CONTROLLING PLANT-BED DISEASES

Tobacco mosaic and the leafspot diseases of tobacco, wildfire and angular leafspot, often originate in the plant bed. Black root-rot may also occur. For the control of these diseases and others, Valleau (Kentucky Experiment Station Bulletin 362, Tobacco Diseases, 1936) makes the following recommendations:

"Select a plant-bed site each year where tobacco has not been grown previously. A bed used year after year becomes infested with the black root-rot fungus unless burned or steamed thoroly or a highly resistant strain of tobacco has been grown. Beds should be located away from tobacco barns or other sources of tobacco trash. Burn or steam the bed very thoroly so that little weeding will be necessary. If horsenettles or ground-cherries are found in the bed it is best not to handle them at all either while weeding or pulling, because they sometimes carry mosaic. Never use ground tobacco stalks or other tobacco material, as it comes from the barn, on the bed as a fertilizer, because it is nearly certain to introduce mosaic. Boil old tobacco cotton unless it has been stored in a place free from tobacco trash. Have the cotton as insect-proof as possible as there is a chance of the introduction of disease by insects. Experience has shown that tightly boxed and covered beds are more likely to be free from wild-fire and angular leaf-spot than unboxed beds. When the tobacco plants are established in the bed, that is, when the first leaves are just developing, spray or sprinkle the bed with 3-4-50 Bordeaux mixture at the rate of 1 quart per square yard. This tends to prevent the bacterial diseases, angular leaf-spot and wildfire.

"It has been clearly demonstrated in Kentucky that cured tobacco is the source of most of the mosaic infection of tobacco plants before and during transplanting. Therefore do not use natural leaf tobacco for either

chewing or smoking and do not carry it or otherwise handle it while working around the plant bed. If natural leaf tobacco has been handled recently, scrub the hands thoroly with soap and water before handling plants in the bed. If natural leaf tobacco has been carried in the pockets, brush them out, after which plug or twist tobacco may be substituted. Commercial plug, twist, and scrap chewing tobacco usually are free from mosaic and are much safer to use than natural leaf tobacco. Pipe smokers should use a brand of canned smoking tobacco rather than the natural leaf. Manufactured cigarettes probably are safe to use while working with the plants. It is preferable, however, to use no tobacco whatever when working in the bed."

WATERING PLANT BEDS

Rapidly growing plants evaporate much water from the soil, and in dry weather beds must be watered or growth will be checked and the plants injured. Watering a large plant-bed is a laborious operation, but very necessary in many seasons if strong, thrifty plants are to be produced. It is better to give the plant-bed a thoro watering once every eight or ten days than to water lightly every few days. A barrel of water for every one hundred square feet of bed is not too much. It is the equivalent of about 4/5 inch of rain. The tobacco grower can well afford to provide equipment for watering plant-beds rapidly. Seldom are there seasons when watering will not be a help in producing strong, early plants.