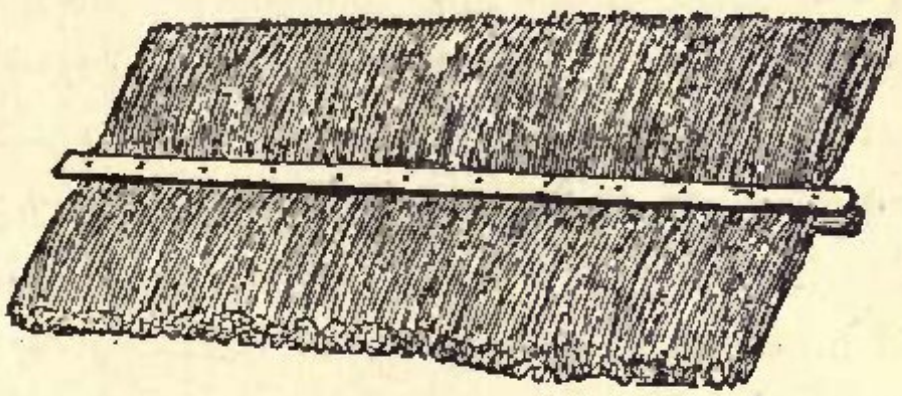
Obviously, no frost must be allowed to reach the seed-bed when once sowing has taken place. To prevent this, and for another purpose to be described presently, Perry Hull advises the construction of a straw mat, as shown in Fig. 4, which is very light to handle, easily made, and

FIG. 4.



sufficiently strong to last one season. It is made "by laying a scantling (6 feet long, 1½ inches wide, ¾ inch thick) upon the barn floor; place a layer of good straight rye-straw upon it, so that the scantling will come about in the middle of the straw, then another layer with the tips the other way, that it may be of uniform thickness in all its parts (about 1½ inches thick). Place a similar scantling exactly over it, and with sixpenny nails, nail them tight; with an axe trim both edges straight, and to a width of 3 feet, and the mat is made. With these the beds should be covered every night, cold or warm; in the daytime they should be set up at the north side of the bed, at an angle of about 65 degrees, by driving crotches just inside of the bed, for the end of the scantling to rest in, the lower edge of the mat resting on the ground, outside the bed.

"The plants, as soon as they are out of the ground, which will be in a few days, require strict attention.

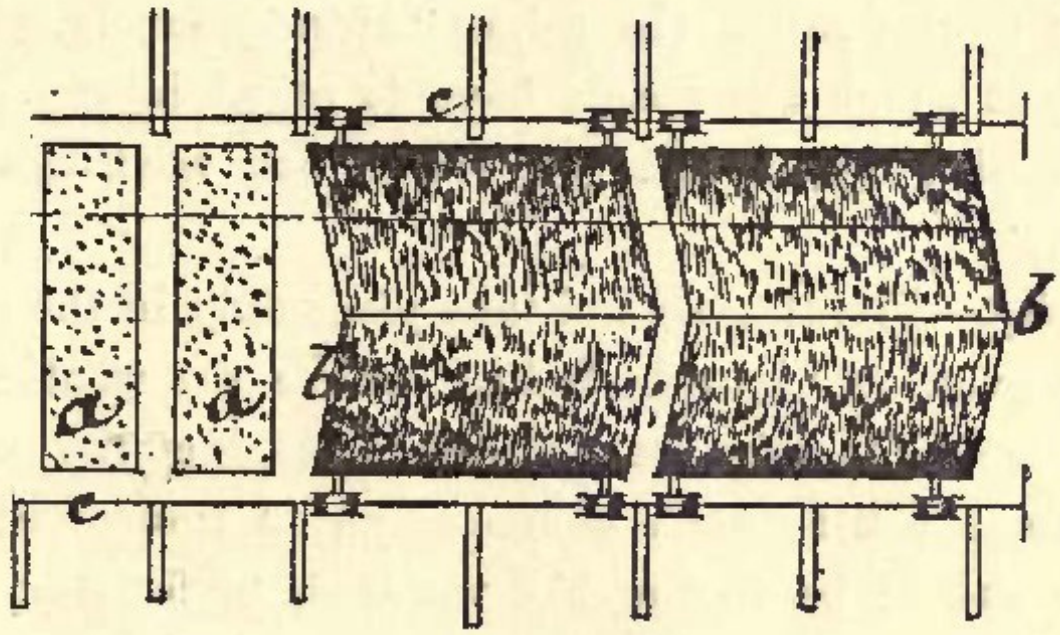
The beds should be made high enough, so that in fair weather a little water can be applied every night. After the fourth leaf appears, manure-water should be used. Place an old barrel near the beds, and throw into it ½ bushel of hen-manure, and fill with water; after it is well soaked, use ½ pailful of it, and fill up with clear water with the chill taken off. As the plants get larger, the strength of the infusion can be increased, being careful that it is not so strong as to turn the plants yellow. As soon as the plants are large enough to be readily taken hold of by the thumb and point of a knife, they should be thinned to about 144 per square foot, and kept free from weeds. This plan is decidedly preferable to raising under glass. It is less expensive, the plants are more hardy to set out in the field, are got fully as early, and a little carelessness on a hot day will not ruin the whole. It has been my method for the past 8 years, and during that time I have never failed to have good strong plants ready for the field between the 5th and 10th of June."

Mitjen, whose essay on tobacco-growing in Cuba has been already mentioned, recommends a system of shade frames borne on small tramway trucks, as illustrated in Fig. 5—(*a*) seed beds, raised above the surrounding level; (*b*) light pointed covers of thatch on a wooden frame, and provided with grooved wheels; (*c*) rails on which the frames run, facilitating their application or removal as the vicissitudes of the weather may demand.

Preparation of the Field.—Land intended to be planted with tobacco should receive several ploughings not less than 9 inches deep. As a rule, clay requires to be more

deeply ploughed than sandy or loamy soil. It greatly conduces to success, if the land is allowed to lie fallow for several months before planting the crop, to admit of the proper preparation of the soil, by ploughing, rolling, harrowing, &c., and to allow the attainment of as fine a

FIG. 5.



tilth as is usual in gardens. No crop will better repay the expense of proper preparation of the soil than tobacco; the fineness of the leaf and the aroma of the tobacco depend to a great degree upon this. The land should be ridged immediately before planting. The distance apart at which to make the ridges is governed by the quality

of the soil and the sort of plant to be raised. With good soil, the ridges must be farther apart than in a poor one, because of producing larger leaves. The ridges should allow a passage between the rows, for the purpose of weeding, hoeing, suckering, &c., without breaking the leaves. In the lines, the plants may be 6 in.–1 ft. closer than the ridges. In some places, a plough is run at right angles across the ridges before planting, at the distance at which the plants have to stand in the lines, thus forming small hills on which the seedlings are planted.

Planting.—Planting should take place only in the evening (or even at night in India), unless the weather be cloudy, when it may be performed during the whole day. Some hours before commencing to transplant, the nursery should be thoroughly watered, to facilitate the removal of the plants, without tearing their roots. If the plants are of even size, so that all can be removed, the best plan is to take them out with a spade, or trowel, leaving a lump of soil on each. But in most cases, it will be necessary to take up each plant separately; this should be done very carefully, holding with the thumb and forefinger as near as possible to the roots, and drawing out the plants, if possible, with a little soil adhering to their roots. The plants are taken at once in a basket to the field for planting. An attendant going between two ridges places a plant on each hill, right and left. One attendant is sufficient for two planters, who follow immediately. The planting is nearly the same as with cabbages, but requires more care, the plants being more tender, and their roots and leaves springing nearly from

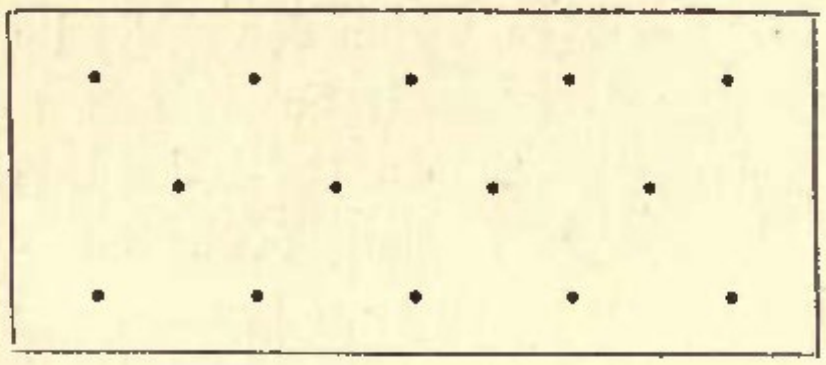
the same point, they are more difficult to handle. The plants should be placed in a hollow made on each hill, which will serve as a reservoir for the water to be applied, and also afford some shade.

In India, the plants are watered immediately after planting; they should also by some means be shaded during the first few days, which can easily be done when only a small area is planted, but is rather difficult to manage on a large scale. In the latter case, the shade afforded by planting in a slight cavity must suffice. If the plants have been taken from the nursery with some soil adhering to their roots, and are kept sufficiently moist during the first few days, few of them will die. When the weather is dry, water should be applied at morning and evening, and after that time, once daily until the plants have taken root, after which, occasional waterings, varying with soil, weather, and kind of plant, must be given. In dry weather, and with a soil poor in humus, one watering every second or third day may be necessary, whereas with a soil rich in organic matter, and in a moist atmosphere, watering may be entirely dispensed with. During the first few days, the water is applied with a watering-pot, held very low, otherwise the soil would be washed from the plant-roots, and expose them to the direct rays of the sun, causing death. The arrangement of the plants in what is known as quincunx order, as shown in Fig. 6, is generally adopted.

This part of the operations connected with tobacco-growing is described at some length by Mitjen so far as the practice rules in Cuba. His translator remarks that "as soon as the land has been prepared, it should

be furrowed at a distance of 1 yard between each two furrows. This operation should be simultaneous with the planting, and should be done, if possible, after 3 o'clock in the afternoon, and on cloudy days, so as to

FIG. 6.



prevent the recently set plants from being scorched by the sun. The furrows should run more or less from north to south, as, by making them in this direction, the plants are less injured by the sun, or the strong winds which generally blow about the planting season. Immediately, and behind the man who is furrowing, another should follow, placing the plants at every ½ foot all along the furrow, and behind them another should at once set the plants, the first walking in the distance, or bank, and the other in the furrow. The one should open the land with his right hand, behind which, with his left, the other will place the plant, being careful neither to double the stalk nor the roots, and, letting the ground fall directly on the roots, should press it lightly on them with his hand. The plants should be buried half-way up the stalk, or, if the plant is small, it should be covered to where the leaves spread. Care should be taken that the plants have no *dry* mould sticking to their roots, and that no ground from the furrow falls in the *centre or*

sprout, and when the planting is going on, the ground should not be too wet. The plants should be set on the side of the furrow, and on that side which is next the setting sun, so that the rising sun may strike upon them, and they may be somewhat protected from the rays of the afternoon sun.

"Generally the plants wither after being transplanted, but on the third or fourth day after they are set they begin to shoot up, and on the fifth day or the sixth, those that have not taken root can be distinguished. Then, and without loss of time, others should be supplied, this operation being repeated at the end of another 5 or 6 days, so that the whole field may be well filled with living plants. This is one of the most important operations for securing a good crop, because the fields will require as much cultivation and labour bestowed on them if they have vacant spots as if they were full and regularly planted, and, of course, the yield will be less, besides many other evils well known to practical *vegueros*.

"According to the best opinions admitted among *vegueros*, one man can take care of 12,000 tobacco plants, and prudence dictates that no more land should be planted than that which can be well attended to, as experience shows that in exceeding this number for each man, instead of proving advantageous to the planter, it is frequently the cause of considerable loss. Excessive planting produces, at once, an increase of labour, and if, unfortunately, a hard year should occur, occasioned by caterpillars or other causes, it almost always happens that the man who has only planted 12,000 plants, for each labourer he can command, produces four times as

much tobacco, and of a better quality, than he who may have planted from 25,000 to 30,000 plants per labourer.

"When the plantations are out of proportion to the strength of the labour which can be counted on, all the work becomes slowly and badly done, and these faults most sensibly prejudice both the yield and the quality of the crop, and consequently the interest of the planter. Immediately after supplying the fields, the tobacco plants should be carefully inspected, almost daily, in order to exterminate the caterpillars of every kind that may be found, and this operation should *always* be made during the morning, because in the heat of the day the worms are accustomed to hide themselves from the sun, and the wind agitates the leaves too strongly to permit them to be handled without risk of being broken or torn, especially when they are somewhat large."

After-cultivation.—After the plants have once taken root, they grow rapidly. They are hoed when about 6–9 in. high, and the soil is drawn from the furrows to raise the hills, maintaining a depression round the stems. If the soil is not very rich, a special manure should be applied at this stage of growth. The best manure generally will be nitre in a liquid state, which can be applied in the depression around the plants with a watering-pot. By applying it in solution and close to the plant, less is required than when spread over the whole field. Some weeks afterwards, another hoeing and heaping of earth round the plants will be necessary. It is most difficult to say the number of hoeings which may be required by a tobacco crop. The general rule to be followed is to keep the soil loose, friable, and free from weeds. The more

organic matter the soil contains, the more will it remain loose and friable; the less organic matter, the more waterings will be required, which causes the soil to crust over, and to assume a close texture, and necessitates frequent hoeings. As long as the plants have not spread much, the hoeing may be done by a cultivator, followed by some men to perform the heaping. Insects which attack the tobacco must be carefully sought for and killed at once. They can easily be discovered in the mornings; if not killed, they may destroy the whole crop in a few days. Turkeys are invaluable for their grub-eating propensities.

Worms, in the American phraseology, here generally known as caterpillars, are the *bête noire* of the tobacco grower. The most common is highly destructive also to the potato and tomato foliage. The worm as it comes from the egg is so small as to be unobserved, but having an enormous appetite, it devours rapidly, and soon grows to a great size. When not feeding, it lifts up the head and fore-part of the body, and remains apparently lifeless. From its resemblance in this position to the Egyptian Sphinx, Linnæus gave the name *Sphinx* to the genus. The larva is of a light green colour, with whitish oblique stripes, and has a horn upon the rear end of the body. Though it is repulsive in appearance, it is perfectly harmless to touch, and may be picked off with the hands without fear. After it has reached its full size, it leaves the scene of its ravages and goes into the earth, where it throws off its skin and becomes a brown-coloured chrysalis. The curious projection, like a handle, at the end of the chrysalis, is a sheath which holds the tongue of

the future moth. The moth or perfect insect is fully 2 in. long in the body and the spread of its wings reaches

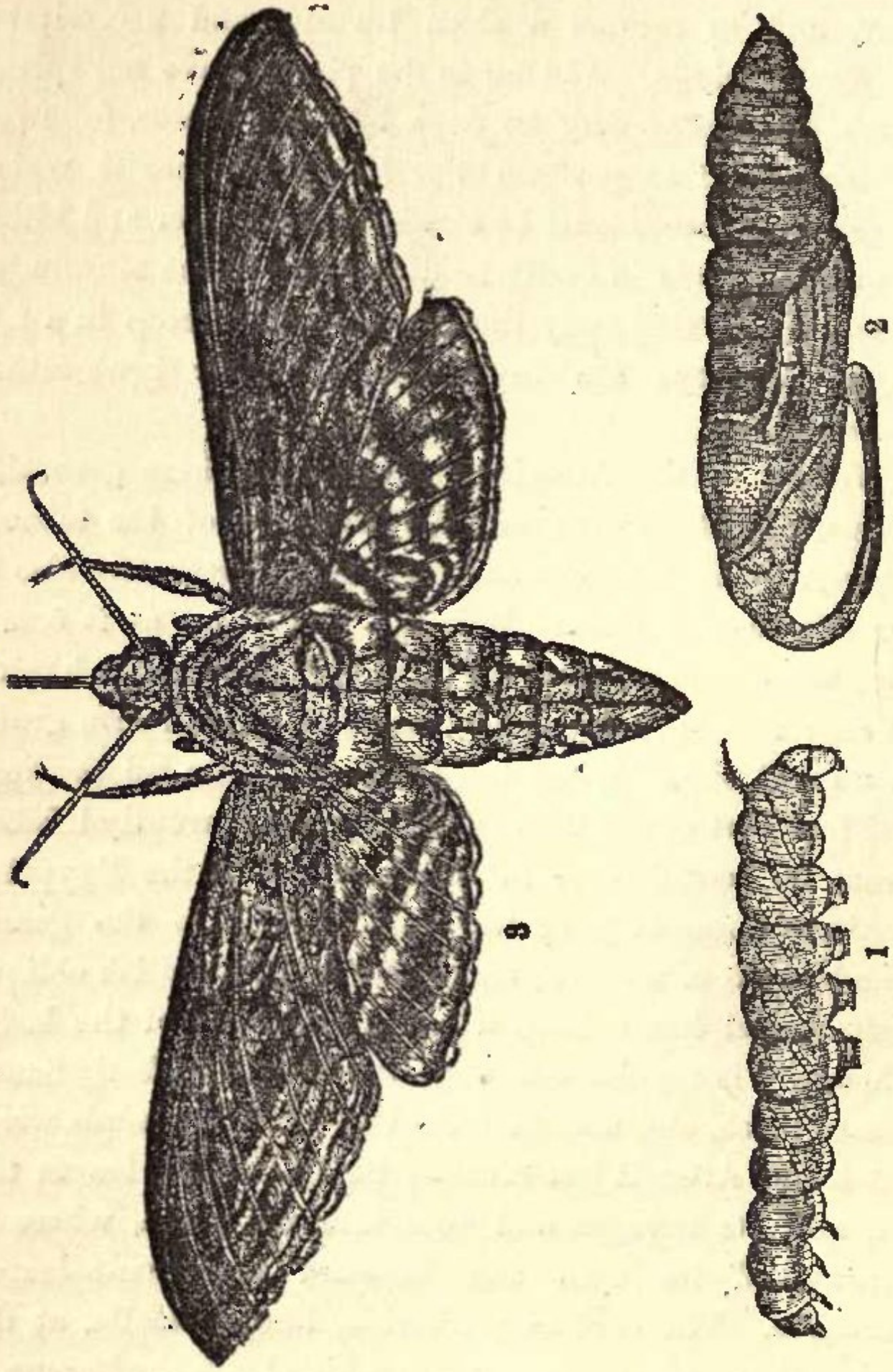


FIG. 7. The Tobacco Worm.

5 in. It is of a grey colour, with orange-coloured spots on each side of the body. As there are five of these spots on each side, it is called *Sphinx quinque-maculatus*, or Five-spotted Sphinx. The moths may be seen towards night flitting about the flowers, from which they suck the juices by means of their remarkable tongue, which is 5–6 inches long. When the tongue is not in use, it is closely coiled up and hidden between the two feelers. From the manner of their flight and feeding, they are frequently mistaken for humming-birds, and are called "humming-bird moths," and "horn-blowers." The moths should always be destroyed if possible; by so doing we prevent the production of several hundreds of most destructive worms. Naturalists make one or two other species, which closely resemble the Five-spotted Moth, and are only distinguished by characters which would not be noticed except by the entomologist.

Judson Popenoe gives the following advice with regard to these pests. "As soon as worms appear, which is generally when the leaves are as big as a man's hand, go over the tobacco, looking carefully at every plant. The worms usually stay on the under side of the leaf; if you see a hole in the leaf, no matter how small, raise it up and you will generally find a worm under it. Worming can not be done too carefully. Miss one or two worms on a plant, and before you are aware of it the plant is nearly eaten up. When you find a worm, take hold of it with the thumb and forefinger, giving your thumb that peculiar twist which none but those who are practised in it know how to do, and put the proper amount of pressure on, and my word for it you will render his wormship

harmless. Worming has to be continued until the tobacco is cut; the last worming to immediately precede cutting and housing."

Schneider remarks that "from the first starting of the tobacco plant, it has its enemies. First appears a cut-worm that works in the soil and eats the roots off. Then comes a little caterpillar which enjoys itself on the young leaves, and lastly the beautiful and large tobacco-worm, which eats into the leaf, and in a short time leaves nothing but the leaf-stems and stalk. The only remedies against these enemies are the vigilance and industry of the planter—looking after them, digging up, picking, and destroying once or twice a day, or as often as there are any traces of them. Children, to whom premiums are offered, will be very successful in destroying them. A herd of turkeys, if given access to the tobacco-field, are a very valuable help. A negro from South Carolina told me a few days ago, that a solution of blue vitriol in water, sprinkled over the plants, will kill the worms. The remedy may be worth trying. Of course the solution must be made weak enough, so that it will not destroy the plants as well as the worms."

On the same subject, White recommends the planter on the "next, or at farthest, the second morning after having set your plants, go over to see that the worms do not eat up one-half of them. You can tell where they are and have been, by seeing a plant with a single leaf, and sometimes the whole plant eaten off and drawn down into the hole occupied by a large brown or black worm; you will see little ant-hills like, and round holes in the ground; by poking around a little in the dirt, you will

find a worm very near the mouth of these little holes. Destroy it, and all you can find, and thus save your crop. This searching for worms must be kept up till they cease to do mischief. All plants missing in the field should be renewed from the bed at the first opportunity. The morning is the best time to find the worms, as they are near the surface of the ground; later, they retire into the ground to appear again near sundown, and work during the night and early morning."

Thomas describes tobacco worms as "hatched from eggs deposited by what is called the 'tobacco fly.' It is a large, dusky-brown, winged miller, nearly as large as a humming-bird. It lays its eggs on fair evenings and moonlight nights in July and August. It can be seen almost any clear evening, among what are called 'Jimson-weeds,' sucking the flowers. The eggs will hatch out in 24 hours, and the worms commence eating when less than ½ inch long, and continue to eat till they attain the length of 4–5 inches. One worm, in 6 weeks, will destroy a plant so completely as to render it utterly valueless. This pest is vastly more numerous in some seasons than in others. Four years ago there were scarcely any; but for the last three years they have been destructively numerous. The worming of the crop, when they are numerous, is, by far, the most disagreeable and tedious labour attending it. Much of the value of the crop depends upon the care or inattention of performing this part of the work. The crop may have been planted in good time—ploughed, hoed, primed, suckered, topped, cut, and cured well; yet it may have been so riddled by worms as to be comparatively good for nothing in market;

hence, they must be picked off and destroyed, and that promptly."

Topping and Suckering.—The plants will commence to flower about two months after planting, when 2–7 feet high. When the flower-buds appear, they must be broken off, and with them the top and bottom leaves. By breaking off the flower-buds at an early date, the sap that would be used in the formation of these organs flows to the leaves, which thereby increase in size, and the outturn becomes much heavier than when the plant is allowed to flower. But it is generally admitted that the leaves lose much in aroma. To what extent the early removal of the flower-buds impairs the quality has not been properly investigated. It is very probable that the greater yield does not always compensate for the loss in quality. The bottom leaves are generally of inferior quality, small, torn, and dirty. The number of leaves to be left on the plant varies greatly, according to species, quality of soil, and method of cultivation. The minimum may be placed at 6, the maximum at 22. The only rule to be observed is to retain as many leaves as the plants are able to mature. Soon after the plants have been topped, suckers appear in the axils of the leaves; these should be broken off as soon as they come, at least they should not be allowed to grow longer than 4 inches. If the suckers are not removed soon after their appearance, the size of the leaves will be seriously impaired. After the plants are half-grown, great care must be taken when going through the lines, whether for the purposes of hoeing, watering, or suckering, &c., not to tear the leaves. In India, hoeing and suckering should be performed only when the leaves have lost

part of their turgescence, attained at night. Insects, however, must be killed during the morning and evening; at other times, they are not easily found. Leaves which are torn are not fit for cigar-wrappers, and must often be thrown on the refuse heap as valueless, even if well developed and of good colour.

The plants commence to ripen about three months after being planted; this is indicated by the leaves assuming a marbled appearance, and a yellowish-green colour. The leaves also generally become gummy, and the tips bend downwards. It is considered that tobacco intended for snuff should have attained more maturity than tobacco for smoking. Nessler found that the less ripe leaves contained more carbonate of potash, and burnt consequently better, than the more ripe ones, but the total amount of potash was larger in the latter than in the former; cigars made from less ripe leaves kept the fire when lighted for a shorter time than those made from more ripe leaves.

In the words of Judson Popenoe, the "tobacco is ready to top when the button (as the blossom or top of the stalk is called) has put out sufficiently to be taken hold of, without injury to the top leaves. As tobacco is not regular in coming into blossom, it is the usual practice to let those stalks that blossom first, run a little beyond their time of topping, and then top all that is in button as you go. There is no particular height to top at, but as a general thing 16 to 18 leaves are left; judgment is necessary to determine where to top; if topped too high, 2 or 3 of the top leaves are so small as not to amount to much; if topped low, the tobacco spreads better; if just coming out in top, reach down among the top leaves, and