

Connecticut Agricultural Experiment Station
New Haven

Control of the European Corn Borer by Sprays and Dusts

NEELY TURNER



FIGURE 1. Self-propelled power duster operating in a field of corn in the evening. Note the headlight, and mask to protect the operator from breathing dust.

HIGHLY profitable increases in yield of borer-free early sweet corn have been produced by applying dual-fixed nicotine dust four times at intervals of five days in experiments conducted on a commercial scale. In 1940, Market Hybrid sweet corn was planted about April 15, and was dusted June 11, 16, 21 and 28 (the last treatment was delayed two days by rain). A two-row, self-propelled power duster was used for all applications. The dust cost \$35.00 an acre, labor \$2.00 (at 50 cents an hour) and the use of the machine

\$4.50, or the total expense was \$41.50. The dusted corn, harvested July 18 to 24, yielded 6,910 borer-free ears to the acre and 3,450 infested ears which could be marketed. The entire crop, both infested and borer-free, was sold on the farmers' market for \$350. Corn not dusted (from the same field) brought less than \$100 an acre for 2,600 borer-free ears and produced about 7,500 infested ears which could not be sold.

The corn was sorted immediately after picking and graded as "borer-free" or "infested". Borer-free ears had no signs of borer feeding and brought \$3.50 to \$4.00 a hundred ears on the farmers' market. Infested ears from the dusted field sold for \$2.50 to \$3.00 a hundred ears. The cost of sorting was about the same as the cost of picking.

In 1941, the same variety of corn was planted April 12, and dusted June 4, 7, 12, 18 and 23. Immediately following the first, or June 4 application, a heavy rain fell, making it necessary to repeat the treatment. The cost of the operation was: Dust for the five treatments, \$35.70; labor \$2.50 (at 50 cents an hour); and the use of the machine, \$4.50; or a total of \$42.70. The dusted corn produced 11,050 saleable ears which sold for \$279.00 on the farmers' market. Corn was marketed from July 8 to 11 and the price was \$2.75 to \$3.00 a hundred ears for unsorted corn. The acre of corn not dusted produced only 2,800 borer-free ears which sold for \$77.50. The infested ears were not sold.

A careful examination of the dusted corn showed that it was 70 percent borer-free, while the untreated corn was only 26 percent borer-free.

In both seasons the experiments were carried out on approximately an acre of corn and the entire operation conducted on a commercial basis. The corn was sold by the grower and the prices given are actual cash payments on the farmers' market and not sales to stores or at retail. It is believed, therefore, that these experiments establish the fact that commercial treatment of early corn to control the European corn borer is both practical and profitable.

SEASONAL HISTORY OF THE CORN BORER ON CORN

Control measures for the European corn borer¹ are based on important facts concerning the life history and habits of the insect. The seasonal history is as follows: The mature larvae pass the winter within their burrows in the stalks. During the last half of May, these larvae transform to pupae, and the moths emerge late in May and during the first half of June. The eggs are deposited in masses on the undersides of the lower leaves of the corn plants. The young larvae hatch within a week or 10 days and may feed for a short time on the leaves, but soon migrate to the main stems. There they feed in the spaces between the leaves in the developing whorls of the main stem and the tillers. A few larvae may feed in the space between the leaf sheaths and the stalks.

¹*Pyrausta nubilalis* Hubn.

As the plant develops, the tassel forms and emerges, and the larvae feed in the tassel buds and stalk. Later they migrate down to the main stalk and to the ear shoots. Larvae that hatch after the tassel has formed enter developing ear shoots or leaf sheaths.

The period of egg hatching lasts from about June 5 to July 1 in normal seasons.

The larvae become fully grown in July, pupate at once, and emerge as moths during the last half of July and all of August. They fly to fields of late corn, and infest the plants as described above. The second generation larvae appear early in August and are present until late in September. They pass the winter in this stage.

CONTROL BY APPLICATION OF INSECTICIDES

The use of sprays and dusts to control the European corn borer on sweet corn depends upon the fact that the young larvae feed for some time between the leaves in the growing whorl and in the ear shoot as stated above. If the spaces between these leaves are kept filled with toxic material, a large percentage of the larvae may be killed. Repeated applications are necessary because sprays or dusts applied in the whorl stay on the developing leaves, which grow out and away from the whorl. The new leaves formed in the center are, therefore, not covered. As a rule, four applications of sprays or dusts are necessary during the time that larvae are hatching. These are applied to the growing whorls of the main stalks, starting soon after the first eggs hatch and repeating the treatment four times at five-day intervals. At the time of the first application the earliest corn is usually about 15 to 18 inches high, and the final treatment is made when the corn is in full tassel.

Later corn, that may be 6 or 8 inches high when the first eggs hatch, does not require treatment until it is about 15 inches high.

CONTROL MATERIALS

Dusts

Dual-fixed nicotine dust (developed by Dr. C. H. Batchelder of the Federal Bureau of Entomology and Plant Quarantine) has been the most effective dust material used in our experiments. *This is not the same nicotine dust that has been used for control of aphids and should not be confused with it.*

Dusting has been done successfully both by hand and by machine. In either case the first two applications on early corn (about June 10 and 15) are made with nozzles directed downwards into the whorls of the plants. The last two applications (about June 20 and 25) are made on the developing ears. From 150 to 200 pounds of dust are required for the four applications on one acre.

Most power dusters at all suitable for dusting corn have two nozzles for each row. Normally both nozzles should be adjusted to deliver the dust straight down into the plants for the first two appli-

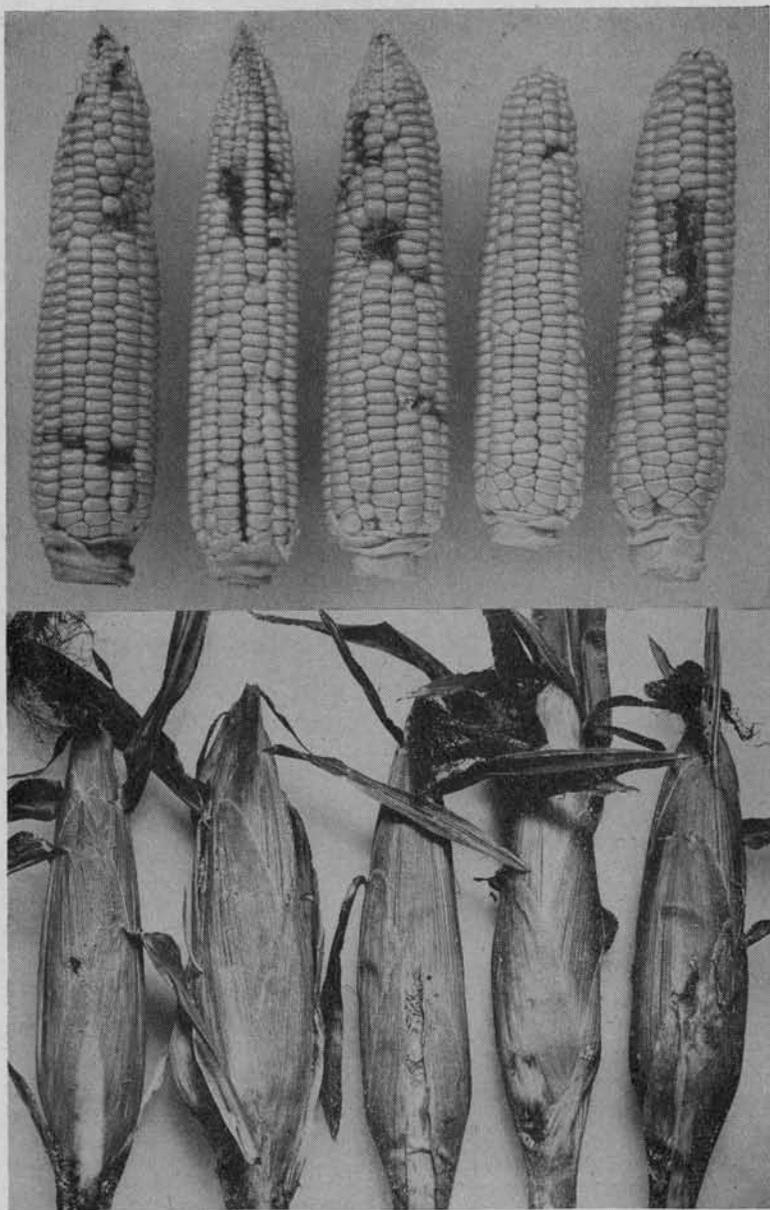


FIGURE 2. Sample of corn taken from untreated plots July 17, 1939. Ears as picked, below; as husked, above. The field averaged only 13 percent borer-free ears and 25 percent marketable ears.

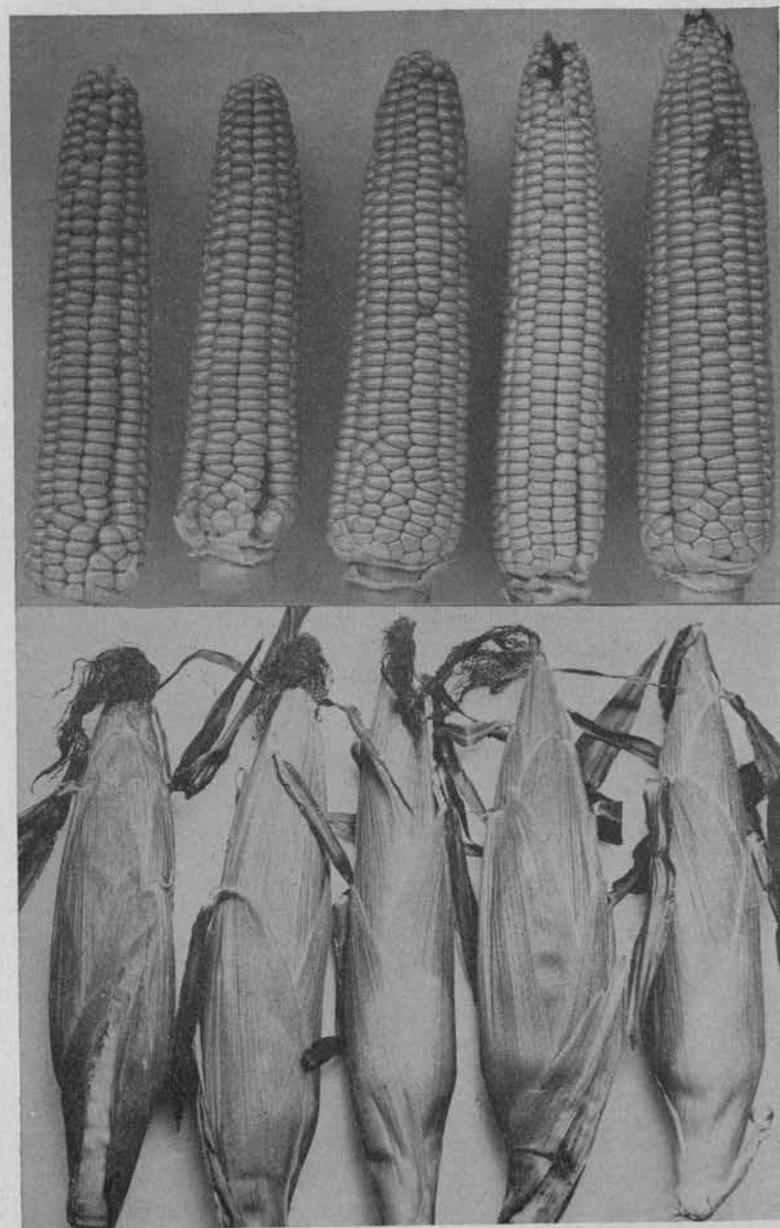


FIGURE 3. Sample of corn taken from dusted plots, the row adjoining the untreated plot sampled and illustrated on the opposite page. The ears were 50 percent borer-free and 65 percent marketable in the dusted field. Note the small amount of damage to the infested ears.

cations. The last two treatments require ear shoot and ear treatment. Best results have been obtained with the nozzles set about a foot away from either side of the row, with dust delivery slightly downwards and hitting the plants about a foot behind the nozzles.

Dusts containing one percent rotenone have been used in several experiments. Invariably the control obtained was substantially less and the percentage of borer-free ears much smaller than with dual-fixed nicotine dust. As a rule, rotenone dusts produce about 50 percent borer-free ears, and dual-fixed nicotine from 66 percent to 75 percent borer-free ears.

Sprays

The use of derris, cubé or timbo ground roots (4 percent rotenone content) in sprays has provided control as satisfactory as that of dual-fixed nicotine dust. Any of these three materials may be used at the rate of one pound in 25 gallons of water. The spraying is done on the same dates and in a similar manner as described above for dusting. The cost of spraying is somewhat less than the cost of dusting.

Compressed air hand sprayers and wheelbarrow hand sprayers have been used in spraying corn.

Sprays versus Dusts

In effectiveness there is little choice between sprays and dusts. In dry years, sprays are somewhat better than dusts, and in wet years the reverse is true. A good hand duster is about the same price as a wheelbarrow sprayer. One man with a duster can treat one acre of corn in about four or five hours. Two men working with either knapsack or wheelbarrow sprayers can treat an acre in five or six hours.

Figures from large-scale spraying operations show that two men worked 32 hours in spraying an acre of corn with a wheelbarrow sprayer (including hauling of water and cleaning the sprayer). The material, 16 pounds of pure ground derris root in 400 gallons of diluted spray, cost about \$4.80. Figuring the use of the sprayer (cost \$30) at \$1.50 and labor at 50 cents an hour, the total was \$38.50. Thus spraying is somewhat less expensive than dusting and even more so if labor is less than 50 cents an hour.

Dusting must be done in the early morning or late evening when there is little wind. Spraying can be done at any hour.

Transportation of water to the field and weighing and mixing of spray materials are avoided by dusting.

Inexpensive, self-propelled power dusters are on the market and can be used effectively not only on corn but also on beans, celery, tomatoes, melons and cucumbers. This machine will dust an acre of corn in about an hour.

No self-propelled sprayers suitable for small fields of corn are available at present.

A few growers have used large-row crop sprayers on comparatively large fields of early corn. With proper nozzle adjustment (as outlined under *Dusts* above) such sprayers should be satisfactory. However, in some seasons the corn is too tall for this type of machine when the final application should be made. Some modification in planting may be made, such as omitting two rows at intervals for passage of the sprayer.

WHAT CORN CAN BE TREATED PROFITABLY?

First early sweet corn, maturing in normal seasons before August 1, has been treated profitably in several parts of the State. As a rule, corn picked during August is reasonably free from corn borers, and even if it is lightly infested, it is less expensive to sort out the few infested ears than to dust or spray. September corn is usually heavily infested, but the price is sometimes too low to justify the use of sprays or dusts. If late corn is to be treated, the same methods as described above may be used, with the dates of application about August 5, 12, 19 and 26.

Great variation in the corn borer infestation may be expected in different parts of the State. Some areas are now and always will be more heavily infested than others. The lowlands along the shore and the larger river valleys have had much more severe infestations than the highlands in the interior. In general it has been more profitable to control the corn borer in the heavily infested areas than in the lightly infested fields.

Furthermore, differences in planting dates of corn affect the infestation markedly. Results published previously¹ showed that in each of the three years the experiment was conducted there was a sharp difference in infestation of corn ears at certain planting dates. In 1935, early corn planted May 2 was picked July 26 to August 1 with 63 percent of the ears infested. The planting made May 11 was picked July 26 to August 5 and was 35 percent infested, although its maturity overlapped the earlier planting. The same type of results was recorded for plantings on similar dates in 1936 and 1937.

As a rule the first native corn on the market brings a higher price than that sold a week or two later. This same early corn is most likely to be heavily infested by the corn borer. Profits from successful corn borer control are largest on this first early corn. However, there is every reason to believe that control should be profitable as long as borer-free corn can be sold for \$2.50 a hundred ears and undusted corn is as much as 40 percent infested by corn borers.

In the final analysis each grower will have to decide whether or not dusting or spraying sweet corn is profitable. It is suggested that a part of any field to be treated be left untreated so that an accurate comparison of results can be made.

SOME SUGGESTIONS REGARDING TREATMENT

Early sweet corn has been so heavily infested by the European corn borer in Connecticut that there is little use in planting this crop unless it is to be sprayed or dusted.

Since dusting or spraying corn is an entirely new problem to most growers, it would be advisable to try it on a small scale the first season. Even one-half acre, treated properly, with a few rows left untreated for comparison, is more satisfactory than five acres dusted or sprayed only once or twice.

In all field plot and large-scale experiments, dusts and sprays have been repeated if as much as one-half inch of rain fell during the first 24 hours after treatment. In no season were more than five applications used, and the fifth application was necessary only twice in six seasons.

Corn planted in rows with the plants approximately one foot apart can be sprayed or dusted much more effectively than if it is planted in hills of three or four stalks. Machine treatment of hilled corn is especially wasteful of material and cannot be highly effective.

It seems necessary to sort treated corn to obtain full financial returns from the crop. While this is a new idea, it must be remembered that apples, peaches, potatoes, carrots, beets, and tomatoes are sorted before marketing.

The early hybrid varieties of corn are more suitable for treatment because they grow more uniformly and produce larger yields to the acre than the open pollinated varieties.

Inexpensive dust masks are available to protect the operator from inhaling any dust.

Dusting has been done between daylight and 9:00 a. m. (Standard time) and between 8:00 p. m. and 11:00 p. m. (by use of lights) with equal effectiveness. The corn plants are dry in the evening, and there is less discomfort to the operator.

The seasonal life history of the corn borer varies with weather conditions. Exact dates of applications in any one year may be obtained from the County Farm Bureaus or Extension Service.

NOTES FOR HOME GARDENERS

Control obtained by commercial methods results in about 75 percent borer-free ears. This means that 7 or 8 of every 10 ears picked have no borers. In years with extremely heavy infestations as few as 6 out of every 10 ears picked may be borer-free.

A succession of plantings of corn requires special treatment. It is suggested that any corn 15 inches high on June 10 be treated June 10, 15, 20 and 25. As late plantings reach this height, treatment can be started, but in no case is application of dusts or sprays after June 30 likely to be needed.

If corn is planted near lettuce, cabbage or other leafy crops, the spray of pure ground derris root may be preferable to dual-fixed nicotine dust.

Dusts containing rotenone, which are used for many vegetable pests, may be substituted for dual-fixed nicotine dust in the home garden. Rotenone dusts are more easily obtained in some urban areas and will provide considerable protection from the corn borer.