

Connecticut Agricultural Experiment Station
New Haven

INSECTICIDES TO CONTROL
THE EUROPEAN CORN BORER

NEELY TURNER



Applying spray to the main whorl of the corn plant.
Second application. (U.S.D.A. Photo)

FOR SEVERAL years Dr. C. H. Batchelder of the Division of Cereal and Forage Insect Investigations, United States Bureau of Entomology and Plant Quarantine, has directed experiments to develop insecticides to control the European corn borer, *Pyrausta nubilalis* Hubn. These experiments have been conducted on sweet corn in Massachusetts,

Rhode Island and Connecticut. In 1935 the Connecticut Agricultural Experiment Station coöperated with the Federal Bureau in carrying out an extensive series of tests of insecticides in Connecticut. The results of this coöperative project have been prepared for publication as a Station bulletin which will contain technical descriptions of the experiments and detailed results.

The present circular has been prepared from the manuscript of the bulletin to bring the practical results of the work to Connecticut corn growers. It should be clearly understood that the materials and methods described here are the work of the Federal Bureau of Entomology, and that insecticidal control of the European corn borer is still in the experimental stage.

LIFE HISTORY OF THE CORN BORER

The European corn borer passes the winter in the larval stage entirely within its burrows, mainly in corn plants, but also in the stalks of dahlias and other flowers and in certain weeds. During the last half of May the larvae transform to pupae, and the mature moths emerge late in the month of May and during the first half of June. Eggs are deposited in large masses on the undersides of leaves of corn and certain other plants in June. On corn, the hatching larvae may feed for a short time on the leaves, but later migrate to the main stems. They then feed in the spaces between the leaf sheaths and the stalks, especially in the developing whorls of the main plants and tillers. As the larvae develop, they soon become borers and enter the stalks or the young ears. They mature in July and moths emerge after pupation to deposit eggs.

The second generation develops during August and September and the larvae may cause severe injury to corn maturing at that time. The full-grown larvae live over the winter in their burrows in the stalks and ears.

MECHANICAL CONTROL

The only control measures that have been recommended provide for the proper disposal of the stalks and ears to destroy the borers in them. These are:

1. Cut the stalks close to the ground and feed to live stock or put in silo.
2. Plow under cleanly at least 6 inches deep.
3. Cut the stalks close to the ground and burn them, together with the larger weeds.
4. Place infested ears in screened cribs to prevent escape of the moths.

CONTROL WITH INSECTICIDE APPLICATIONS

The use of insecticides to control the corn borer is based on the fact that the young larvae feed for some time in the spaces between the leaf sheaths and stalks. If these spaces are kept filled with toxic material, a large percentage of the larvae can be killed. This requires several applications of spray materials during the time that larvae are hatching. The most practical way to accomplish this is to apply the sprays to the growing whorls of the main stalks and of each tiller, starting immediately when the first eggs hatch and repeating at five-day-intervals for about

two weeks. At the time of the last application, the spray should be applied to the developing ears to prevent entry by migrating larvae.

This system of application has been used successfully in the experiments. In normal seasons sprays are required about June 5, 10, 15 and 20. In 1935 the borers were retarded by cool weather, and the first spray was required on June 15.

MATERIALS FOR SPRAYS

Of the materials tested, two have proved to be outstanding and a third only slightly less effective. Pure ground derris root (4 per cent rotenone) and phenothiazine (thio-diphenyl-amine), used in suspension at the rate of 2 pounds in 50 gallons of water, with a suitable spreader were very effective. Sprayed plots produced 85 per cent borer-free ears, while adjoining unsprayed plots produced only 36 per cent borer-free ears. Tank-mixed nicotine tannate was somewhat less effective, and about 77 per cent of the ears from sprayed plants were free from borers. In terms of yield, unsprayed corn produced about 5,500, and sprayed corn from 12,000 to 14,000 borer-free, number one ears.

SPREADERS

One of the greatest difficulties in the development of a corn borer spray has been the selection of a suitable spreader. Several very promising materials have been tested, among them some compounds which are not as yet on the market. Three available materials have proved to be satisfactory and have not injured corn plants in the amounts used up to the present. These are *IN 181*, a sulfated alcohol; *Areskap*, a phenyl-phenol preparation; and *SS-3*, a sulfated alcohol combined with a resinous sticker. The first two are dry powders, and the last a self-emulsifying liquid.

Formulae

The following are formulae of the materials mentioned above:

1. Water	25 gal.
Spreader (select one)	
<i>IN 181</i>	1.5 oz. (avoirdupois)
<i>Areskap</i>	1.5 oz. "
<i>SS-3</i>	2.5 liquid oz.
Pure ground derris root	1 lb.
2. Water	25 gal.
Spreader (select one)	
<i>IN 181</i>	1.5 oz. (avoirdupois)
<i>Areskap</i>	1.5 oz. "
<i>SS-3</i>	2.5 liquid oz.
Phenothiazine	1 lb.
3. Water	25 gal.
Spreader (select one)	
<i>IN 181</i>	1.5 oz. (avoirdupois)
<i>Areskap</i>	1.5 oz. "
<i>SS-3</i>	2.5 liquid oz.
Liquid tannin	12 "
50% free nicotine	4 " "

In all cases the ingredients should be mixed in the order given. Dry ingredients should be mixed with a small amount of the water before being added. **It is very important that the exact amounts be used.** Any changes in the formulae may cause injury to corn plants.

METHOD OF APPLICATION

The only practical sprayer used to date has been a hand sprayer, either a knapsack type or a small compressed air sprayer. The spray mixture is prepared in a barrel and poured through a fine screen into the hand sprayers. If an acre or more of corn is to be treated, at least three sprayers with operators should be available. A two-foot rod with an "auto-pop" valve has been most practical. In making the application, enough material is used on each whorl, whether main stalk or tiller, to wet the developing leaves thoroughly.

The total cost of spraying an acre of corn, including both materials and labor, has been estimated at \$15, but may be slightly higher, depending on the rate of pay and the efficiency of the labor.

WHAT CORN CAN BE SPRAYED PROFITABLY?

To date only first early sweet corn, maturing in July, has been sprayed profitably. As a rule corn maturing during August and September brings too low a price and is too lightly infested for profitable spraying. Nevertheless some may wish to try it in the home garden. In 1935 four sprays were required to control the second generation borers. These were applied on August 11, 16, 21 and 28. The dates will probably vary in different seasons.

Growers who have had heavy infestations of corn borers in the past may use sprays profitably. In some sections of the State, the losses have been small and spraying is unnecessary at present.

It is suggested that growers who want to try these sprays use them conservatively the first season. Since the methods are new and careful work is required to obtain satisfactory results, it would be advisable to spray only a portion of the entire crop. The corn treated should not exceed the amount that can be sprayed in two days with the equipment and labor available. The crop from the sprayed block can be compared with the crop from unsprayed corn and should show the grower whether or not the spraying is practical and profitable.

These sprays will not affect the corn ear worm.