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# United States Department of Agriculture,

## DIVISION OF ENTOMOLOGY.

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### REMEDIAL WORK AGAINST THE MEXICAN COTTON-BOLL WEEVIL.

In the course of the investigations of the boll-weevil problem in southern Texas in the spring of 1896 by my first assistant, Mr. C. L. Marlatt, it was early discovered that the overwintered weevils were not only collecting on the volunteer cotton but were feeding to a noticeable extent on the expanding leaves and soft green stems of the new shoots. The possibility of destroying the beetles by wetting this new growth by an arsenical poison at once suggested itself, and experiments which were promptly instituted with confined beetles on small plants demonstrated conclusively that not only do the beetles feed on the leaves and tender shoots voraciously, but that by poisoning such shoots the beetles subjected to experiments could all be killed in the course of 8 to 12 hours.

A more general experiment to test the value of poisoning was instituted in a field containing much volunteer cotton which had already (April 26) made considerable growth, forming rather dense bushes. This experiment was carried out on the farm of Judge Borden, of Sharpsburg, the plants being sprayed from an ordinary wagon cart. Great difficulty was experienced in wetting more than the outer leaves, which were now of large size and protected much of the inner growth, especially the squares. The outcome of this work demonstrated that while the poisoning of the cotton plant was thoroughly feasible and practicable when done at the right season and would result in the killing of the overwintered weevils, if delayed too long it was very unsatisfactory and promised very little of value. In other words, it is much more difficult to poison plants successfully as a means of destroying the weevil than to poison them for the cotton-leaf worm, which feeds very often if not generally on the outer leaves and can be reached by powder dusted over the plant in the most careless and general way. The weevil, on the other hand, feeding as it does on the tender growing tips and on the flower buds, which are very often concealed and covered up by the larger leaves of older growth, requires for its destruction very careful and thorough spraying, such as would be impossible after either volunteer or planted cotton has reached any considerable size.

As a means, however, of destroying the overwintered weevils on volunteer cotton, a spraying of poison in April promised very valuable results, and a recommendation for such treatment was inserted in the last edition of the boll-weevil circular (Circular No. 18, second series), as follows:

The beetles which have survived the winter collect in the early spring on the first sprouts which appear on old cotton and eat the partially expanded leaves and the tender leaf stems, and at this stage can be poisoned by the application of an arsenical to this new growth. To do this it will be necessary to thoroughly spray the growing tips, and this should be done when volunteer cotton is very small, preferably mere sprouts or bunches of leaves an inch or two in length; later on the growing parts can not be easily reached. With an ordinary knapsack pump a field may be gone over rapidly and the volunteer cotton thoroughly treated, the nozzle being directed at each growing tip. The first application should be made as soon as the volunteer plants sprout, and perhaps repeated two or three times within as many weeks. As ordinarily cultivated, the number of volunteers is small and the time required for the thorough spraying of such plants will not be great. A strong solution should be applied, viz, 1 pound of the poison to 50 gallons of water, because no harm will be done if the volunteer plants are ultimately killed by the poison.

The use of poisons, either London purple or Paris green, as described in the paragraph quoted, is thoroughly practicable and undoubtedly will be of value. The careful study, however, of the weevil damage in Texas conducted by the Division during the last three or four years has demonstrated that the prevention of weevil damage is more a question of the adoption of a proper system of cultivation than of remedial or preventive schemes, such as the use of poisons. In other words, it is admitted by intelligent planters everywhere that the presence of the weevil is made possible by a system of culture which admits of the existence of volunteer cotton, and if the methods followed are such as to prevent such volunteer growth the weevil will rarely if ever be troublesome.

In our publications on this insect, therefore, great stress has been given to the cultural method of control, which is undoubtedly the one thoroughly effective means of avoiding loss from the boll weevil. The details of this method are repeated at the close of this circular.

Unfortunately a great deal of the cotton culture in Texas is of the rather careless sort, and there probably always will be more or less volunteer cotton in fields unless very stringent regulations are passed and great care is taken to see that these are strictly enforced. The poisoning of volunteer cotton in early spring remains, therefore, a procedure of importance and of considerable practical utility.

The present season attention has again been directed to this or a very similar method of control, in the course of the investigation of the weevil conditions in Texas by Professor Townsend, a field agent of the Division. In the course of this work it was discovered that

the weevils seemed to have a marked fondness for sweets, such as molasses, and would eat the latter when smeared on cotton stalks or young shoots either with or without an admixture of arsenic. After eating the poisoned sweets the beetles died within 8 to 24 hours. After some weeks of experimentation in the field, chiefly at Cuero, Tex., Professor Townsend recommends and indorses very heartily two formulas, one for the treatment of young planted cotton and the other for the destruction of the overwintered beetles on the volunteer.

#### FORMULA FOR VOLUNTEER COTTON.

The undiluted molasses is mixed with one-fourth its volume of arsenic and applied to the volunteer stalks in spring when the leaves are beginning to appear. The molasses must be kept well stirred to prevent the arsenic from settling, and may be smeared on the stalks of the volunteer cotton with a stick or brush. All untreated plants must be killed and only a few poisoned plants should be left to the acre. This applies to districts where the foliage of the cotton is killed in winter. In warmer districts, where the foliage is not always killed in winter, all but a few of the plants should be killed and uprooted, and the remainder smeared with the poisoned molasses, all squares and bolls having been removed to insure the quickest effect. It is believed that the weevils will be attracted to these poisoned plants by the molasses and will be killed, and this will obviate the necessity of treating the young planted cotton.

#### FORMULA FOR PLANTED COTTON.

White arsenic (arsenious acid)  $1\frac{3}{4}$  to 2 ounces boiled in a gallon of water until thoroughly dissolved; two or three gallons of the cheapest grade of molasses, and one barrel (40 gallons) of water. Stir the molasses into the water, then add the dissolved arsenic and mix the whole thoroughly. Apply to the plant with a force pump and spray nozzle as in spraying for the cotton-leaf worm.

This mixture is designed for use particularly on young cotton plants, and may also be used for the poisoning of volunteer cotton with a knapsack sprayer or larger apparatus, as described in the quotation from Circular 18. The only advantage of the sweetened or sirupy wash over Paris green, London purple, or arsenite of copper, as ordinarily used, is in its being supposed to attract the weevil; so that, even although the entire plant might not be wetted with the mixture, the weevil would be attracted by the sweetened bait to the parts struck by the liquid.

It should be remembered that the white arsenic recommended is very caustic and is very much more apt to burn or scald plants than are the other arsenicals just mentioned, and it is quite probable that either London purple or arsenite of copper, which are of about the same cost as white arsenic, will be preferable to the latter.

The cheap grade of molasses referred to can be laid down in Texas at a rate of 10 cents per gallon. White arsenic costs about 10 cents a pound retail, but wholesale can be obtained for much less. London purple and Paris green also cost about 10 cents a pound retail. A barrel of the mixture at the prices quoted will cost about 25 cents, and should spray an acre or more of young planted cotton. The much heavier mixture for volunteer cotton is used in very limited quantities and a small amount will cover a large area. The directions and cautions given at the outset for spraying for the boll weevil are equally applicable to the molasses and arsenic wash described. For field work, however, a large machine is necessary, such as the mounted horse spray machines commonly used for treatment of potato farms.

It should be remembered that this treatment rests merely on some preliminary experiments made with confined weevils on poisoned plants, and its success on a large scale remains to be demonstrated. Its greatest value will come, undoubtedly, in the treatment of volunteer plants and young planted cotton, and its success with the latter will, undoubtedly, diminish as soon as the plants have formed a head or become at all bushy. It is given publicity by means of this circular, to get planters to test it fully in field trials, which alone will demonstrate its value or worthlessness.

#### THE CULTURAL METHOD OF CONTROLLING THE BOLL WEEVIL.

It should be remembered that the poisoning of the volunteer and also of the young planted cotton is suggested merely as a means of correcting a condition which has resulted from imperfect cultivation, and that the great value of the cultural method of control should not be lost sight of.

The description of this method given in our last circular on the boll weevil is as follows:

The careful investigation of this weevil during the past two or three years by the Division of Entomology has fully demonstrated the supreme importance of the cultural method of control, to which fact we gave special prominence in our first circular on this insect. There can be no question now that in the proper system of growing cotton a practically complete remedy for the weevil exists. In the first place, it has been established beyond question that the conditions of cultivation which make volunteer growth possible also make the continuance



of the weevil inevitable. Of first importance is the early removal of the old cotton in the fall, preferably in November or earlier. This can be done by throwing out the old plants with a plow, root and all, and afterwards raking them together and burning them. This treatment should be followed, as promptly as may be, by deep plowing, say to a depth of 6 or 8 inches. This leaves the field comparatively clean of old cotton stalks, facilitates thorough cultivation the following year, and, at the same time, collects and destroys all the weevil larvæ and pupæ in the cotton at the time, and also most of the adults. The escaping beetles will be buried by deep plowing, and will not again reach the surface. Few, if any, of them will succeed in hibernating in the absence of the ordinary rubbish in the fields in which they winter. Fields treated in this way have given a practical demonstration of the usefulness of the method.

The greatest danger from the weevil is due to the presence of volunteer cotton, which means early food for the weevils in the spring and abundant means for their overwintering, and the effort made to retain volunteer and get early cotton, or the "first bale," is a very serious menace to cotton culture within the weevil district.

This cultural method, if generally practiced, will undoubtedly prove a perfect remedy for upland cotton, and will vastly reduce weevil damage in the lowlands, where the weevil is more apt to winter, perhaps in adjoining woods or roadside vegetation. The early removal of cotton by the means suggested is especially advised whenever the presence of the weevil shows that the picking of a top crop is problematical. In such instances it would be well to uproot and destroy cotton stalks in September or October, as would have been thoroughly feasible for much of the upland cotton in 1896. If this cultural method can be enforced, either by State legislation or by the cooperation and insistence on the part of landowners that their renters shall carry out the system outlined, the weevil difficulty can undoubtedly in very large measure be overcome.

In connection with the system of fall treatment of the cotton, constant and thorough cultivation of the growing crop as late as possible is of considerable value, and is also what should be done to insure a good yield. With a crossbar to brush the plants many of the blossoms and squares containing weevils will be jarred to the ground and buried, together with those already on the ground, in moist soil, and a large percentage of the material will rot before the contained insects have developed.

Somewhat in line with the last paragraph is the collection and destruction of the infested bolls and weevils from the plants themselves. A complex machine has been devised for this purpose by Mr. Stronhall, of Beeville, Tex. In operation this apparatus passes over one row at a time and brushes the plants from both directions vigorously by means of revolving brushes working in opposite directions, and the stung bolls and squares which fall readily are caught on receiving trays and carried to bags and may be ultimately burned or otherwise destroyed. The machine may be adjusted to plants of different ages within certain limits, but becomes less effective as the plants get larger. As witnessed in operation the present season by Mr. Townsend, it proved, on young plants, to be very effective and satisfactory, collecting a large percentage of the weevils and the stung bolls and

squares. The temporary advantage of the use of this machine no doubt will be considerable and may materially protect the early cotton; it probably will not be of much service as a protection for late cotton or the second crop.

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*Entomologist.*

Approved:

JAMES WILSON,  
*Secretary.*

WASHINGTON, D. C., *July 1, 1898.*

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