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United States Department of Agriculture,

BUREAU OF PLANT INDUSTRY,

Farmers' Cooperative Demonstration Work,

WASHINGTON, D. C.

THE PRODUCTION OF COTTON UNDER BOLL-WEEVIL CONDITIONS.

In response to the general and insistent demand for a special circular explaining how to make cotton under boll-weevil conditions, the following is submitted as the result of our experience in the cotton States for a number of years.

It is evident that the cotton-boll weevil has come to stay; that it will soon spread practically over the entire cotton-producing portions of the United States; and that at present there is no known method of completely destroying it, and consequently it will be a factor in all future cotton production in this country.

Fortunately there are some factors in this apparently hopeless problem which point to results which promise relief. The Bureau of Entomology of the United States Department of Agriculture in its outline of the life history of this pest has brought out among other things the following facts:

(1) The cotton boll weevil feeds upon nothing but cotton.

(2) It goes into winter quarters mainly in or near the field of its depredations.

(3) Comparatively few weevils survive the winter and emerge in the spring.

(4) The overwintered weevil feeds upon the terminal buds of the young cotton plants until the forms or squares develop, then the female deposits her eggs in the squares, exclusively at first, but later deposits them also in the immature bolls.

(5) The life of the adult weevil when supplied with food is about 70 days. If deprived of food it lives only 6 or 7 days, except in hibernation.

(6) For a period after emergence from winter quarters the weevil is comparatively sluggish and while feeding upon the cotton plants it may be picked or poisoned.

(7) The weevils remain mainly in the field where they locate in the early spring until they become very numerous. Their principal period of migration is in the fall.

Based upon these life habits of the weevil, the Bureau of Plant Industry has planned its fight for the production of cotton, which may be summarized as follows:

(1) Under boll-weevil infestation the fields selected for cultivation should be well drained, because a successful crop will then depend

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upon the possibility of cultivating them at the proper time. The low, poorly drained lands should be devoted to other crops. They have always been an uncertain factor in cotton production. It is not the intention to state that well-drained alluvial lands should not be planted to cotton.

(2) The early destruction of the cotton stalks before frost and the burning of all rubbish in and about the infested field are imperative.

(3) Break the field deep as early in the fall as possible with an implement that does not bring too much of the subsoil to the surface. Some winter cover crop should be grown if practicable; if not, harrow occasionally during the winter. Before planting, thoroughly pulverize the soil and make the best seed bed possible.

(4) Care must be taken to secure seed of an early-maturing variety and of the highest vitality—not necessarily a small-boll variety, for on uplands we have been more successful with some large-boll varieties.

(5) Plant reasonably early in rows somewhat wider apart than under non-boll-weevil conditions. Planting should be delayed until all danger from frost is past and the soil is warm enough to produce rapid germination and growth.

(6) The use of the section harrow before planting and after planting, and again just as soon as the plants are well up, is advised.

(7) Use intensive, shallow cultivation of the crop and never lay by the cotton till picking commences. Late cultivation is very important.

(8) In case it is evident that a large number of weevils have been overwintered, it is advisable to hand-pick or poison the early-appearing weevils.

(9) As soon as the wēevil commences to work, as evidenced by the punctured squares, attach a pole or brush to the handles of the cultivator so as to knock the squares off. Most of them will fall of their own accord in a few days after they are punctured.

(10) Persistently pick up and burn the fallen squares.[1]

This battle against the weevil is in two divisions:

The first division of the work consists in reducing the number of weevils just as much as possible so that a crop can be made.

The second division is to push the cotton plant to maturity as fast as possible and by extra cultivation and fertilization cause it to put on more forms or squares than it can mature, so that what the weevil takes is only a surplus—of no consideration in making the crop.

The burning of the stalks is very destructive to the weevils in the field, but its value depends considerably on when and how it is done. It must be done early and before frost. Demonstrations have been made showing that it caused the destruction of as many as 97 per cent of the weevils if done early and properly, but if delayed it might allow as many as 45 per cent to escape.

There are several methods of destroying the stalks. First, every third or fifth row may be allowed to stand and the rows on each side uprooted and thrown against it. Second, all the stalks may be cut and thrown into piles of convenient size. In either case, some of the adult weevils will collect in the windrows or piles and be destroyed when the stalks are burned.

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[1] The Bureau of Entomology advises that the gathered squares be placed in a wire cage. The receptacle must be tight enough to retain the weevils, but allow the escape of the parasites.

Another plan practiced is to turn cattle in the fields to eat the foliage and immature bolls. This plan, however, should not be followed except by those farmers who can turn in enough cattle to completely clean up the field in a week's time.

The object in destroying the stalks is a twofold one: (1) To deprive the adult weevil of food and breeding places; (2) to kill the vast numbers of weevil eggs, larvæ, and pupæ contained in the squares and immature bolls at this time. To make this destruction complete, the stalks should be burned as soon as possible after being cut and piled. As soon as the foliage will burn readily fire should be applied, although the main stem and branches may not yet be dry enough to burn. All rubbish in and about the field should also be burned and the field immediately broken.

If this single instruction to destroy all cotton stalks in the fall while still green could be carried out by every grower, it would practically solve the weevil problem. The difficulty is that only part of the growers follow the plan. It requires early-maturing cottons and rapid gathering to get the crop out in time to do this work to the best advantage.

If delay is made until after a heavy frost and large numbers of the weevils have escaped from the field, either to hibernate or to go elsewhere, then to cut and burn stalks may be of little value, and the better practice is to thoroughly cut the stalks and plow them under.

It is seldom practicable for farmers in the northern portion of the cotton belt to cut and burn stalks early enough to be of value.

The next most important work in eliminating the weevils is in the spring, when the cotton plants begin to put on squares and the infesting weevil punctures them. The grower should take note of this and immediately attach a pole to the handles of the cultivator so as to knock the bush and hasten the falling off of the squares, and then the squares must be carefully picked up and burned. In one sense this picking up of squares goes to the root of the matter more than early fall destruction of the stalk, because in the fall destruction only a small percentage of the weevils would live through the winter anyway, while we can rest assured that practically every square not picked up and destroyed, at least in cloudy weather, will result in furnishing a boll weevil to infest the crop. We know of hundreds of instances where fields were located in the best situation for weevil depredation, on bottom lands surrounded by heavy timber, with a rank growth of cotton and no previous preparation or burning of the stalks or destruction of the rubbish, and yet by picking up the squares and intensive cultivation a large crop of cotton was made. If care is taken that every punctured square is destroyed, a whole generation of weevils will be wiped out in two or three weeks. The old weevils will die and we can go right on making the crop. Of course, in sections where there is very slight rainfall and on sandy upland soils anywhere during periods of dry and very hot weather, dependence may be placed on the heat to kill the weevil larvæ in the squares.

It will seldom be safe to depend on this on alluvial soils and never on any kind of soil except under the conditions of drought and heat above noted.

We therefore wish to emphasize the two points, the early destruction of the stalks in the fall and the picking up and burning of the

squares, as of primary importance in making a successful crop of cotton. The early destruction of stalks in the fall has a double advantage. It not only kills a vast number of the weevils, but it destroys all their supply of food, so that such as are not killed by fire mostly perish for lack of food before winter.

On the plant side of the boll-weevil fight the old theory that cotton would make some time during the season will not work under boll-weevil conditions. The plant must grow off rapidly and produce cotton early. To this end deep fall breaking on uplands is an important step. Deep breaking in the fall provides more plant food and a more uniform supply of moisture in the soil. It also destroys many weevils and gives the soil time to become firm before cotton planting in the spring. It is a mistake to suppose that deep breaking is good at any season of the year. The object of plowing or breaking is to pulverize the soil, and in the spring the subsoil is generally too wet to be pulverized; hence deep spring breaking is rather a disadvantage, especially for cotton.

The best seed bed requires well-drained land and plenty of vegetable matter in the soil. Our attention has been called to many cases where the land was so poorly drained that it was impossible to get into the field to work the crop for 10 to 15 days or more at a time. This gave grass, the arch enemy of a large cotton crop, a great advantage. Besides, under weevil conditions, it permitted the rapid increase of the pest. Working the soil two or three times before planting, with a section harrow, is of great advantage.

The next important point is the variety of cotton to be planted. It will not do to continue the too common policy of selecting gin-run seed or any variety only that it be cotton. It must be a variety of cotton that throws out its fruit limbs close to the ground and has short joints, because the short joint can grow in less time than the long joint. A plant that produces good bolls clear to the end of the limbs and can make a full crop of cotton on the lower half of the plant is what is desired. If the best results are to be achieved, it is not only unwise to take gin-run seed but even to depend upon seed selected in the general field. It is important that a special plat of land be set apart as a seed bed and from this every plant which does not meet the requirements should be destroyed, leaving only the best types from which to select seed. Care must be exercised in ginning the seed that it be not mixed with inferior varieties, and careful attention should be given to storing in a dry place and in such a way that it will not heat so as to weaken the germs.

The field should be planted with a somewhat wider space between the rows than in noninfested fields. The object of this is simply to allow more sunshine on the soil so as to assist in destroying the larvæ in the squares, as it is helpful to the weevil if the rows are so close that the limbs interlock, providing a shade which is ideal. Use intensive, shallow cultivation except on rich or alluvial soils, where the tendency of the plant is to grow too rank. Where this is the case, cultivate deep and close until the cotton begins to set squares freely, after which only shallow cultivation should be practiced.

The time of planting is important. Very early planting is deprecated because the crop is liable to be injured by frost or retarded by cool weather. Planting should, however, be delayed only until all danger of frost is past and the ground is warm, when germination

will be rapid and growth vigorous. The best time to plant will vary with the seasons, but is probably about the same under boll-weevil as non-boll-weevil conditions. Extremely early or extremely late planting is equally unsafe.

If the directions herein given are followed, more cotton per acre will be grown under boll-weevil conditions than is now produced and the boll-weevil problem will be practically solved.

It is easy to account for the causes of disaster when the boll weevil first invades a territory. In the main they are as follows:

The farmers neglect to inspect their fields and generally, as the invasion is in the fall, they do not observe the presence of the weevil until the second season. Then they use no preventive against its destructive effects, and by the end of that season the weevil is fully established and ready to do great damage. In most cases it is difficult to induce farmers to take effective measures until they have lost one or two crops. In the first year or two of the infestation if the farmers promise to follow instructions they mainly follow them only in part, whereas it requires an observance of all of them in order to insure the crop. We have repeatedly noted that it is about the third year after we have commenced our demonstration work before the farmers accept all of our instructions and try to follow them closely.

The second cause noted is the lack of confidence, first, on the part of the farmer. If a man does not believe that he can accomplish a thing, it is about halfway toward not doing it at all. He loses force and energy. The second result of the loss of confidence is that the bankers and merchants withhold credits, and since much of the cotton crop is made upon the credit system the planter is crippled and prevented from planting as many acres as usual. The withholding of credits compels the farm laborers to seek employment elsewhere, so that there is an immense reduction in the area of land devoted to cotton and in the labor to handle the crop. This loss of confidence greatly encourages diversification—the production of the food supplies and especially crops that may bring a cash income.

The actual damage done by the boll weevil is always vastly overestimated, first, because all reduction in the cotton crop is charged to the weevil. Other pests are ignored; the unfavorable season is not mentioned; and conditions that prior to the advent of the weevil frequently reduced the cotton crop 50 per cent in certain States are forgotten and the crop of one year simply compared with another, and all credited to the invasion of the weevil. In some cases this loss of confidence and the general alarm which arises are more disastrous than the pest itself.

In the spring of 1904 the farmers' cooperative demonstration work was inaugurated in the State of Texas. The boll weevil had passed over the prairies of southwest Texas, and the people believed that, while the pest could be managed in prairie districts, as soon as it entered the rolling sandy loam timbered belts of eastern-central and eastern Texas it would not be possible to make cotton. I recall that in the county of Limestone, on the Houston & Texas Central Railroad, where conditions are as described, it was so fixed in the minds of the farmers that they could not make cotton that about one-half of the sandy loam farms were abandoned and a third of the stores in the villages closed. Prior to the advent of the weevil the county of Limestone produced normally from 50,000 to 54,000 bales of cotton.

In 1903 this fell to 17,039 bales. We took vigorous measures to alleviate the condition in that section, and in 1904 the crop was 41,902, and in 1906 Limestone County produced 72,320 bales of cotton. I recall distinctly the blood-stirring stories with regard to the weevil that they told at the commencement of our work in that section. One farmer rose in a large meeting and stated that it was impossible to fight the weevil—it was proof against everything that had been tried. He had put them in 95 per cent pure alcohol and held them an hour and three-quarters and they were only staggering drunk; he had sealed them in a tin can, thrown them on a brush heap and set it on fire; the solder melted and the red-hot weevils flew out and set his barn on fire. These are simply samples of the stories told about the weevil. As a matter of fact the actual damage done by the weevil doesn't begin to compare with that caused by the deterioration of soils in the cotton States. We have carefully compiled the yield per acre for the State of Texas by decades, commencing in 1867. From that date to 1873, inclusive, the yield of lint cotton in Texas was 234 pounds per acre. In the next decade it was 202.9 pounds; in the next decade—1884 to 1893, inclusive—it was 192.3 pounds. In the next decade, closing with the year 1903, it was 172.8 pounds. Thus, in the period named the reduction was nearly 3 pounds per acre annually less than in the first period, and so it continued to decline from 1 to 2 pounds per acre annually until 1903. At this time the weevil had invaded about one-half of the cotton area of Texas. In 1904 the farmers' cooperative demonstration work commenced, and we have statistics for six years, including 1909. The average production for those six years was 171.6 pounds per acre. Thus it is shown that the decline in cotton production in Texas for the past six years, when the weevil has been practically over the entire State most of the period, was only 1.2 pounds per acre, whereas according to the general deterioration in soils it should have been over 6 pounds, even if the weevil had not been present; while in the decade preceding, when most of the years the weevil had infested only a portion of the cotton area, the decrease was 19.5 pounds for the period. That is, the effective work of demonstration by the Bureau of Plant Industry not only offset the influence of the weevil, but very nearly counterbalanced the loss from the deterioration of soils.

The exclusive production of cotton has not been favorable to the prosperity of the South. The advent of the weevil has forced diversification and especially the home production of food supplies. Again, prior to weevil invasion the price of cotton was so fluctuating that the farmers either made a large crop and received a small price for it or made a small crop and rarely obtained its full value. The presence of the weevil has tended to steady the price of cotton, and a vote of thanks should be tendered to the weevil for its effective work in this direction.

On the other hand, it must not be considered that the invasion of the weevil is a trifling matter. It requires heroic work. It will not do to continue the practice of any little old slipshod method of making the crop. (1) The farmer must look to his drainage. (2) He must improve the preparation of his soil and practice the rotation of crops, feeding the soil by the addition of humus. (3) He must look to the selection and preservation of seed with greater care. (4)

He must become independent and self-supporting by the production of home supplies. (5) The system of advances must be relegated to a past era. (6) It will not do in future to simply allow a tenant to follow his own methods. There must be universal supervision, and everyone must work in accordance with a plan. Finally, all men must be encouraged to use more energy and become more thrifty.

The problems discussed are not doubtful in the result. A crop can be profitably made, except under conditions so extraordinary that there would be a crop failure even if there were no weevils. In sections of very heavy precipitation there may be such extraordinary rainfall at the pivotal time in making a crop that it will not be possible to get into the field and work the crop, and hence there may be a failure. But it is rare that there is not some time during the season in which a crop can be made. Therefore, let every man go into his field, even with the worst infestation of the weevil, and commence his work courageously and hopefully.

The following statements of yields, taken from a large number of certified crop reports received for the year 1910, will throw some light on the problem of making cotton under boll-weevil conditions. They prove what can be accomplished in a very unfavorable season by following the instructions of the United States Department of Agriculture. All the parties named are planters of the highest reliability and are making cotton in boll-weevil territory.

In estimating the results given it should be understood that very little commercial fertilizer is used in Louisiana and Texas, and hence these yields compare favorably with what was secured from the same farms prior to the invasion of the weevil.

K. W. Jackson, Livingston, Polk County, Tex.—One hundred and fifty acres planted to cotton in the Trinity bottoms, surrounded by heavy timber; no previous fall preparation of the soil; rubbish of the previous season allowed to remain on the land over winter; season very wet till July; lost the first planting, replanted the last of April; medium stand; picked up and burned the squares regularly and followed department instructions fully; made on the entire farm an average of 1,000 pounds of seed cotton per acre; from 8 acres on which department instructions were more carefully observed the yield was 1,600 pounds of seed cotton per acre.

R. A. Keaslur, Hallsville, Harrison County, Tex.—Eighty acres planted to cotton; sandy loam soil; adjacent to timber; followed department instructions; made 1,350 pounds per acre on the 80 acres.

L. M. Calhoun, Gilbert, Franklin Parish, La.—Eighty acres in cotton, worked strictly in accordance with the Government plan; alluvial land with plenty of near-by timber; all department instructions observed; produced seventy-nine 500-pound bales.

L. M. Calhoun, jr., Gilbert, Franklin Parish, La.—Ninety acres planted to cotton; alluvial lands with plenty of near-by timber; all instructions of the department carried out; 88 bales of cotton produced.

R. M. Ward, Gilbert, Franklin Parish, La.—The community has generally followed instructions and many have made as much as a bale of cotton per acre; lands alluvial, with plenty of timber.

F. L. Maxwell, Mound, Madison Parish, La.—One of the largest plantations in the State; lands alluvial; negro tenant labor; observed department instructions as carefully as possible with the labor employed; produced an average of 350 pounds of lint cotton per acre on 2,000 acres.

T. D. Gilbert & Co., Wisner, Franklin Parish, La.—One thousand acres planted to cotton; alluvial lands; timber adjacent; department plan carried out; averaged three-fourths of a bale per acre on the entire tract.

E. C. Bott, Calvin, Winn Parish, La.—Mainly a pine-timber section; on trial field under department instructions produced 1,000 pounds seed cotton per acre.

H. C. Clark, Logansport, De Soto Parish, La.—Hill lands; generally a sandy loam soil with timber environment; followed instructions; has made each year for the past three years not less than 1,000 pounds of seed cotton per acre.

G. W. Tull, Grand Cane, De Soto Parish, La.—Forty acres planted to cotton; hill land; sandy loam; surrounded with timber; observed department instructions; gathered 22 bales of cotton.

J. H. Nettersville, Newellton, Tensas Parish, La.—Alluvial lands; timber adjacent; followed department instructions; made 1,500 pounds cotton per acre on 9 acres; also made 300 bales of cotton on 550 acres on general crop by following department instructions as nearly as possible on so large an area.

B. W. Berry, Newellton, Tensas Parish, La.—Averaged 1,500 pounds seed cotton per acre on 5-acre special demonstration plat, and made 300 bales of cotton on 500 acres by following department instructions.

J. L. Buckles, Newellton, Tensas Parish, La.—Alluvial land; timber; made 24 bales of cotton on 35 acres; followed department instructions.

W. H. Ally, Newellton, Tensas Parish, La.—Followed instructions of the department; made 800 bales on 1,500 acres.

Fifteen demonstrators in Concordia and Catahoula Parishes, La., on sandy loam land, with heavy weevil infestation, made from 1,000 to 1,500 pounds of seed cotton per acre. These demonstration plats varied from 2 to 25 acres.

The value of picking up the squares is shown by the following:

J. P. Sempe, Frierson, De Soto Parish, La.—Red River land; 500 acres planted to cotton; would not pick up squares; did not cultivate well; about June 15, first poisoning, 3 pounds Paris green per acre; poisoned three times; made less than 100 bales on the 500 acres.

W. J. Hutchinson, Caspiana, Caddo Parish, La. (5 miles from J. P. Sempe).—Red River land; planted 1,500 acres in cotton; picked squares regularly; cultivated well; made half a bale of cotton per acre on the entire tract.

N. W. Katchings, Hazlehurst, Copiah County, Miss.—Pine-hill land; red clay subsoil; averaged 1,450 pounds seed cotton per acre on 5 acres, under boll-weevil infestation; followed department instructions closely.

J. Marwin Smith, Wesson, Copiah County, Miss.—Pine-hill land; red clay subsoil; followed department instructions and made 1,400 pounds seed cotton per acre on demonstration plat.

J. W. Patrick, Crystal Springs, Copiah County, Miss.—Good upland; red clay subsoil; made 1,500 pounds seed cotton per acre on his demonstration plat.

S. A. KNAPP,
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Approved:
G. H. POWELL,
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DECEMBER 5, 1910.

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