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The Culture of Cigar Leaf Tobacco in Texas

By

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The Culture of Cigar Leaf Tobacco In Texas

By Otto Olson

INTRODUCTION.

The interesting processes connected with the production of the cigar are almost wholly unknown outside of the tobacco trade. In the first place, the cultivation and handling of cigar leaf tobacco is a highly specialized industry, differing in several important points from the production of other tobaccos, and secondly, the several processes through which cigar leaf tobacco passes before it is ready for the cigarmaker's table, require considerable technical skill and experience.

In all cigars of American manufacture three distinct sorts of leaf tobacco are used,* namely, the wrapper, binder, and filler. The wrapper is the outside covering of a cigar, and the domestic tobaccos used for wrappers are grown in Connecticut and Florida, and to a limited extent in Texas and Alabama, usually from Cuban and Sumatra seed. A considerable part of the acreage devoted to wrapper tobacco consists of "shade," that is, posts nine feet high are placed on the fields at convenient distances and wires are strung between and on top of the posts, forming a frame on which cheese cloth is stretched, or laths interwoven. The object of growing tobacco under shade is to produce wrappers of silky texture and even colors. A good cigar wrapper should possess evenness of color, elasticity, good texture and grain, and last but not least, a good "burn," by which is meant the ability of the leaf to burn freely and without charring, leaving a gray or white ash. Wrapper tobacco is usually negative in taste, and does not affect the aroma of a cigar to any appreciable extent.

The binders are used to hold the filler in shape, and are obtained from Connecticut, Wisconsin, Pennsylvania, and New York. The tobacco varieties used for binders are the Connecticut and Pennsylvania Broadleaf, and several types of the so-called Havana seed. A good binder should have very good burning qualities, and the flavor should not be pronounced.

The filler is, as the name implies, the inside filling of a cigar, and the taste and aroma of a cigar are almost entirely dependent on the quality of the filler. The domestic cigar filler varieties are grown in Pennsylvania, Connecticut, New York, Wisconsin, Ohio, and to a limited extent in Alabama, Texas, and Florida. The northern varieties usually are, after barn curing and assorting, packed in cases, in which the tobacco undergoes the fermentation process. The southern cigar filler varieties are bulk-fermented for from three to six months, assorted, and packed in Cuban style, that is, the palm leaf bark, or else in the so-called Yankee bale, which is covered with straw mats.

*See Circular No. 48, "The Present Status of the Tobacco Industry," Bureau of Plant Industry, U. S. Department of Agriculture.

Of all domestic cigar filler tobaccos, the Texas product is undoubtedly among the very best, if not the best, especially when grown from straight Cuban seed, though the relatively high cost of production uncertainty of disposal of crops, and general trade conditions have combined more recently in causing a decided curtailment in tobacco production in Texas.

PREVIOUS TOBACCO WORK IN TEXAS BY THE U. S. DEPARTMENT OF AGRICULTURE.

The cigar leaf tobacco industry in Texas is of comparatively recent origin. Although cigar tobacco had been grown near Willis, in Montgomery County, since 1892, it was not wholly a commercial success until the Department of Agriculture introduced improved methods of cigar leaf tobacco production.*

Before complying with the general demand for assistance in tobacco culture, the Department had conducted extensive experiments in order to determine whether or not a high grade cigar filler tobacco could be grown successfully in Texas. These experiments were carried on during 1903 and 1904 on different soils in several localities in East Texas, but the results varied. It was shown conclusively, however, that the so-called red lands, or Orangeburg soils in Nacogdoches, Anderson, Montgomery and Houston Counties were best adapted for the production of a high grade cigar filler tobacco grown from Cuban seed.

At the conclusion of these experiments, the Department was asked by the business men and farmers of the above mentioned counties for further aid in developing the tobacco industry by giving instructions and assistance to the farmers in tobacco culture. In response to this petition, trained tobacco experts were stationed in the various counties with instructions to visit those farmers who so desired and give them instructions and assistance in all phases of tobacco culture. This advisory work was, with some later modifications, continued until the fall of 1910.

During 1908 the Department conducted some much needed fertilizer experiments at Palestine and Nacogdoches in order to determine the influence of various compositions of fertilizers upon the yield and quality of both filler and wrapper tobacco. During 1909 fertilizer experiments were conducted in co-operation with several tobacco growers at Palestine.

During 1910 and 1911 experiments in crop rotation with tobacco as the principal crop, fertilizer tests, and seed selection and breeding of tobacco have been conducted near Nacogdoches in co-operation with the Texas Experiment Stations.

*See Bulletin No. 27, "Experiments in Growing Tobacco in Texas," Bureau of Soils, U. S. Dept. of Agriculture.

TYPES OF TOBACCO GROWN IN TEXAS.

CIGAR FILLER TOBACCO.

The culture of tobacco on a commercial basis was not attempted in Texas until 1892, though native varieties of Tennessee and Kentucky tobaccos were grown in small patches for home consumption prior to the Civil War. In 1890 and 1891 some tobacco was grown from imported Cuban seed near Willis, Montgomery County, with such promising results that the attention of several leaf tobacco dealers was attracted to the possibility of producing a cigar leaf tobacco in Texas that would, in their opinion, rival the genuine Cuban tobacco, which is the standard of the world as far as cigar filler tobacco is concerned. Consequently, a large acreage was grown in Cuban seed tobacco in 1892 around Willis, and the industry prospered for several years. Owing to impractical methods in cultivation and handling, however, a decline followed, until the U. S. Department of Agriculture revived and extended the cigar leaf tobacco industry in 1903 by its experiments in the culture of Cuban tobacco.

In these experiments several types of imported and domesticated Cuban seed were used, and the best types grown the first year selected for propagation. By a gradual process of elimination two distinct types, Texas Cuban 403 and 408 were evolved, and seed from these types distributed among the tobacco growers. This tobacco, which is called Texas Cuban and known locally as "Little Cuban," is used for high grade cigar fillers only, because its heavy body and dark color renders it unsuitable for wrapper purposes. In aroma and flavor it resembles rather closely the tobacco grown in Cuba. The Texas Cuban has of late, however, been superseded in the favor of the tobacco buyers by a hybrid tobacco known locally as "Big Cuban," which was introduced in Texas in 1907. The reasons are partly because of the relatively higher yield of the latter and partly because it can be used as a substitute for imported Cuban wrapper tobacco and hence is more profitable to the buyer. When used as a filler the Big Cuban has a mild, flat taste and lacks the full, strong aroma of the Texas Cuban. As the average smoker desires a mild cigar independently of aroma, the attitude of the buyers toward Texas Cuban can be easily understood.

CIGAR WRAPPER TOBACCO.

The culture of Sumatra and wrapper tobacco under shade was introduced in Texas in 1903, when ten acres of shade were erected near Nacogdoches by tobacco dealers from Florida. Owing to climatic conditions, the results obtained did not for several years justify the extension of this branch of the tobacco industry. The shade crop of 1906, however, proved to be of good yield and quality due to the exceptionally fine season, and was sold at good prices. Encouraged by the results of this crop, the above mentioned tobacco dealers organized companies, largely with local capital, in Palestine and Nacogdoches for the purpose of growing shade tobacco, and invoked the aid of the Department in supervising and designing the erection and

construction of shades and barns, and in giving instructions regarding the cultivation and handling of the shade crops. The Department, however, had not at any time advised the introduction and production of shade tobacco in Texas.

The seasons of 1907, 1908 and 1909 proved to be especially unfavorable for the growth of shade tobacco and, in addition, the prices paid for this class of tobacco produced in the South decreased materially because of the "panic" of 1907, overproduction in Florida, and, with a few exceptions, the generally inferior quality of the Texas shade-grown tobacco, caused primarily by climatic conditions. Consequently, the conditions did not warrant the continued production of shade tobacco in Texas, and it has gradually been abandoned.

It has been shown, however, that a good quality and percentage of wrappers can be obtained from the Big Cuban hybrid, when grown in the open field without shade, provided the tobacco is properly fertilized and handled in the field. In order to obtain a good percentage and quality of wrappers, the fertilizer must contain a properly balanced ratio of nitrogen, phosphoric acid, and potassium in the form of sulphate applied at the rate of from 1600 to 1800 pounds per acre, according to the condition of the soil. The plants are topped high as soon as the bud begins forming, and the leaves are "primed," that is, picked off the stalk, when they are grown and just before they are matured. They are then strung on twine, which is attached to a lath, about 40 leaves to the lath, after which the laths are placed on tier poles in the barn for curing. After curing, the tobacco is fermented and assorted, the inferior grades packed as fillers, and the good, sound leaves as wrappers. There is at present a decided demand for these wrappers, principally because of the fact that they closely resemble the imported Cuban wrapper. The veins of the leaf are small so that the entire leaf can be used for wrappers. From 3 to 5 pounds of the Texas Big Cuban tobacco will wrap a thousand cigars.

Unfortunately, the prices paid in the past for the Texas Big Cuban when primed for wrapper are not remunerative to the growers, and for this reason the area planted in tobacco in Nacogdoches County has decreased from 250 acres in 1910 to 30 acres in 1911. The "priming" process is considerably more expensive than the method practiced in harvesting filler tobacco, which consists in cutting the entire stalk and spearing from 10 to 12 stalks on the same lath. By "priming," however, all the leaves are saved, because they are picked from the stalk as they ripen, whereas in cutting the entire stalk the bottom leaves are worthless, being overripe, and consequently the yield is somewhat increased by "priming," though the increased yield does not fully cover the increased cost.

The growers received from 8 to 10 cents per pound for cut tobacco in 1910, the low price being due to the prevalence of "white veins" on the leaves, and the average yield was 1000 pounds per acre. As the average cost of producing this class of tobacco is about 8 cents per pound, the margin of profit was not very great. This low price, in connection with the high prices paid for cotton in the fall of 1910, is responsible for the fact that only 30 acres were grown in tobacco in 1911. The growers received 17 cents per pound for "primed"

tobacco in 1911, and the average yield per acre was 1100 pounds. It should be stated, however, that even at 17 cents per pound the growers claim, not without reason, that there is little profit in "priming" tobacco.

METHODS OF PRODUCING CIGAR LEAF TOBACCO IN TEXAS.

SEED BEDS.

A southern exposure is considered best for seed beds because they are then protected from the cold north winds. The best place for a seed bed is near a stream and as close to the field to be planted in tobacco as possible. After selecting a suitable location with plenty of humus in the soil, all trees and bushes should be cut down, not only on the site for the seed beds, but also all around it, to a distance of 30 feet, so that there will be no obstruction to the sunlight. A seed bed of 50 square yards will produce enough plants for 1 acre.

It is safest to burn the seed bed in order to destroy grass and weed seeds and insects.* This should be done in the latter part of January by placing skids 3 feet apart on the area, and piling brush and wood on one end of the skids. After setting fire to the brush the pile can be pushed forward on the skids by means of long poles until the whole area is thoroughly and uniformly burned. After burning, all coals, roots and trash should be raked off, allowing the ashes to remain, after which the area should be spaded up or plowed, not deeper than 3 inches. The fertilizers are usually applied about two weeks previous to sewing the seed. 25 pounds cotton seed meal and 10 pounds acid phosphate to every 50 square yards of seed bed will give good results if thoroughly mixed with the soil. The mixing is done by scattering the fertilizer broadcast over the beds and raking it thoroughly until it is entirely incorporated with the soil. Previous to applying the fertilizer, boards 12 inches wide should be placed on edge, about 5 feet apart, supported by stakes driven into the ground. These boards form a cold frame, over which wires are strung, supporting the cheese cloth, which is put on after sowing the seeds.

The seeds, which should have been previously subjected to the cleaning process described in Bulletin No. 96, "Tobacco Breeding," Bureau of Plant Industry, U. S. Dept. of Agriculture, are usually sown in the latter part of February. The beds are first raked off, leaving the surface soil in a mellow condition. The seeds are then mixed with cornmeal or sifted ashes and sown broadcast over the beds, care being taken to have the seeds distributed evenly. Two tablespoonful of seed mixed with about five handsful of ashes are sufficient for 50 square yards of seed bed. After sowing, the seeds should not be covered with soil, but should be firmly pressed down, either by tramping the beds or by means of a roller, after which the beds should be thoroughly watered. The beds are then covered with

*See Farmers' Bulletin No. 451, pages 41 to 43, U. S. Dept. of Agriculture.

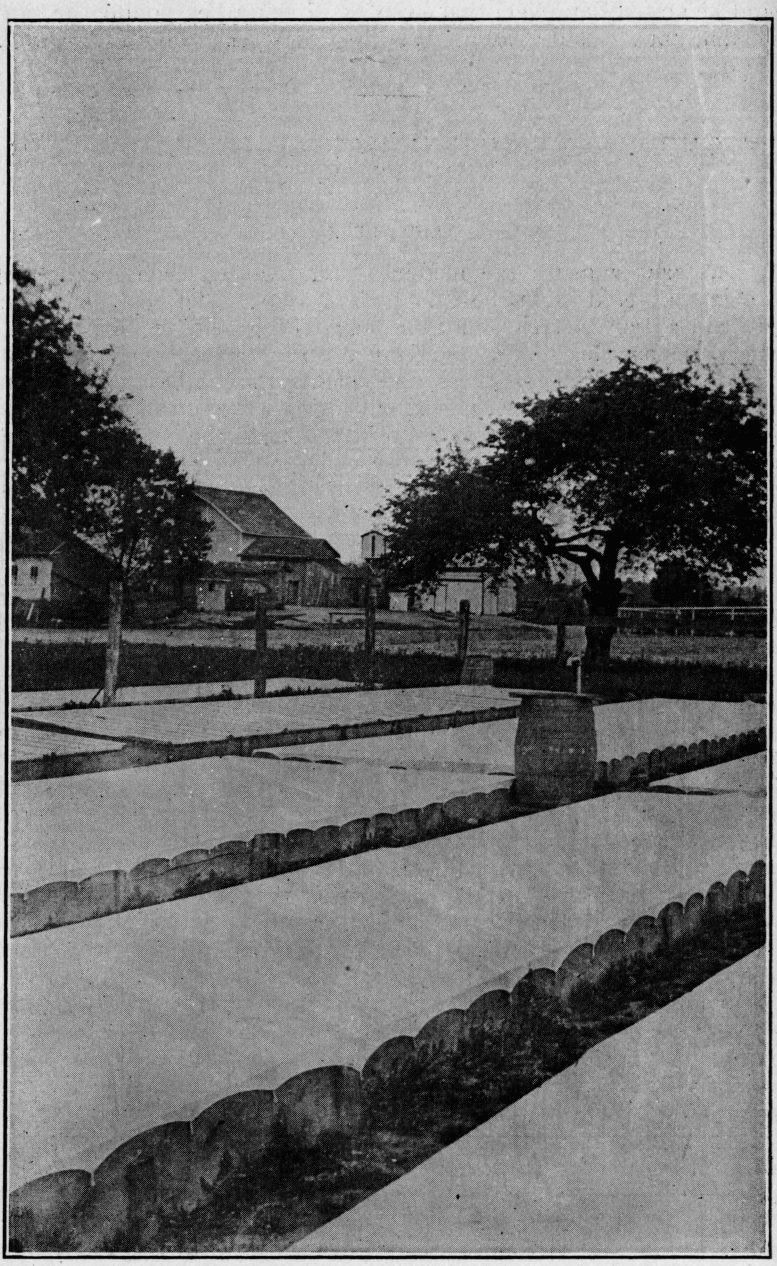

Fig. 1—Completed Seed-bed.

the cheese cloth, which is hooked to the side boards by nails driven through from the inside. If the weather is dry, the beds should be watered regularly from time to time because the seeds do not germinate unless the soil is in a moist condition, and for this reason it is absolutely necessary to prevent the soil from drying, though, on the other hand, too much water will cause the young seedlings to rot off. The seeds germinate in from 10 to 14 days, under usual conditions, and it then becomes necessary to inspect the beds frequently and to wage a relentless warfare on the multitude of insects that prey on the young plants. All weeds and grass growing on the beds must also be removed. (For information regarding the best methods of combating these insects see Farmers' Bulletin 120, U. S. Department of Agriculture.) In from six to seven weeks after sowing the seeds, the plants will be ready for transplanting to the field. The growth of the plants, however, can be forced by sprinkling a solution of nitrate of soda over the beds. Five pounds of nitrate dissolved in one barrel of water is the rate at which the first application should be made, later increasing the strength up to 10 pounds of nitrate of soda to one barrel of water. Care should be taken, however, to water the beds thoroughly after applying this solution, as otherwise the nitrate of soda may injure the foliage of the plants. Liquid manure is also very efficient in forcing the growth of the plants.

The covers should be removed when the plants are nearly grown, so they may become inured to climatic conditions.

PREPARATION OF FIELD.

The field intended for tobacco culture should have been plowed up to a depth of from 10 to 12 inches during the preceding fall. If this is not practicable, the plowing should be done as early in the winter as possible and the field ought to be harrowed after every rain so that the moisture can be conserved as far as possible. It is also advisable to subsoil the field once every two or three years.

If stable manure is to be used, it should be scattered broadcast at the rate of from 15 to 20 loads per acre just before this first breaking up of the field and plowed under.

Lime has been found to be very beneficial to the East Texas soils, but its high cost has prevented a more general use of it. It should also be applied just before the first plowing at the rate of from 500 to 700 pounds per acre.

The field should be bedded up and prepared for transplanting about the latter part of March, or two weeks before transplanting. Frequently the heavy rains pack the soil, so that it will be necessary to plow up the field before bedding it. This plowing can be done with an 8-inch shovel plow, which thoroughly pulverizes the soil. In bedding up the field a small shovel plow is used in laying or streaking off the field into rows 3 feet apart, which is the usual distance between the rows, though some growers place them 3 1-2 feet apart. Four furrows are then thrown over these rows with a turning plow, forming a water furrow, in which the fertilizer is drilled. When a transplanting machine is used, it is not necessary to bed up the rows and the fertilizer is simply drilled in the rows after they are laid off.

FERTILIZERS.

The amount of fertilizer to be used depends on the fertility and condition of the soil, though it must be borne in mind that the tobacco plant is a heavy feeder and requires an especially strong ration of potash because of the great influence of the latter on the "burning" qualities of the leaf. It has been shown that a crop yielding 1000 lbs. of leaf per acre contains about 67 lbs. of nitrogen, 9 lbs. of phosphoric acid, and 85 lbs. of potash and, consequently, the fields must be heavily fertilized in order to secure good yields. Moreover, the use of a liberal application of fertilizers improves the quality of the leaves to a surprising extent, and it is known that potash chiefly influences the leaves in that respect. The form of potash to be used is important, as muriate of potash is decidedly injurious to tobacco. Carbonate of potash has been used in Texas to some extent and has given good results, but it is expensive and is believed to injure the soil when used continuously, and for that reason the use of a high grade sulphate is advised.

A liberal supply of phosphoric acid must also be applied as well as nitrogen and potash, because the soils of East Texas generally are deficient in this plant food, and the experiments at Nacogdoches clearly demonstrate its value in tobacco culture.

In regard to the amount of fertilizer to use, it is difficult to give a formula that would give satisfactory returns when applied generally, because of the differences in fertility of the soils in East Texas, but, broadly considered, the following formula has produced the best results in the Nacogdoches experiments, both in yield and quality, when compared for a period of two years, and is especially adapted to light, sandy soils: 1200 lbs. cotton seed meal; 400 lbs. 16 per cent acid phosphate; 200 lbs. sulphate of potash per acre. When stable manure is used at the rate of from 15 to 20 loads per acre, the amount of cotton seed meal may be cut in half. On the heavier soil types a fertilizer containing from 800 to 1000 lbs. cotton seed meal, 400 lbs. acid phosphate, and 200 lbs. sulphate of potash per acre may be used with good results.

Experience has shown that better results are obtained when the fertilizers are drilled in the row than when they are applied broadcast. It is also absolutely necessary to practice intensive cultivation if good yields are desired, because frequent plowings not only destroy grass and weeds, but they aerate the soil, thereby aiding in rendering the plant food contained in the fertilizers available, so that the tiny rootlets of the tobacco plant can absorb it.

The fertilizers should be applied about two weeks before transplanting. When applied in the drill a small shovel plow should be run through the fertilizer so as to mix it with the soil, afterwards throwing two furrows back over the fertilizer, which forms a slightly elevated ridge for planting. The ridge left between the rows is broken out flat after transplanting.

TRANSPLANTING.

The plants are ready to be transferred to the field when they are from four to five inches high in the plant bed. Only the healthy,

stocky ones should be selected for transplanting. Great care is to be exercised when pulling the plants, as the tender roots and bud leaves are easily injured. After pulling, the plants should be placed in baskets with the roots down and the baskets placed in a shady place, preferably in a shallow pool, until needed in the field. Before transplanting, the ridges on the field rows are leveled by means of a board attached to a plow stock, leaving the soil in a moist, mellow condition and on a level with the field. It is always best to transplant as soon after a rain as conditions will allow, but in case no rain has fallen for a week or two, and the plants are growing too large in the plant bed, it will be necessary to water them as they are set out. This can be done immediately after transplanting by pouring about a cupful of water on the side of each plant, taking care not to spill any on the plant itself, which would cause it to wilt, afterward raking dry dirt over the watered spot to prevent baking. Another and better method of watering the plants, especially in dry weather, is to make holes in the rows with a hoe handle and pour water in them just before transplanting. The plants should be set deep, so that only the upper or bud leaves are above ground, and care should be taken to press the soil firmly to the roots.

In a few days after transplanting, the field should be inspected and all missing hills re-planted.

The best method of transplanting tobacco is by means of a transplanting machine which not only sets the plants uniformly at any desired distance, but also waters them. It would hardly pay the average tobacco grower in Texas, however, to use such a machine, because of the small individual acreage, unless a number of growers could purchase one in co-operation.

The Texas Cuban variety should be set about fourteen inches apart in the drill, with the rows three feet wide, which would require about 12,000 plants per acre. The Big Cuban hybrid ought to be set twelve inches apart in the drill, with the rows three or three and one-half feet wide, requiring about 13,000 to 14,000 plants per acre.

CULTIVATING.

The first cultivation should be made with a hoe to loosen up the soil between the plants, afterward running a side harrow close to the plants about ten days after transplanting, or sooner, depending on the rapidity with which the plants take root. In case heavy rains have packed the soil, a six-inch shovel plow should be run close to the plants on both sides of the rows, while an eight-inch shovel can be run twice in the middle, thus thoroughly pulverizing the soil. A few days later it is advisable to plow the tobacco three times to the row with a heel-sweep to which a small shovel has been attached. This should be repeated every four or five days until a soil mulch is established, which prevents loss of moisture from droughts, which are likely to occur at any time in East Texas during May and June. In normal seasons the tobacco should receive a thorough cultivation once every week, and after a rain as soon as the soil has dried out sufficiently for working. A cultivator is one of the best implements to use for this purpose, though a heel-sweep will answer. Two hoeings are usually sufficient. The tobacco is generally cultivated up to the

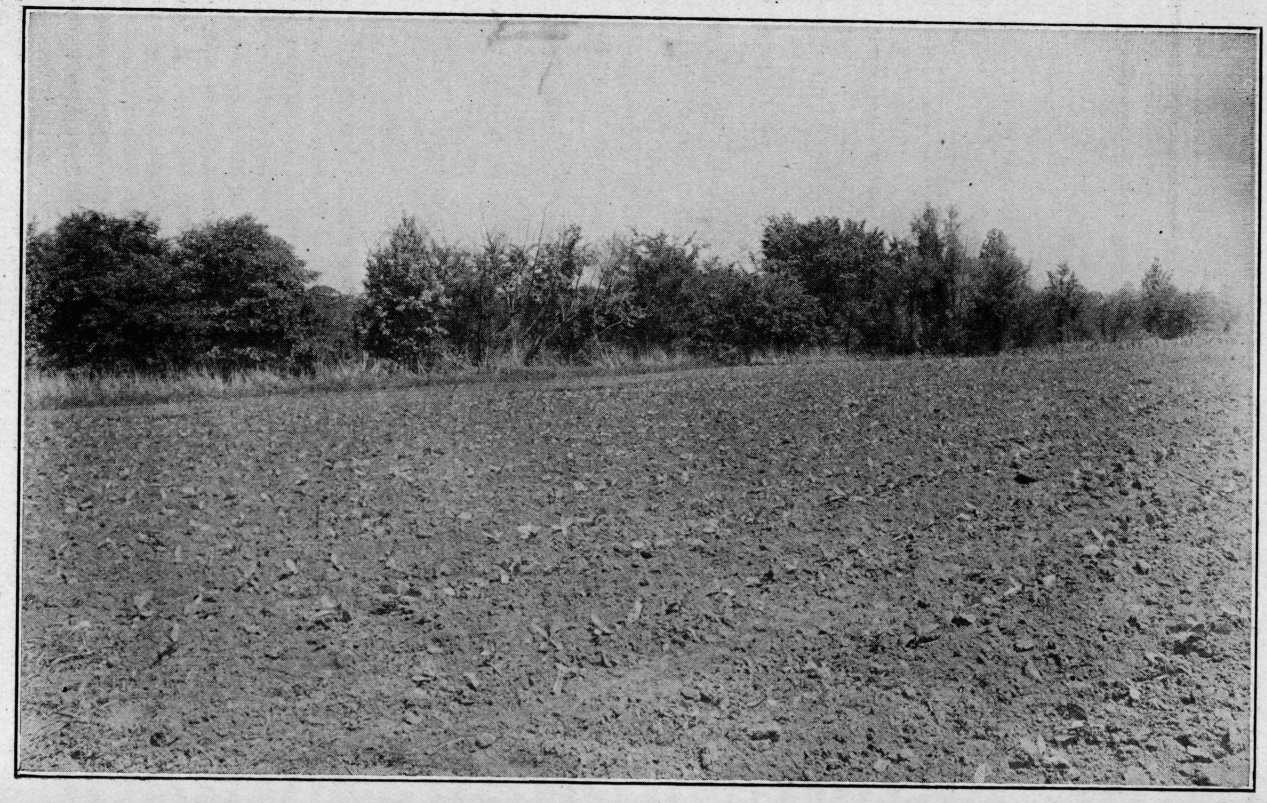

Fig. 2—Tobacco field just after transplanting.

time it is topped, although in case of heavy, packing rains it may become necessary to plow it even after topping.

No hard and fast rules can be laid down for cultivating tobacco, because different soils require different treatment, and then, again, weather conditions may be such as to require an entirely diffrent method of cultivation from that described here. But as a general rule it should be observed that tobacco responds readily to intensive cultivation when intelligently practiced, especially when large amounts of fertilizer are used.

COMBATING INSECTS.

As soon as the plants commence taking root, usually about eight to ten days after transplanting, it becomes necessary to apply poison for grasshoppers, budworms and other insects, using for this purpose a mixture of cornmeal and Paris green or arsenate of lead once a week and after every rain. This poison is mixed as follows: One and a half tablespoonful of Paris green to two gallons of corn meal thoroughly stirred. It is applied by means of a perforated tin can to which a stick has been fastened as a handle, so that the poison can be shaken directly in the bud of the plants. In poisoning the Big Cuban tobacco, it is necessary to gently open the bud leaves, because these grow closely together in this type.

The horn or tobacco worm usually makes its first appearance in Texas during early May, and this arch-enemy of the tobacco plant requires a special system of poisoning, as follows: Sixteen parts of hydrated lime are thoroughly mixed with one part of Paris green and applied to the tobacco plants once a week and after every rain by means of the so-called blow-gun, or dust-gun. Arsenate of lead may be used instead of Paris green at the rate of five pounds to the acre, mixed with five or six pounds of flour or sifted ashes. It is considerably more expensive than the Paris green, however, though it is less likely to burn the tobacco.

This poisoning should be started early in May, even if there are no signs of the hornworm visible, because it is certain to appear sooner or later. Once the work has obtained a foothold, it is difficult to combat. because an increased strength of the poison, especially the Paris green, will injure the foliage of the plants.*

TOPPING

By "topping" is meant the removal of the flower bud of the tobacco plant. The object in doing this is to force the nutritive substances of the plant to remain in the leaves, because when the plant is allowed to flower, the nourishment is gradually transferred from the leaves and used for the formation and production of seed.

The yield and quality of a tobacco crop depend to a certain degree upon the way in which the topping has been done. and it is important

*For a complete description of insects affecting the tobacco plants and means of controlling them, see Farmers' Bulletin 120, entitled "The Principal Insects Affecting the Tobacco Plant," U. S. Dept. of Agriculture, also "Insect Enemies of Tobacco in the United States." 1910 Yearbook Separate 537, U. S. Dept. of Agriculture.

Fig. 3—Poisoning tobacco with blow-gun

to have this done right. Cigar filler tobacco is usually topped low, which causes the leaves to become thick and heavy, while tobacco intended for wrappers should be topped high, which will assist in producing thin leaves. As a general rule, however, all good, stocky plants of vigorous growth should be topped higher than those of weak growth. It is the custom among the tobacco growers in Texas to top each individual plant as soon as the flower bud appears, which necessitates going over the field several times, resulting in an uneven ripening, and consequently, additional work in harvesting. This can be obviated by waiting until a majority of the plants are budding out, when the entire crop can be topped.

SUCKERING.

In a few days after topping, offshoots of the plant appear at the junction of the leaves with the stalk. These offshoots are called "suckers," and are the results of the efforts of the plant to reproduce itself. The suckers should be removed as soon as they appear, because they absorb considerable plant food, thereby injuring the growth and quality of the tobacco. It is necessary to sucker the Texas Cuban tobacco twice, once about five days after topping, and again just before harvesting. Big Cuban tobacco does not need to be suckered more than once, because it is not productive of suckers.

HARVESTING.

A decided change takes place in the tobacco plant after topping. The leaves increase in size and thickness and assume a mottled appearance, usually within from twelve to fourteen days after topping, but depending on weather conditions. In dry weather the changes occur sooner than during rainy or cloudy weather.

Exhaustive tests have shown that though the yield is greatly increased when filler tobacco is harvested in a ripe or over-ripe condition, the quality of the tobacco is greatly inferior to that obtained when the plant is harvested just before maturity or when still slightly green.

In normal weather conditions the upper leaves of the plant begin to feel stiff and hard to the touch in about twelve to fourteen days after being topped, which is a good indication that the tobacco is ready for harvesting. Filler tobacco is harvested in Texas by cutting the stalk, leaving one or two leaves, which, being over-ripe, are worthless, on the stubble, afterwards carrying the stalks on a stretcher, or hauling them in a wagon either to a shady place near the field or direct to the barn, if this is nearby. They are unloaded on to a low table. The plants should be exposed to the sun for a few minutes after cutting in order that they may wilt, so they can be handled without breaking off the leaves, but if they are exposed too long, the leaves will be damaged. The stalks are then speared onto laths or sticks from ten to twelve stalks to the stick. The sticks are 52 inches long, one inch wide and one-fourth inch thick, and after receiving, the plants are placed at a distance of from six to ten inches on the tier poles in the barn. The tobacco sticks should be placed closer together if dry weather is prevailing at harvesting time because this

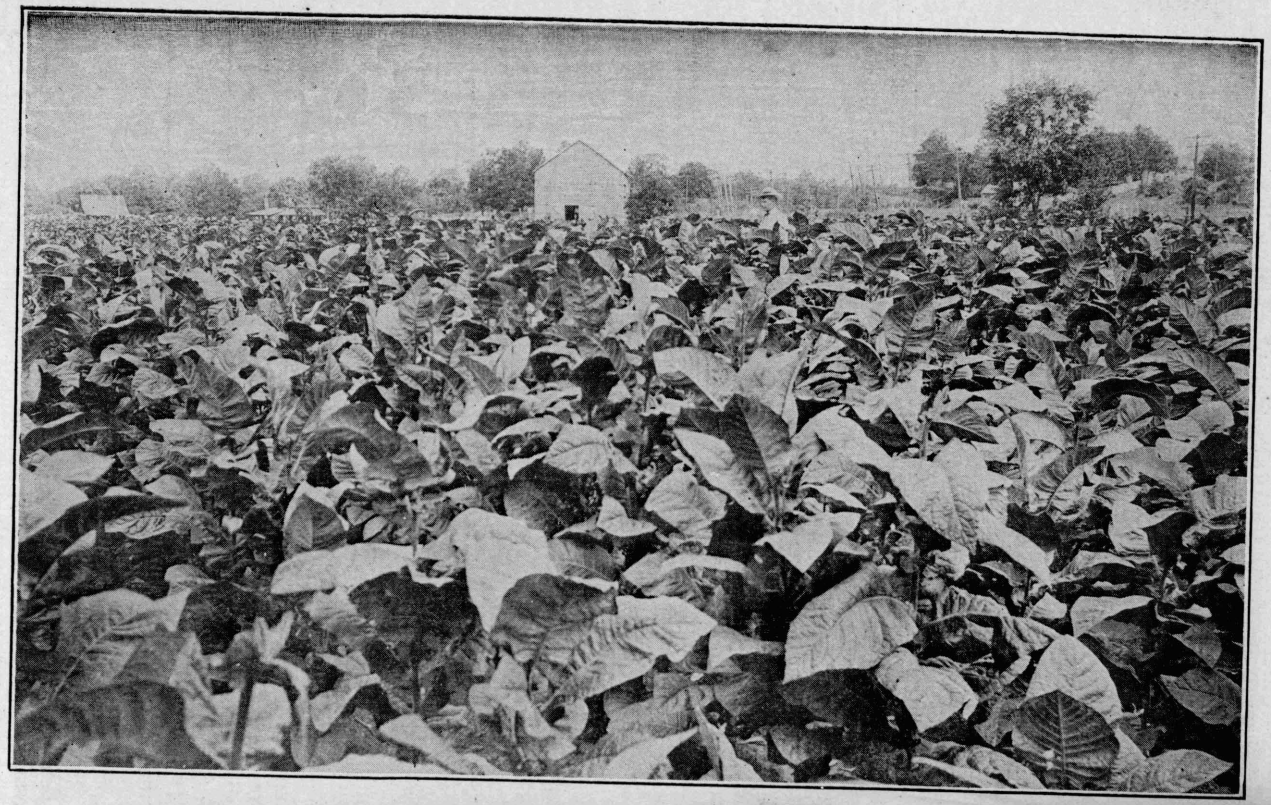

Fig. 4—Cigar filler tobacco ready for harvesting.

will prevent the tobacco from curing too fast. During rainy weather, however, it is better to give the sticks more distance, because otherwise there is danger of "pole sweat" and mould.

Wrapper tobacco is harvested in Texas in a different way from that practiced in harvesting fillers. Instead of cutting the entire stalk, the leaves are picked off as they ripen, which process is called priming. The bottom leaves are primed before the upper part of the plant is fully grown, and the remaining leaves are primed 3 or 4 at a time, just before they are fully ripe. The leaves are carried in baskets to the barn where they are strung on twine, attached to sticks, from 35 to 40 leaves to the stick, which are then hung on the tier poles from 4 to 6 inches apart.

CURING.*

The barns are kept closed during the first 24 hours of curing or until the tobacco has passed through the yellowing process. They are then opened up and ventilated thoroughly during the daytime, being closed at night. This is continued until the tobacco is nearly cured, or until the leaves turn brown, when the barn should be opened at night and closed during the day. In case of extremely dry weather, which is likely to occur during the curing season in Texas, the barn should be kept closed as tight as possible, and only opened occasionally to allow some ventilation when the need of it is indicated by the peculiar, rank odor in the barn. When the barns are kept open during very dry weather, the tobacco cures too fast, and is liable to become affected with the so-called "white vein," which ruins the leaf for wrapper purposes, though it does not affect its value as a filler. The "white vein," as known in Texas, is caused by the leaf tissues curing faster than the veins on the leaf, which causes the moisture content of the veins to be deposited on both sides of the veins, producing in the cured leaf a straw-colored streak running parallel with the veins.

In case of a prolonged damp period it will become necessary to kindle small fires in the barn in order to dry the tobacco so as to prevent pole sweat and mould. Small sticks of pine wood should be used for this purpose, because pine imparts less odor to the tobacco than any other wood. The fires should be built in small pits under every third or fourth tier in the barn, and the tobacco hanging immediately above the fires should be removed. The firing should be continued until the tobacco is nearly dry.

It takes from five to six weeks to cure tobacco on the stalk, while primed tobacco cures in much less time, usually in about four weeks.

STRIPPING AND TYING.

The tobacco should be taken down from the tier poles as soon as possible after it is cured, but it is too dry to handle until a good rain has put it in "case," that is, in a moist condition, so that it can be handled without breaking. By opening the doors and ventilators

*See Bulletin 143, "Principles and Practical Methods of Curing Tobacco," Bureau of Plant Industry, U. S. Dept. of Agriculture.

Fig. 5—Harvesting cigar filler tobacco.

at night and closing them in the morning the tobacco will remain in "case" for several days after a rain.

In "taking down," the tobacco stalks are first pushed to one side of the stick, pulled off and piled on boards placed on the floor of the barn. After all the tobacco has been piled up neatly, with the tips of the stalks to the inside, the pile is covered up with blankets or green weeds. The pile should not be made higher than about four feet, because it will heat, but may be as long as the barn. The leaves are stripped off the stalks and tied up in "hands," about 30 leaves to the hand. In stripping, the first three or four bottom leaves are kept separate, because they are of inferior quality. These bottom leaves are called "sand leaves." The hands are packed neatly in large boxes, after which the tobacco is ready for sale to the packer. It is by no means ready for manufacture, however, for it must first pass through the fermentation process, after which it is assorted, sized, baled and aged, requiring in all from 8 to 12 months.

Primed tobacco is taken down simply by pushing the leaves to the middle of the string, after which the string is taken off the stick and wound around the butts of the leaves, the hands then being packed in boxes.

TOBACCO SEED SELECTION.

To consistently conduct seed selection work requires time and labor, but the results obtained more than repay the extra work. By selecting and propagating plants of a given type, the yield may be increased, a uniform shape of the leaf obtained, and the growth of suckers more or less eliminated. In order to select desirable plants, the grower should go over the field, and before the fields are budding, and mark the plants he wishes to save for seed by tying a string or bag on the stalk. In selecting plants care should be taken to choose those having desirable and similar height, shape of leaf, and uniform number of leaves per stalk, because these points will in all probability be transmitted to the next generation, resulting in a more uniform crop. As soon as the flower head appears, and just before the flowers open, a light 12-pound paper bag should be placed over the flower-head and tied securely in order to prevent cross fertilization. The bag should be removed every three or four days, the seed head shaken out and the bag replaced for the first two weeks, in order that the flower-head may be thoroughly inspected and all bud worms and other insects removed. It is advisable to poison the flower-head every time it is inspected. The plants finally selected and bagged should be those giving the largest yield per stalk, and all plants not having a deep green color or a perfectly healthy appearance should be rejected. The seed-heads should be cut from the stalk when the pods turn brown and hung up in a dry place until thoroughly dry, when the seed should be shelled out, cleaned and subjected to the seed separation process.*

*See Bulletin 96, "Tobacco Breeding," Bureau of Plant Industry, U. S. Dept. of Agriculture.

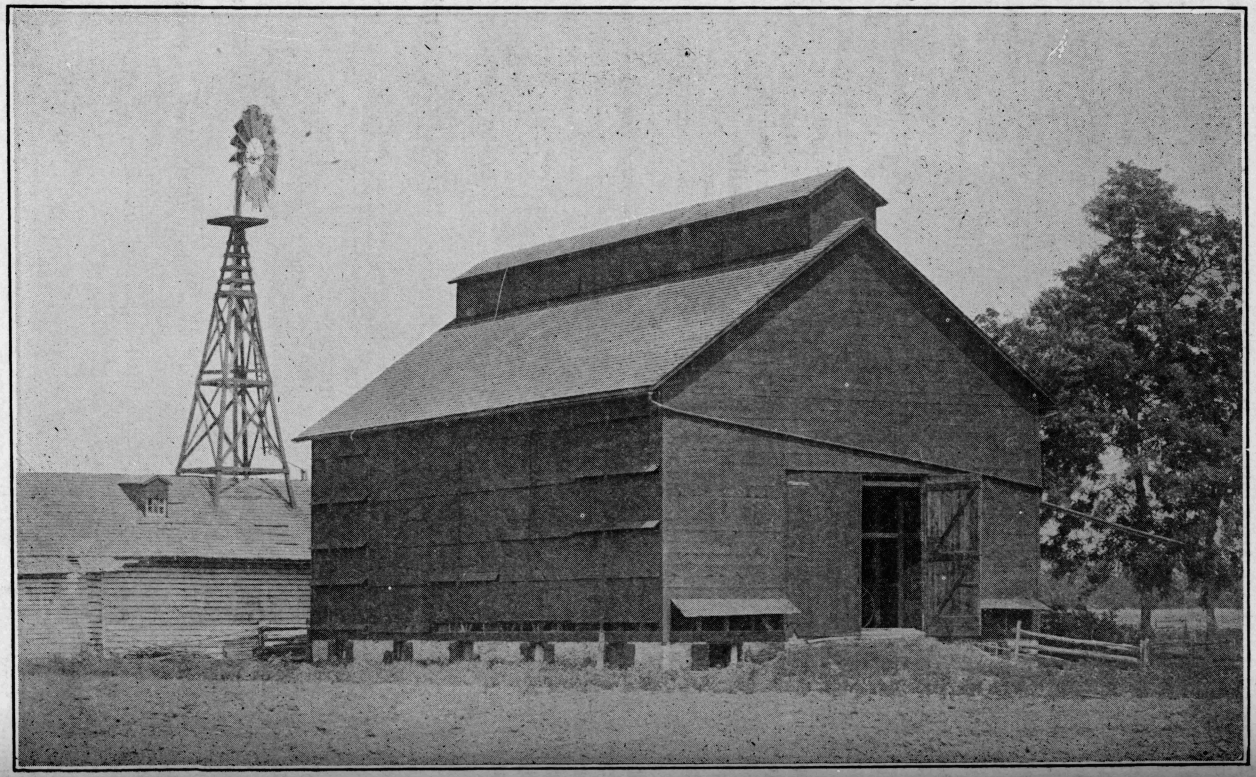

Fig. 6—Model tobacco barn.

COST OF PRODUCING CIGAR LEAF TOBACCO IN TEXAS.

As stated in the introductory paragraphs, the relatively high cost of producing the Texas filler is one of the dominant factors restricting the extension of the tobacco industry in the State. It was thought at the time of the introduction of cigar leaf tobacco in Texas that the filler produced from Cuban seed would, in a measure, supplant the imported Cuban filler, but the conservative position of the tobacco trade has prevented the realization of this expectation. It is beyond doubt that the Texas Cuban filler tobacco possesses decided merit and is second to, if not as good as, some imported Cuban fillers, but cigar manufacturers hesitate to use the Texas Cuban in their 10-cent cigars, while they claim, not without reason, that the high cost of this tobacco prevents its use in 5-cent cigars.

The Texas Cuban filler was sold during the time of its production in largest quantity in the State at a uniform price of 15 cents per pound in the barn-cured stage. The buyer must ferment the tobacco for from 4 to 6 months, after which it is assorted, sized, tied, and baled. Tobacco loses from 15 to 25 per cent of its weight during fermentation, and the buyer has, of course, to stand this loss. Assuming the loss from fermentation to be 20 per cent, the following estimate of the cost of cigar filler tobacco to the buyer or packer is approximately correct:

Cost of barn-cured tobacco	15 cents per pound
20 per cent loss of weight during fermentation	3 cents per pound
Cost of fermentation	1 cent per pound
Cost of assorting, sizing and tying the leaves	3 cents per pound
Cost of baling and baling material	1 cent per pound
Cost of supervising, rent, lights, etc.	2 cents per pound
Total	25 cents per pound

The tobacco usually remains in the bale 6 months or longer before it is sold, and, as it continues to shrink during that period, and as the cost of storing and selling the tobacco must be reckoned in, the additional cost easily runs the total to the packer up to 27 cents per pound The prices paid for this tobacco by the manufacturers are not available, but it is probable the average has been about 35 cents per pound.

The cost to the cigar manufacturer is not easily computed because so many factors enter into the problem, such as the difference in cost of labor, etc., but the approximate cost is about as follows per one thousand cigars:

20 pounds Texas Cuban filler, at 35 cents per pound	$ 7.00
3 pounds binders, at 75 cents per pound	2.25
3 pounds wrappers at $2.00 per pound	6.00
Total	$15.25

After the cost of making the cigars has been added to the cost of the

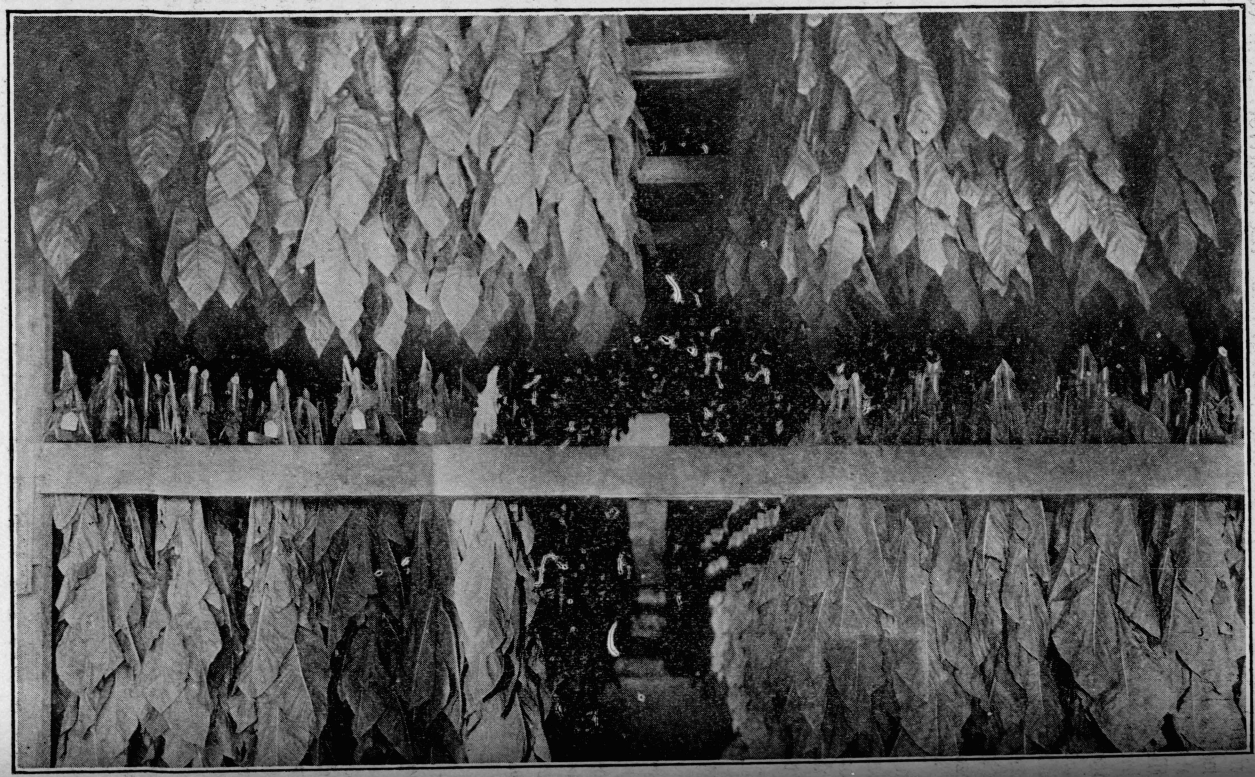

Fig. 7—The interior of a tobacco barn, showing arrangement of tiers and method of hanging filler tobacco

tobacco, as well as the cost of revenue stamps, rent, light, etc., it appears that the cigars made of Texas Cuban tobacco can not be sold for 5 cents.

As to the cost of producing Texas Cuban tobacco, the following is an approximate estimate:

Cost of tobacco seed beds	$ 8.00 per acre
Cost of preparing field	6.00 per acre
Cost of fertilizer	25.00 per acre
Cost of transplanting	8.00 per acre
Cost of cultivating	8.00 per acre
Cost of poisoning	5.00 per acre
Cost of harvesting	8.00 per acre
Cost of stripping and tying	10.00 per acre
Total	$78.00 per acre

Estimating the average yield at 600 pounds per acre, the cost of producing this class of tobacco to the grower would be 13 cents per pound. The cost of producing the Big Cuban, which is now being grown in Texas, is decidedly less, because of the greater yield, and can be put down at about 8 cents per pound when this type is harvested by cutting the plant.

COOPERATIVE TOBACCO TEST FARM, NACOGDOCHES, TEXAS.

In order to assist the United States Department of Agriculture in conducting tobacco investigations in the Seventeenth Representative District, the Texas Legislature in the spring of 1909 passed an act making available additional funds in support of this work.

Accordingly, a tract of land comprising 5 acres was leased for a period of 2 years, beginning December 6, 1909. The work was planned to include three principal features, as follows: First, a comparative test of different types and strains of Cuban seed as to both quality and yield; second, a series of fertilizer tests intended to determine the best methods of fertilizing the tobacco and other crops grown in rotation; and, third, experiments to discover the best rotation system to be followed in growing tobacco as a money crop in connection with other crops adapted to this region.

Description of Farm: The field selected for the experiments is located 1½ miles north of the court house in Nacogdoches on what is known as North street. It had been under cultivation for over 25 years, cotton and corn being grown alternately, and had never been fertilized prior to the beginning of the experiments, except once, 12 years previously, when stable manure was applied at the rate of 10 loads per acre. The field is fairly level, with a gentle slope towards the east. The soil is of the Orangeburg fine, sandy loam type, described as follows by the Bureau of Soils, United States Department of Agriculture: "The surface soil of the Orangeburg fine sandy loam is a compact, red sandy loam, containing considerable silt and ranging in depth from 10 to 20 inches, with an average depth of 12 inches. The soil contains from 10 to 20 per cent of rounded iron

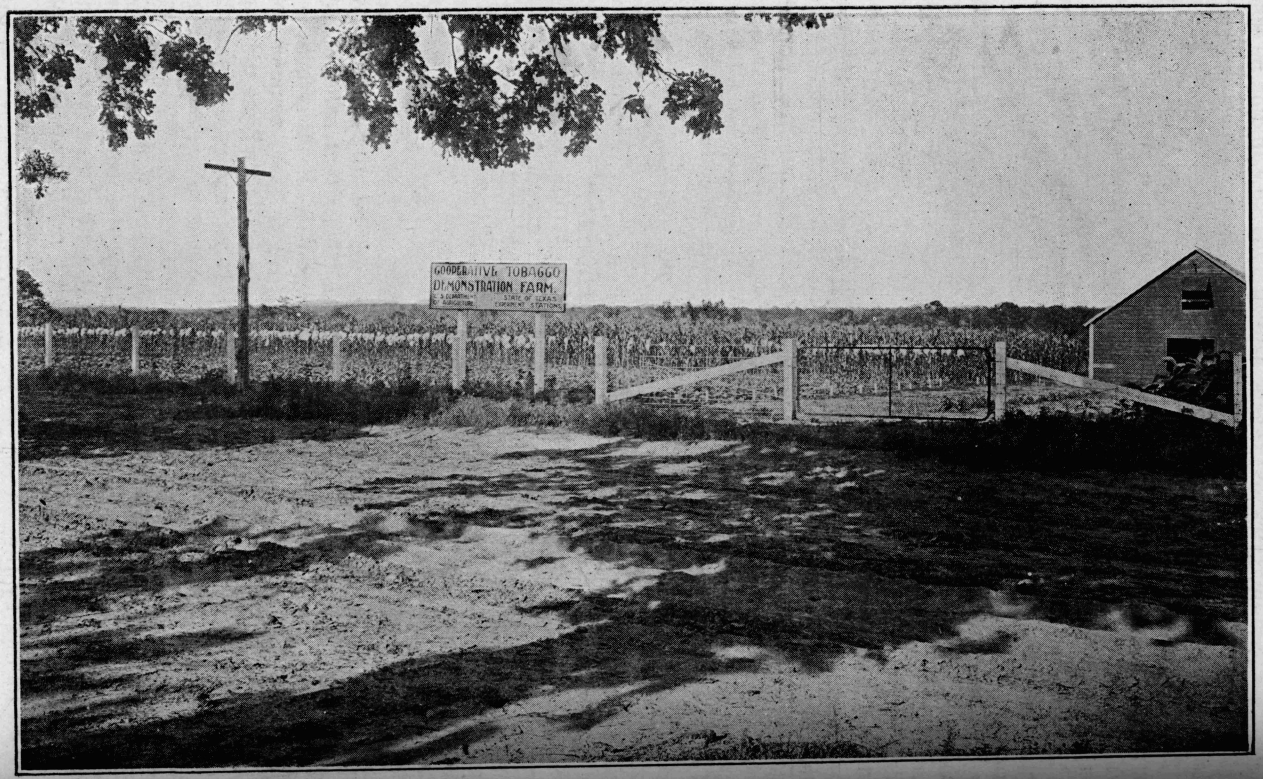

Fig. 8—General view of test farm.

concretions about one-fourth of an inch in diameter. The subsoil is a heavy, sandy clay, reaching to a depth of 3 feet or more. It contains a small quantity of quartz sand and a few quartz gravel, and contains iron concretions similar to those found in the soil, although not in such large quantities."

Preliminary Work: The area to be used in the experiments was surveyed, in December, 1909, and some 25 fruit trees removed, after which the field was plowed up to a depth of 10 inches with a steel beam plow and subsoiled 3 inches deeper.

The field was then staked off into 4 sections with a roadway 6 feet wide extending through the center. Each section was 501 feet long and 110 feet wide, containing 1 1-15 acres. Twelve fertilizer plots, each containing 1-15 acre and 2 variety and breeding plots, each containing 2-15 acre, were then laid off on each of the larger divisions, making a total of 48 fertilizer plats and 8 variety and breeding plats. All fertilizer, variety and breeding plots were separated by guard rows 5 feet wide.

A model barn that could be used for curing tobacco as well as for other purposes was erected near the experimental field. The dimensions of the barn are as follows: Length, 44 feet; width, 30 feet; height, 9 feet from sill to plate, and 11 feet from plate to top. It contains 11 tiers and will house 2 acres of cut tobacco, or 1 1-4 acre of primed tobacco.

Owing to the extremely heavy rains during the spring and early summer of 1910, the field was badly washed, and in order to prevent this as much as possible, terraces were thrown up in the guard rows between the plots. These terraces did not effectually stop the washes, however, because the growing crops prevented making the terraces large enough. During the next fall, after the crops were harvested, three large terraces were built across the field, with ditches on the upper side, effectually preventing any additional erosion by the heavy rains so common in this section.

ROTATION SYSTEM.

It has been shown conclusively that tobacco should not be grown continuously on the same soil, and in order to devise a practical system of crop rotation to be used in connection with the growing of tobacco on the East Texas soils, the following rotation systems were planned for a period of four years. It will be noted that the principal difference between the two systems followed is that in the one case corn precedes tobacco, while in the other tobacco is preceded by oats and a legume.

The work, however, has been conducted for only two years, and, while the weather conditions were uneven and the work has not been completed as planned, the results show without a doubt the beneficial influence of rotation, not only on the quality and yields of the crops, but also on the mechanical condition of the soil itself. During the first year of the experiments the soil was extremely deficient in plant food, as shown by the very low yields on the unfertilized plots, and it also showed a tendency to bake, while the yields were increased the second year, even in the face of a disastrous drought. The soil

had also become porous and mellow because of the vegetable matter plowed under.

West side of field.

Plot A. 1910 Tobacco followed by Burr Clover. 1911 Cotton followed by Oats. 1912 Oats followed by Peas and Rye. 1913 Corn followed by Peas and Rye.		**Plot A.** 1910 Tobacco followed by Burr Clover. 1911 Cotton followed by Rye. 1912 Corn followed by Peas and Oats. 1913 Oats followed by Peas and Rye.
Plot B. 1910 Corn followed by Peas and Rye. 1911 Tobacco followed by Burr Clover. 1912 Cotton followed by Oats. 1913 Oats followed by Peas and Rye.	Center roadway.	**Plot B.** 1910 Oats followed by Peas and Rye. 1911 Tobacco followed by Burr Clover. 1912 Cotton followed by Rye. 1913 Corn followed by Peas and Oats.
Plot C. 1910 Oats followed by Peas and Rye. 1911 Corn followed by Peas and Rye. 1912 Tobacco followed by Burr Clover. 1913 Cotton followed by Oats.		**Plot C.** 1910 Corn followed by Peas and Oats. 1911 Oats followed by Peas and Rye. 1912 Tobacco followed by Burr Clover. 1913 Cotton followed by Rye.
Plot D. 1910 Cotton followed by Oats. 1911 Oats followed by Peas and Rye. 1912 Corn followed by Peas and Rye. 1913 Tobacco followed by Burr Clover.		**Plot D.** 1910 Cotton followed by Rye. 1911 Corn followed by Peas and Oats. 1912 Oats followed by Peas and Rye. 1913 Tobacco followed by Burr Clover.

North side of field.

The 4 sections into which the field was divided, each containing one and one-fifteenth acres, were designated by the letters A, B, C and D, and a description of the rotation systems as carried out follows:

1910, Section A, Tobacco: The plat was broken up to a depth of 10 inches and subsoiled 3 inches deeper in December, 1909. It was then allowed to remain until the early part of March, 1910, when it was plowed up again with an 8-inch shovel plow, which thoroughly pulverized the soil. The plot was harrowed a few days later and bedded up in rows 3 feet apart by turning four furrows to the row with a turning plow. The fertilizers were then applied in the drill, stirred in, and covered by throwing two furrows back on it, forming a list for planting. The tobacco was transplanted April 4, and the entire plat, with the exception of one breeding plot, planted in Texas Cuban tobacco. The plants were set 14 inches apart in the drill and the rows were 3 feet apart. The first cultivation was given ten days later, when a side-harrow was run close to the plants, followed by a thorough hoeing. The subsequent cultivations were made with shovel plows and heel sweeps about twice every week, until the plants were topped in early June. The tobacco was harvested in the latter part of June, and the plat was disc-plowed in July, when the tobacco stubble was turned under. It was disc-harrowed in the latter part of July and again in September.

1910, Section A, Cover Crop: Twenty-five pounds of Burr clover were sown broadcast over the plat in the latter part of September and harrowed in with a brush harrow. The clover came to a good stand, though the warm and dry weather prevailing during October and November retarded its growth. A severe freeze damaged the

stand in January, 1911. The clover was plowed under early in March.

1911, Section A, Cotton: The plat was disc-harrowed March 22 and again March 29. It was then bedded up in three-foot rows and the fertilizer distributed in the drill, stirred in, and two furrows thrown back, forming a list for planting. Two weeks later, on April 15, the lists were harrowed down and the cotton seed planted. The seed used was the Mebane Triumph. The heavy, washing rains in the latter part of April injured the stand, and the entire plat was replanted May 2. The cotton was chopped to a stand May 18, leaving a plant every 12 inches in the drill. The rows were 3 feet apart. After chopping, a deep and thorough cultivation was made with an eight-inch shovel plow, and the subsequent cultivations were made with a heel-sweep and small shovel at intervals of two or three days until a dust mulch was formed. By July the growth was so dense that cultivation had to be stopped. In August great damage resulted from the depredations of the "army worm," and it was very difficult to control the spread of these insects, because of the frequent rains which washed off the poison applied. The entire top crop was ruined, decreasing the yield considerably.

Cotton picking was commenced September 5 and finished October 21.

1910, Section B, Corn and Oats: The plat was broken up to a depth of 10 inches, and subsoiled 3 inches deeper in December, 1909. It was harrowed the following January and plowed up again and harrowed in the early part of February. Half of this section, including plots B2, B4, B6, B8, B10, B12, and variety and breeding plot 2-2 were sown broadcast in Texas Red Rust Proof Oats February 12 at the rate of 2 bushels per acre, and the oats were disc harrowed in.

The other half of the section or plots B1, B3, B5, B7, B9, B11 and variety and breeding plot 2-1 were planted in Native White Corn March 14. The field had previously been laid off into four-foot rows, three rows to every plot, and half of the fertilizer to be used for the corn drilled in two weeks before planting. The other half of the fertilizer was applied May 25. The corn was thinned out April 12 to a stalk every 3 feet in the drill and was given a good, deep cultivation with a shovel plow the same day. It received 10 cultivations before the corn was laid by.

The nitrate of soda, which was the only fertilizer used on the oats, was applied broadcast after a rain May 4. The oats were harvested June 20, and the oat stubble plowed under, together with Iron cowpeas, which were sown broadcast, at the rate of 3 bushels per acre.

Iron cowpeas were also sown in drills every two feet between the corn rows June 1.

Both the corn and the oats suffered from the drought in May and never fully recovered from the severe freeze in April. The corn was harvsted September 19.

1910, Section B, Cover Crops: After the corn stalks and pea vines had been plowed under and the plot subsoiled in early October, a section harrow was run over it repeatedly in order to thoroughly pulverize the soil. Rye was then sown broadcast at the rate of 2 bushels per acre and harrowed in with an Acme harrow. The

growth of the rye was excellent and the stand good. It was plowed under March 10, 1911.

1911, Section B, Tobacco: The plat was disc-harrowed March 25 and harrowed with a section harrow March 28 and April 6, in order to pulverize the soil after the rains had caused a crust to form. The plat was plowed with an 8-inch shovel plow April 7 and harrowed April 13. It was then laid off into three-foot rows and bedded up, after which the fertilizers were sown in the drill, stirred in and covered up. The tobacco plants were transplanted April 27, and were set at a distance of 14 inches in the drill, with the rows 3 feet apart. The variety planted was the Texas Cuban. The first cultivation was made ten days later with a side-harrow, after which the plants were thoroughly hoed. The subsequent cultivations were made from two to three times per week until a soil mulch was formed.

The tobacco plants began to flower out in early June, when they were only 12 to 14 inches high, the cause of this abnormal condition being the long drought, which began May 2, and was not broken until July 6. In order to obtain, if possible, some sort of crop from the suckers, which always grow out after a tobacco stalk is cut, the plants were all cut down June 19 and one sucker allowed to grow from each stalk, all the others being trimmed off. The heavy rains of July and August fostered this growth, and the resulting crop was as good, if not better, as the crop from the parent plants would have been under normal conditions. The tobacco harvesting was commenced August 10 and finished August 25.

1910, Section C, Oats and Corn: This plat was given exactly the same treatment as described under the heading, *1910, Plat B, Corn and Oats.* One-half of the section, including plots C1, C3, C5, C7, C9, C11 and variety plat 3-1 were sown in oats and the other half, or plots C2, C4, C6, C8, C10, C12 and variety plat 3-2 were planted in corn. Cowpeas were planted in drills between the corn rows and broadcast over the oat stubble.

1910, Section C, Cover Crops: After the corn stalks and pea vines had been plowed under, oats were sown and harrowed in on that part of the plat where the corn had been planted, while rye was sown where the preceding crop of oats had been grown.

1911, Section C, Corn and Oats: The rye was plowed under in February and the plat harrowed, after which the rows were bedded up for corn March 7, and half of the fertilizer applied in the drill, the other half being applied May 15. The corn was planted March 14 and cultivated frequently until a soil mulch was established. The growth of the corn was at first excellent, but the drought of May and June spoiled the outlook for a good crop.

The oats, which had been sown the preceding fall, came up to a good stand and looked very promising, but the severe freeze in January ruined the stand, so that it was necessary to re-sow the plots February 2. The growth of the oat stalks was good, but the yield of grain was very small, due, no doubt, to the drought.

1910, Section D, Cotton: After breaking up and sub-soiling the plat in December, 1909, it was harrowed the following January and again in early March. The plat was then plowed up again and disc-harrowed and bedded up for planting March 23, at which time the

fertilizer also was applied. The cotton seed was planted April 7, but heavy rains and cold weather injured the stand, so that it was necessary to re-plant the entire plat April 20. The cotton was chopped out to a plant every 12 inches in the drill, with the rows 3 feet apart. It was cultivated frequently, with the object of obtaining a soil mulch as soon as possible after every rain. The growth was excellent. Picking was begun August 29 and finished September 30.

1910, Section D, Cover Crops: After the cotton stalks had been cut and plowed under and the plat harrowed, half of it, including plots D1, D3, D5, D7, D9, D11, and variety plot 4-1 were sown in oats, and the other half, or plots D2, D4, D6, D8, D10, D12, and variety plat 4-2 were sown in rye exactly as described on plat B.

1911, Section D, Oats and Corn: The half of the plat which was sown in rye was plowed up February 24 and subsequently planted in corn, which received the same treatment as described under *1911, Section C, Corn and Oats,* and the other half was sown in oats, which were handled in the same way as the oats on plat C.

COMPARATIVE RESULTS FROM FERTILIZER PLOTS.

The experimental field was so laid off as to make it possible to combine the crop rotation and the fertilizer experiments and the method followed has been described on page 37. The portion of the field used for the fertilizer tests contained 48 plats, one-fourth of which were used each year for experiments with tobacco. The remaining plats were used for similar tests with other crops, which followed tobacco in rotation. These tests were designed to determine the best system of fertilizing to follow in producing tobacco of high quality along with other crops, and in maintaining and improving the productiveness of the tobacco soils. Each plot contained one-fifteenth of an acre, and all the plots were separated by a guard row 5 feet wide. The fertilizers used on the tobacco, cotton and corn were applied two weeks before planting, except lime, which was applied during the February plowing. The nitrate of soda used on the oats was applied as a top dressing when the oats were half grown.

The kinds and quantities of the fertilizers applied to each plot, the cost of the fertilizers and the yields obtained of the several crops are shown in the following tables:

Fig. 9—Tobacco fertilizer plots B-1 and B-3

TOBACCO.

Fertilizer per acre.	1910. Cost of fertilizer per acre.	1910. Yield of tobacco per acre.	1910. Quality of tobacco.	1911. Cost of fertilizer per acre.	1911. Yield of tobacco per acre.	1911. Quality of tobacco.
1200 lbs. C. S. Meal. 400 lbs. Acid Phos. 200 lbs. Sul. Pot. 500 lbs. Lime. Plot 1.	$33 60	1,035 lbs.	very good	$32 60	1,365 lbs.	very good
200 lbs. Sul. Pot. Plot 3.	$ 6 00	420 lbs.	poor	$ 6 80	445 lbs.	poor
600 lbs. C. S. Meal. 400 lbs. Acid Phos. 200 lbs. Sul. Pot. Plot 5.	$19 30	930 lbs.	fair	$19 20	1,065 lbs.	fair
No fertilizer. Plot 7.		510 lbs. 510 lbs.	inferior unfit for commercial use		430 lbs.	very poor unfit for commercial use
1200 lbs. C. S. Meal. 400 lbs. Acid Phos. Plot 9.	$22 60	1,162 lbs.	good	$20 80	1,075 lbs.	good
400 lbs. Acid Phos. 200 lbs. Sul. Pot. Plot 11.	$10 00	525 lbs.	fair	$10 80	515 lbs.	fair
1000 lbs. C. S. Meal. 200 lbs. Acid Phos. 100 lbs. Sul. Pot. Variety Plot I.	$20 50	1,132 lbs.	good	$19 40	1,085 lbs.	very good

TOBACCO.

Fertilizer per acre.	1910. Cost of fertilizer per acre.	1910. Yield of tobacco per acre.	1910. Quality of tobacco.	1911. Cost of fertilizer per acre.	1911. Yield of tobacco per acre.	1911. Quality of tobacco.
1200 lbs. C. S. Meal. Plot 2.	$18 60	930 lbs.	good	$16 80	1,040 lbs.	good
400 lbs. Acid Phos. Plot 4.	$ 4 00	645 lbs.	poor	$ 4 00	747 lbs.	fair
1200 lbs. C. S. Meal 400 lbs. Acid Phos. 200 lbs. Sul. Pot. Plot 6.	$28 60	1,155 lbs.	very good	$27 60	1,163 lbs.	very good
No fertilizer. Plot 8.		517 lbs.	very poor unsalable		400 lbs.	very poor unsalable
1200 lbs. C. S. Meal. 200 lbs. Acid Phos. 200 lbs. Sul. Pot. Plot 10.	$26 60	1,230 lbs.	very good	$25 60	1,200 lbs.	very good
1200 lbs. C. S. Meal. 200 lbs. Sul. Pot. Plot 12.	$24 60	1,245 lbs.	very good	$23 60	1,060 lbs.	very good
1000 lbs. C. S. Meal. 200 lbs. Acid Phos. 100 lbs. Sul. Pot. Variety Plot 2.	$20 50	1,320 lbs. (Big Cuban)	very good	$19 40	1,365 lbs. (Big Cuban)	very good

Fig. 10—Tobacco fertilizer plots B-6 and B-8.

COTTON.

Fertilizer per acre.	1910. Cost of fertilizer and yield of cotton per acre.	1911. Cost of fertilizer and yield of cotton per acre.	Fertilizer per acre.	1910. Cost of fertilizer and yield of cotton per acre.	1911. Cost of fertilizer and yield of cotton per acre.
Plot 1. 200 lbs. C. S. Meal. 400 lbs. Acid Phos. 100 lbs. Sul. Pot. 500 lbs. Lime.	$30 60 1,361 lbs.	$29 20 1,950 lbs.	Plot 2. 1200 lbs. C. S. Meal.	$18 60 1,320 lbs.	$16 80 1,305 lbs
Plot 3. 100 lbs. Sul. Pot.	$ 3 00 570 lbs.	$ 3 40 810 lbs.	Plot 4. 400 lbs. Acid Phos.	$ 4 00 1,290 lbs.	$ 4 00 1,200 lbs
Plot 5. 600 lbs. C. S. Meal. 400 lbs. Acid Phos. 100 lbs. Sul. Pot.	$16 30 1,350 lbs.	$15 80 1,410 lbs.	Plot 6. 1200 lbs. C. S. Meal. 400 lbs. Acid Phos. 100 lbs. Sul. Pot.	$25 60 1,875 lbs.	$24 20 1,530 lbs
Plot 7. No fertilizer.	735 lbs.	750 lbs.	Plot 8. No fertilizer.	755 lbs.	675 lbs
Plot 9. 200 lbs. S. C. Meal. 400 lbs. Acid Phos.	$22 60 1,305 lbs.	$20 40 1,333 lbs.	Plot 10. 1200 lbs. C. S. Meal. 200 lbs. Acid Phos. 200 lbs. Sul. Pot.	$23 60 1,965 lbs. 1,965 lbs.	$22 20 1,365 lbs 1,365 lbs
Plot 11. 400 lbs. Acid Phos. 100 lbs. Sul. Pot.	$ 7 00 870 lbs.	$ 7 40 1,245 lbs.	Plot 12. 1200 lbs. C. S. Meal. 100 lbs. Sul. Pot.	$21 60 1,740 lbs.	$20 20 1,210 lbs
Variety Plot 1. 1000 lbs. C. S. Meal. 200 lbs. Acid Phos. 100 lbs. Sul. Pot. 500 lbs. Lime.	**$25 50** 1,155 lbs.	**$24 40** 1,260 lbs.	Variety Plot 2. 1000 lbs. C. S. Meal. 200 lbs. Acid Phos. 100 lbs. Sul. Pot. 500 lbs. Lime.	$25 50 1,770 lbs.	$24 40 1,200 lbs.

The cost refers to the cost of fertilizer alone, and the yield means the yield in seed cotton.

CORN.

Fertilizer per acre.	1910. Cost of fertilizer and yield of corn per acre.	1911. Cost of fertilizer and yield of corn per acre.	Fertilizer per acre.	1910. Cost of fertilizer and yield of corn per acre.	1911. Cost of fertilizer and yield of corn per acre.
Plot 1. 600 lbs. C. S. Meal. 400 lbs. Acid Phos. 400 lbs. Sul. Pot. 600 lbs. Lime.	$19 30 49 bus.	$18 80 11 bus.	Plot 2. 1200 lbs. C. S. Meal.	$18 60 36 bus.	$16 80 8 bus.
Plot 3. 400 lbs. Sul. Pot.	$ 3 00 30 bus.	$ 3 40 11 bus.	Plot 4. 200 lbs. Acid Phos.	$ 2 00 28 bus.	$ 2 00 14 bus
Plot 5. 600 lbs. C. S. Meal. 400 lbs. Acid Phos. 400 lbs. Sul. Pot.	$14 30 49 bus.	$13 00 11 bus.	Plot 6. 600 lbs. C. S. Meal. 200 lbs. Acid Phos. 100 lbs. Sul. Pot.	$14 30 42 bus.	$13 80 19 bus.
Plot 7. No fertilizer.	30 bus.	11 bus.	Plot 8. No fertilizer.	28 bus.	9 bus.
Plot 9. 600 lbs. C. S. Meal. 400 lbs. Acid Phos.	$13 30 47 bus.	$12 40 9 bus.	Plot 10. 600 lbs. C. S. Meal. 200 lbs. Acid Phos.	$11 30 46 bus.	$10 40 20 bus.
Plot 11. 400 lbs. Acid Phos. 400 lbs. Sul. Pot.	$ 5 00 31 bus.	$ 5 40 13 bus.	Plot 12. 600 lbs. C. S. Meal. 100 lbs. Sul. Pot.	$12 30 38 bus.	$11 86 20 bus.
Variety Plot 1. 600 lbs. C. S. Meal. 400 lbs. Acid Phos. 400 lbs. Lime.	$22 50 4 bus.	$21 00 8 bus.	Variety Plot 2. 1000 lbs. C. S. Meal. 200 lbs. Acid Phos. 500 lbs. Lime.	$22 50 37 bus.	$21 00 26 bus.

The cost refers to the cost of fertilizers alone, and the yield means weighed bushels at 72 lbs. per bushel.

OATS.

Fertilizer per acre.	1910. Cost of fertilizer and yield of oats per acre.	1911. Cost of fertilizer and yield of oats per acre.	Fertilizer per acre.	1910. Cost of fertilizer and yield of oats per acre.	1911. Cost of fertilizer and yield of oats per acre.
Plot 1. 100 lbs. Nit. Soda.	$ 3 00 390 lbs.	$ 3 25 430 lbs.	Plot 2. 100 lbs. Nit. Soda.	$ 3 00 600 lbs.	$ 3 25 585 lbs.
Plot 3. 100 lbs. Nit. Soda.	$ 3 00 330 lbs.	$ 3 25 330 lbs.	Plot 4. 100 lbs. Nit. Soda.	$ 3 00 495 lbs.	$ 3 25 345 lbs.
Plot 5. 100 lbs. Nit. Soda.	$ 3 00 390 lbs.	$ 3 25 430 lbs.	Plot 6. 100 lbs. Nit. Soda.	$ 3 00 480 lbs.	$ 3 25 450 lbs.
Plot 7. No fertilizer.	300 lbs.	345 lbs.	Plot 8. No fertilizer.	240 lbs.	285 lbs.
Plot 9. 100 lbs. Nit. Soda.	$ 3 00 420 lbs.	$ 3 25 525 lbs.	Plot 10. 100 lbs. Nit. Soda.	$ 3 00 480 lbs.	$ 3 25 480 lbs.
Plot 11. 100 lbs. Nit. Soda.	$ 3 00 420 lbs.	$ 3 25 360 lbs.	Plot 12. 100 lbs. Nit. Soda.	$ 3 00 450 lbs.	$ 3 25 345 lbs.
Variety Plot 1. 100 lbs. Nit. Soda.	$ 3 00 300 lbs.	$ 3 25 510 lbs.	Variety Plot 2. 100 lbs. Nit. Soda.	$ 3 00 375 lbs.	$ 3 25 390 lbs.

The cost refers to the cost of fertilizers, and the yield means the weight of the grain exclusive.

DETAILED STATEMENT OF TOBACCO FERTILIZER PLOTS.

Fertilizer per acre.	Year.	Average number leaves per stalk.	Average length of leaves, inches.	Average width of leaves, inches.	Average height of stalk, inches.	Average circumference stalk, inches.	Color of plants at maturity.	Growth.	Cost per acre of fertilizer.	Yield per acre, pounds.
Plot 1. 1200 lbs. C. S. Meal. 400 lbs. Acid Phos. 200 lbs. Sul. Pot. 500 lbs. Lime.	1910	20	16	10	48	2½	Dark green	Rapid	$33 60	1,035
	1911	25	18	11	60	3	Dark green	Rapid	$33 60	1,365
Plot 3. 200 lbs. Sul. Pot.	1910	10	8	4	24	1½	Yellowish green	Very slow	$ 6 00	420
	1911	14	12	7	27	2	Yellowish green	Slow	$ 6 80	445
Plot 5. 600 lbs. C. S. Meal. 400 lbs. Acid Phos. 200 lbs. Sul. Pot.	1910	16	14	8	38	2¼	Yellowish green	Rapid	$19 30	930
	1911	18	14	9	45	2½	Yellowish green	Very rapid	$19 20	1,065
Plot 7. No fertilizer.	1910	14	10	6	32	1½	Yellowish green	Very slow	--------	510
	1911	14	12	6½	26	1½	Yellowish green	Slow	--------	430
Plot 9. 1200 lbs. C. S. Meal. 400 lbs. Acid Phos.	1910	20	16	11	48	2½	Dark green	Rapid	$22 60	1,162
	1911	22	16	10	53	3	Dark green	Very rapid	$20 80	1,075
Plot 11. 400 lbs. Acid Phos. 200 lbs. Sul. Pot.	1910	14	12	7	30	2	Yellow	Medium	$10 00	525
	1911	15	12	7	31	2	Yellowish green	Rapid	$10 80	515

TOBACCO FERTILIZER PLOTS.

Fertilizer per acre.	Year.	Average number leaves per stalk.	Average length of leaves, inches.	Average width of leaves, inches.	Average height of stalk, inches.	Average circumference stalk, inches.	Color of plants at maturity.	Growth.	Cost per acre of fertilizer.	Yield per acre, pounds
Plot 2.	1910	18	15	7	46	2½	Dark green	Medium	$18 60	930
1200 lbs. C. S. Meal.	1911	18	15	9	44	2½	Dark green	Rapid	$16 80	1,040
Plot 4.	1910	14	12	7	30	1¾	Yellow	Medium	$ 4 00	645
400 lbs. Acid Phos.	1911	16	12	7	36	2	Yellow	Rapid	$ 4 00	747
Plot 6	1910	20	17	10	50	2½	Dark green	Rapid	$28 60	1,155
1200 lbs. C. S. Meal. 400 lbs. Acid Phos. 200 lbs. Sul. Pot.	1911	24	17	9½	58	3	Dark green	Very rapid	$27 60	1,162
Plot 8.	1910	15	10	6	34	1½	Yellowish green	Very slow	--------	517
No fertilizer.	1911	14	12	6	27	1½	Yellowish green	Slow	--------	400
Plot 10.	1910	22	17	10	54	2½	Dark green	Rapid	$26 60	1,230
1200 lbs. C. S. Meal. 200 lbs. Acid Phos. 200 lbs. Sul. Pot.	1911	24	16	9	52	3	Dark green	Rapid	$25 60	1,200
Plot 12.	1910	22	18	12	54	2½	Dark green	Slow	$24 60	1,245
1200 lbs. C. S. Meal. 200 lbs. Sul. Pot.	1911	22	15	9	49	2½	Dark green	Slow	$23 60	1,059

CONCLUSIONS FROM THE FERTILIZER EXPERIMENTS.

The tobacco fertilizer experiments, as well as the crop rotation work, will need to be carried on for at least four years, as planned, in order to yield conclusive results. Still, the yields show plainly the need of applying large amounts of fertilizers in order to obtain better yields and quality, and, at the same time, to increase the fertility of the soil.

The average yield of the Texas Cuban tobacco has been 500 pounds per acre, and of the Big Cuban 800 pounds per acre, and these fertilizer experiments have proven that this average yield can be increased to at least 1,000 pounds per acre of the Texas Cuban and 1,300 pounds per acre of the Big Cuban.

It is well known that well fertilized cigar leaf tobacco has better aroma and flavor and a more rapid growth than tobacco not sufficiently fertilized, and this fact was demonstrated by the tobacco on the unfertilized plots numbers 7 and 8, as well as plats 3, 4, and 11, which did not receive any nitrogen. In addition to the low yield, the tobacco from these plots, with the exception of that from plot 3, which has a high aroma and an exceptionally good burn, lacks "body," that is, the leaves are thin and papery, while the laboratory tests indicated less aroma and flavor and much less ability to stand a heavy

fermentation than the tobacco from the highly fertilized plots. The following table shows the results obtained in the laboratory tests, and in perusing it the fact should be remembered that all the fertilizer plots were planted in the same kind of tobacco, namely, Texas Cuban, so that the differences noted are due to the fertilizers or absence of fertilizers.

	Quality 10 points.	Aroma 40 points.	Flavor 20 points.	Burn 20 points.	Yield 10 points.	Total 100 points.
Plat No. 1	10	37	18	19	8	92
Plat No. 2	9	35	16	19	8	87
Plat No. 3	9	38	18	19	3	87
Plat No. 4	7	35	15	17	5	79
Plat No. 5	9	39	19	19	6	92
Plat No. 6	10	38	18	19	8	93
Plat No. 7	6	34	15	18	4	77
Plat No. 8	7	35	15	18	4	79
Plat No. 9	9	39	19	18	8	93
Plat No. 10	10	38	18	19	8	93
Plat No. 11	5	35	18	19	4	81
Plat No. 12	9	38	15	19	10	91

These tests indicate quite plainly the great influence of a well balanced fertilizer on the yield, flavor, burn and aroma of cigar leaf tobacco. While the low yield of plot No. 3, which was fertilized with sulphate of potash only at the rate of 200 pounds per acre, indicates that potash is not conducive to a good yield when used by itself, the fact remains that the tobacco from this plot ranks very high in the following important qualifications, namely, aroma, flavor, and burn. Owing to the absence of an adequate supply of nitrogen and phosphoric acid, however, the yield was very low.

It has also been clearly demonstrated by these experiments, as well as by numerous others, that phosphoric acid causes an increase in yield when used in conjunction with nitrogen. Phosphoric acid also hastens the maturity of the plants, or, in other words, causes a fast growth, which is highly desirable in tobacco. The East Texas soils are deficient in this plant food, and it should be applied more generally than is the case now. The best form in which to apply phosphoric acid is the so-called acid phosphate, preferably analyzing 16 per cent available phosphoric acid. The highest amount used on the experimental plats was 400 pounds of 16 per cent acid phosphate per acre, and it is probable that even larger amounts may be used to advantage.

Stable manure as a source of nitrogen was not used on any of the plots, because it is not obtainable in sufficiently large quantities to be used to any extent on the tobacco farms in East Texas, though its use where available is advocated. Cotton seed meal was used instead because it is easily to be had in quantiy, and is quite generally used as a source of nitrogen in the manufacture of commercial fertilizers in the South.

TOBACCO SEED BEDS ON THE TEST FARM,

1910 and 1911.

In 1910 the seed beds were prepared early in February. They were located near the experiment field, and a well was dug close by. The area was first thoroughly burned and then spaded to a depth of 3 inches, after which all trash and roots were raked off, leaving the soil

in smooth, pulverized condition. Planks were then laid on edge, forming cold frames 5 feet wide and 30 feet long. Seven of these frames were put up and the soil fertilized with 100 pounds cotton seed meal and 50 pounds acid phosphate. The seeds were sown February 14 at the rate of 1½ tablespoonsful of seed mixed with two handsful of ashes to every 25 square yards. After being sown, the beds were covered with cheese-cloth. They were then watered regularly, care being taken to keep the soil moist, but not too wet. After transplanting in April, the frames and cloth were removed and the area plowed under.

Early in February, 1911, the same area was thoroughly burned again and spaded up. After the frames were put up the fertilizer was applied and raked in. The seeds were sown February 27 and covered with cheese-cloth stretched over the frames. The seeds germinated in ten days after sowing, and the plants grew very rapidly.

TOBACCO DEMONSTRATION PLOT.

In order to test on a larger scale the correctness of the results obtained with fertilizers on the smaller plots, an additional half acre of land of the same soil type as the fertilizer plots forming a part of the same field was leased during 1911. It was fertilized according to the formula used on plot A6, which gave the best results in 1910. This formula consists of 1,200 pounds cotton seed meal, 400 pounds 16 per cent acid phosphate, and 200 pounds 50 per cent sulphate of potash per acre.

The field was thoroughly broken up in January and harrowed in February. It was then plowed up again in the latter part of March with an 8-inch shovel plow and harrowed, after which it was bedded up in three-foot rows. After the fertilizer had been distributed in the drill and stirred in, two furrows were thrown back over it, forming a list or ridge for planting. Just before transplanting, this ridge was leveled down. The field was transplanted April 20, and owing to the heavy rains the field was not in condition to plow until May 6, when a side-harrow was run close to the plants after a thorough hoeing. The next cultivation was made ten days later, when an 8-inch shovel plow was used in thoroughly breaking up and pulverizing the soil between the rows. The reason for this intensive cultivation was the fact that the heavy rains had packed the soil just after transplanting, and in order to form a soil mulch it was necessary to thoroughly pulverize the soil rather deep at first. A few days later a heel-sweep with a small shovel attached was run three times to the row, and this process was repeated every three or four days until a good soil mulch was formed.

The prolonged drought which commenced in May and continued until July did not affect the growth of the plants until early in June, because the field is situated in a low place, whereas the regular fertilizer plots which suffered intensely from the drought were situated on a more elevated spot. In early June, however, the drought forced the plants to commence flowering earlier than would have been the case under normal conditions. At about the same time the bottom leaves of the plants commenced to turn yellow and burn, indicating that all available moisture in the soil was exhausted. Consequently, in order to save the crop, or part of it, it was necessary to top the

plants very low, leaving from 10 to 12 leaves per stalk. This was done June 12, and as there was no indication of rain, the tobacco was harvested June 16 before maturity.

In a few days after harvesting, suckers commenced to grow on the stubble in the field, and as it was thought the available plant food had not all been absorbed by the first crop, an attempt was made to get a second or sucker crop. In order to get a second crop, all suckers except one were removed from each tobacco stump. The sucker left to grow was always the ground one, that is, the sucker coming from beneath the surface of the ground. After a thorough hoeing, the rows were plowed with a 6-inch shovel plow, running close to the plants, with a view to breaking up all roots, thus forcing the plant to form new ones. The field was plowed again within a few days with a heel-sweep and small shovel, after which rains set in and prevented further cultivation until July 20, when the field was plowed for the last time. The tobacco had by this time attained a full growth with marked rapidity, caused by the frequent rains. The plants were topped July 27, leaving from 16 to 18 leaves per stalk, and harvested two weeks later. The yield of the first crop grown was 176 pounds from 4,728 plants, which indicates a yield of 400 pounds per acre from a full stand. This low yield was caused by the drought, which rendered not only the bottom leaves, but also 4 or 5 of the top leaves absolutely worthless. The former burned up in the field, and the latter were too small to use.

The yield of the second or sucker crop was 318 pounds from 5,158 stalks, indicating a yield of 700 pounds per acre from a full stand. This tobacco had too much rain, which caused the leaves to be very thin and light, whereas normally they should have been thick and heavy.

TOBACCO SEED SELECTION AND BREEDING ON THE VARIETY AND BREEDING PLATS.

Twenty-two varieties and types of cigar leaf tobacco were grown on the variety plats during 1910, and twenty varieties and types during 1911. Careful selections were made of these tobaccos, with a view of further propagating the types which seemed most desirable. From 60 to 100 plants of each type were first selected and a 12-pound paper bag placed over the flower head in order to prevent cross pollination. Twenty of the best plants of each type were then tagged and numbered, and the leaves and seed of each plant kept separate for further tests in Washington.

Some of the types grown in 1910 were discarded as being not suitable for East Texas, while a number of new types and varieties were introduced in 1911. Several successful crosses were also made this year with a view of determining the practicability of improving the flavor of the Big Cuban.

It has been demonstrated during these tests that high-grade cigar leaf tobacco can be successfully grown on the Orangeburg soils in East Texas, and the cheaper varieties are not suited for introduction

LIST OF TOBACCO VARIETIES AND TYPES GROWN ON THE VARIETY AND BREEDING PLOTS.

Name of Variety or Type.	Number of selections grown in 1910	Growth.	Number of selections grown in 1911	Growth.
xas-Cuban No. 403	2	very good	2	very good
xas-Cuban No. 408	2	very good	2	very good
xas-Cuban No. 12	1	very good	1	very good
ban low nicotine, selections	3	very good	none	
Cuban Hybrids	6	very good	4	very good
brid cross between Texas-Cuban and onnecticut Broadleaf	1	good	1	good
brid cross between Mexican and Pennylvania Broadleaf	1	good	1	good
ported Java seed	1	very poor	none	
nnecticut Broadleaf	1	poor	none	
nnsylvania Broadleaf	1	poor	none	
Aurora 47818	1	poor	none	
ported Cuban, Vuelta	none		1	good
ported Cuban, Remedios	none		2	good
io Hybrid No. 204	none		1	good
Aurora No. 55	none		1	good
ld Texas tobacco	none		1	good
xican seed	none		3	very poor

WEATHER CONDITIONS.

1910.

The weather was very cold during January, with frequent rains. ebruary was warmer, with heavy rains in the latter part of the onth. March was very warm and dry, while April was cold and iny. After a month of dry weather, heavy rains set in during the tter part of May. The greater part of June was marked by insely hot, dry weather, which culminated in a severe wind and rain orm June 25, which lasted for 4 days. A succession of light showrs fell during the first part of July, winding up in a storm July 18. fter this a drought set in, which was not broken until November 16. number of showers fell during this period, but they dried out soon fter falling, doing no material good.

1911.

January began with a severe freeze, which did considerable damge. It soon turned warm, however, practically no rain falling until ate in March, when the weather became colder again. Frequent eavy rains were of almost daily occurrence during April, washing elds and retarding farming operations. A period of very dry, hot eather set in May 2, resulting in a disastrous drought, which was ot broken until July. The rains continued during July and August, ith severe storms July 4 and August 1. September and October ere dry and hot, though occasional showers relieved the heat.

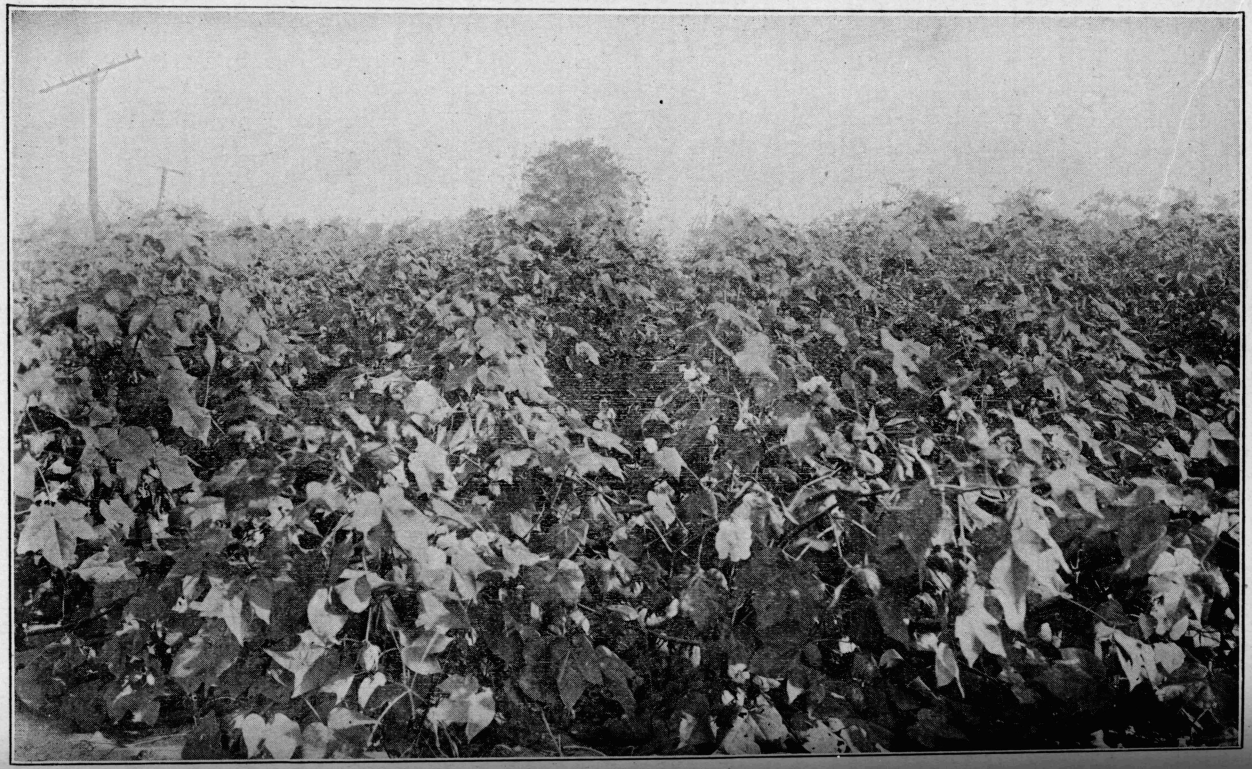

Fig. 11—General view of cotton fertilizer plots.

RAINFALL.

1910.	
April 4	1.50
April 8	.45
April 14	.02
April 15	1.53
April 16	.10
	3.60
May 14	.40
May 17	2.85
May 19	3.15
May 20	.30
May 22	1.80
May 31	.02
	8.52
June 4	.12
June 5	.75
June 10	.56
June 22	.03
June 24	.03
June 25	2.00
June 26	.30
June 27	.10
June 28	.32
	4.21
July 3	.30
July 4	.10
July 5	.47
July 7	.13
July 13	.05
July 14	.20
July 18	1.40
	2.65
October, 1909	2.89
November, 1909	.85
December, 1909	7.59
January, 1910	1.56
February, 1910	9.76
March, 1910	.93
April, 1910	3.60
May, 1910	8.52
June, 1910	4.21
July, 1910	2.65
August, 1910	1.59
September, 1910	1.43
	45.58

1911.	
April 1	.25
April 3	1.70
April 12	.75
April 15	.05
April 16	.50
April 17	1.75
April 18	.25
April 23	.50
April 26	1.75
April 30	.24
	7.74
May 2	.05
May 11	.48
May 20	.12
	.65
June 19	.04
June 23	.30
	.34
July 2	.35
July 4	.97
July 6	2.60
July 8	.70
July 11	1.07
July 13	.15
July 14	.65
July 15	1.45
July 16	.55
July 17	.42
July 18	.75
July 23	.03
July 30	1.20
	10.89
October, 1910	2.25
November, 1910	3.32
December, 1910	.00
January, 1911	.00
Febuary, 1911	2.65
March, 1911	3.85
April, 1911	7.74
May, 1911	.65
June, 1911	.34
July, 1911	10.89
August, 1911	3.50
September, 1911	.32
	35.51

PUBLICATIONS ISSUED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE WHICH RELATE TO TOBACCO.

Bulletins.

Farmers' Bulletins:

No. 60 "Methods of Curing Tobacco." Revised.
No. 82 "The Culture of Tobacco."
No. 83 "Tobacco Soils.
No. 120 "Principal Insects Affecting the Tobacco Plant."
No. 225 (Exper. Sta. Work, pp. 10-11), "Tobacco Seed."
No. 237 (Exper. Sta. Work, pp. 12-13), "Tobacco Seed Selection."
No. 451 (Exper. Sta. Work, pp. 5-7). "Sterilizing Tobacco Seed Beds."

Bureau of Plant Industry Bulletins:
No. 96 "Tobacco Breeding."
No. 143 "Principles and Practical Methods of Curing Tobacco."
Bureau of Soils Bulletins:
No. 29 "Experiments in Growing Cuban Seed Tobacco in Texas."

Circulars.

Bureau of Plant Industry Circulars:
No. 7 "Field Treatment of Tobacco Root-Rot."
No. 48 "The Present Status of Tobacco Industry."
Bureau of Soils Circulars:
No. 14 "Opportunities for the Production of Cigar-Leaf Tobacco in East Texas and Alabama."
Bureau of Statistics Circulars:
No. 18 "Tobacco Districts and Types."
No. 22 "Tobacco Report, July 1, 1911."

Separate Reprints from the Yearbook.

Yearbook September, 188, "Growth of the Tobacco Industry."
Yearbook September, 446, "The Art of Seed Selection and Breeding."
Yearbook September, 490, "Intensive Methods and Systematic Rotation of Crops in Tobacco Culture."