Controlling CORN BORERS in SWEET CORN

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-clearance, self-propelled sprayer
Spraying for second-generation corn borers.

Circular 773

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COLLEGE OF AGRICULTURE
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IN AGRICULTURE AND
HOME ECONOMICS
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NATURAL HISTORY
SURVEY
EUROPEAN CORN BORER has become one of the most important insect pests of sweet corn and is usually very destructive to the crop. To get good control, a grower needs to know how the growth of the corn plant is related to survival of the borer and to the application of insecticides. Though the use of insecticides is very important, it is only one of several measures in a well-rounded control program.

The corn borer and the corn earworm are commonly found feeding on the same corn plant. For this reason, in a discussion of control measures for corn borer, occasional reference to the corn earworm will be necessary as some of the recommendations apply equally to both insects. For additional information on the life history of the corn borer and corn earworm, see Illinois Circulars 637 and 739.

CONTROL ON CANNING CORN

Planting schedule

From the standpoint of insect control, the ideal planting schedule for Illinois canners would permit all corn to be harvested from August 1 to September 1. Corn borers and corn earworms are easier to control on most yellow varieties. Therefore Country Gentleman corn should be planted when it will receive fewer of these insects' eggs. In Illinois it is an advantage to begin planting Country Gentleman early in the season and to complete plantings by May 20.

An ideal planting schedule for yellow and white corn falls into three distinct parts — planting some yellow corn early enough to be harvested first, then planting Country Gentleman, and then planting yellow corn for harvest late in the packing season. Whenever possible, follow these suggested planting schedules as closely as production policies will permit.

How to get a tassel ratio

The mortality rate of borers hatched out on small, young corn plants is very high. The closer the stalk is to coming into tassel, the higher the number of borers that live. The reason for this difference in mortality is due to morphological and chemical changes within the corn plant. For practical purposes, therefore, newly hatched borers on young corn can be ignored. But in later stages of plant development, every egg mass on a plant is important. Growers will need to consider these facts when evaluating the need for control.

To help growers decide what fields to treat and when to time the treatment, Illinois entomologists developed a simple and accurate method of measuring the development of the corn plant in relation
Broken line (top) shows height of plant when longest leaf is pulled upward. To get plant height, measure from base of stalk to tip of longest leaf when pulled upward. Broken line (bottom) shows tassel height. To get this height, slit the stalk lengthwise and measure as shown.

to survival of borers. This method is based on the growth of the tassel and is called the tassel-ratio index. This ratio compares the height of the developing tassel inside the plant to the extended height of the plant. To get the ratio, cut the stalk off at the base where the main roots join the stalk. Measure the stalk from the base to the tip of the longest leaf when it is extended upward. (See Fig.) Then slit the plant lengthwise to expose the developing tassel and measure from the base of the stalk to the very tip of the tassel. Now divide the height of the tassel by the height of the plant and multiply by 100. The answer is the tassel ratio. For example, suppose the height of the plant is 45 inches and the height of the tassel is 9 inches. Nine divided by 45 is .2 and when multiplied by 100 gives a tassel ratio of 20.

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\frac{9 \text{ inches}}{45 \text{ inches}} = .2 \quad \text{.2} \times 100 = 20
\]

All the plants in a field will not have the same tassel ratio at the same time. However, taking the average of 5 to 10 representative plants gives a very accurate index.

A corn plant does not have a measurable tassel for the first 30 days of growth. After this time, the tassel begins to grow and increases in length as it moves up the center of the plant. Very few borers hatching from eggs laid on corn with a tassel ratio of 0 to 20 will live. The number that survive increases from ratio 20 to 55
when most of the borers are feeding in the whorl and developing tassel of the plant. Fifty egg masses per 100 plants on corn with a ratio of 20 will produce many more borers than 500 egg masses per 100 plants on corn with a ratio of 2. Depending on the variety and soil fertility, tassels begin to emerge in sweet corn at ratio 55. By this time some of the borers are large and they have begun to leave the whorl to feed in the stalk. This is why treatments applied before a tassel ratio of 20 or after 55 are comparatively ineffective in Illinois.

What fields to treat for first-generation borers

Shortly after first-generation moths appear in the community, begin regular examination of the first 4 to 6 plantings, taking a tassel ratio each time. As fields reach a tassel ratio of 20 and above, get the tassel ratio and egg mass counts in every field, or at least in representative fields of each day's planting. These records will be the guide in determining the number of fields or days of plantings to be treated. All fields with a tassel ratio of 20 or above and with 20 or more unhatched egg masses per 100 plants will need to be treated. In general, when all first-generation eggs have hatched, those fields with a tassel ratio of less than 20 will not need treatment.

When to treat for first-generation borers

Make the first application of insecticide sometime between tassel ratio 40 and 50. If many fields are involved, begin treatments when the first fields reach ratio 40 and continue so that all fields are treated once before they reach ratio 50. Apply a second treatment 5 days after the first if the field still has 20 or more unhatched egg masses per 100 plants.

Under exceptional conditions, egg laying may continue through the tasseling and silking period. When this happens, make additional treatments of DDT and oil as for second-generation borers until all eggs have hatched.

How to control second-generation borers

In Illinois, two generations of borers are usually produced each year. The intensity of the second generation, however, varies from year to year and depends on the population of the first generation and the weather. There are usually enough of the second-generation borers to cause sweet corn growers and canners serious concern. Tassel ratio cannot be used to time treatments for second-generation borers. For second-generation control, each canner needs a silking-date book for recording the date at which 75 percent of the ears in a field are in silk. This record is his basic tool in a control program, as
it gives rather accurate information on the number of days to harvest for each field. A field will generally be ready for canning whole kernel corn 21 days after 75 percent of the ears are in silk.

Soon after second-generation moths appear, begin examining representative fields that are 10 days or more from harvest. Examine them every day for egg masses. Concentrate greatest effort on fields that are silking, because the first eggs are usually laid on corn in this stage. As soon as you find hatched egg masses, classify all fields according to the number of days to harvest.

In years when second-generation borers are very plentiful, growers can classify all fields as soon as the first hatched egg masses are found in the area. It will not be necessary to examine every field. When second-generation borers are comparatively few, however, it will pay to examine every field regularly and to postpone classifying it until the first hatched egg mass is found in it. Treat any field with 20 or more unhatched egg masses per 100 plants if it will be 10 days or more to harvest. A system for determining what fields to treat and when to treat them is given below.

<table>
<thead>
<tr>
<th>Number of days to harvest at first hatched egg mass</th>
<th>Number of treatments</th>
<th>Time of treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 or less</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>1</td>
<td>At first egg hatch</td>
</tr>
<tr>
<td>15-19</td>
<td>2</td>
<td>At first egg hatch; second treatment, 4-5 days later</td>
</tr>
<tr>
<td>20-25</td>
<td>3</td>
<td>At first egg hatch; second treatment, 3-4 days later; third, 3-4 days after second</td>
</tr>
<tr>
<td>26 or more</td>
<td>4</td>
<td>At first egg hatch; second treatment when 20 percent of field is in silk; third, 3-4 days later; and fourth, 3-4 days after third</td>
</tr>
</tbody>
</table>

When populations of second-generation borers are low and corn earworms are not a serious problem, adequate control can be obtained with one treatment less than is indicated above on corn that will not be harvested for another 15 days or more.

A grower will need to make every effort to control both corn borer and corn earworm. A canning plant will have trouble processing corn having only 1 or 2 percent borer-damaged ears when there are lots of earworms and earworm-damaged ears. The spray schedule for corn earworm is essentially the same as for second-generation corn borer. The two programs must be integrated.
To get good control, keep the spray schedule up to date every day. Unfavorable weather, breakdowns, or lack of enough equipment may cause delays in the second-generation spray schedule. If any of these things occur, skip a few fields in order to keep to a rigid schedule in most of the fields. The skipped fields can be treated by airplane, although control of corn borer and particularly of earworm will be considerably less effective.

**What insecticides to use**

DDT has been the most widely used insecticide for controlling corn borers. It is highly effective, easy to get, and relatively inexpensive. It can be applied as a spray, a dust, or as granules. There is little difference between the effectiveness of ground applications of DDT sprays and granules and airplane applications of DDT granules. Air applications of DDT sprays and dusts are less effective than other methods.

Granules, a recent development in the manufacture and formulation of insecticides, look like small grains of sand. They are heavy enough to roll down the corn leaves into the whorl and leaf axils where many of the borers are. Although granular insecticides are attached to many inert materials, clays are the most common carriers. Mixtures of two or more types of clays in the same formulation are not recommended. For airplane and ground application, clay granules have received more testing than other types of granular formulations and appear to be the best types for corn borer control. Particles that will pass through a 30-mesh screen and be held by a 60-mesh have been most widely used.

*Recommended DDT formulations and rates of application for first-generation borers are given below.*

<table>
<thead>
<tr>
<th>Application rate of diluted DDT per acre</th>
<th>Ground Application</th>
<th>Air Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spray, 25 percent emulsion concentrate</td>
<td>3 quarts in 10 to 50 gallons of water</td>
<td>3 quarts in 2 to 5 gallons of water</td>
</tr>
<tr>
<td>Granules, 5 percent on clay</td>
<td>12 pounds</td>
<td>20 pounds</td>
</tr>
<tr>
<td>Dust, 5 percent</td>
<td>30 pounds</td>
<td>30 pounds</td>
</tr>
</tbody>
</table>

**WARNING:** Do not use DDT on any corn when the refuse is to be fed to dairy cattle or any livestock being fattened for slaughter.

It often happens that some fields miss treatment or for some reason control of first-generation borers is poor. Even though the borers are well established in a field, a large number can be eliminated. Apply
½ pound of parathion to the acre in 40 gallons of water as a ground spray. Parathion should only be used by applicators with experience with this chemical.

Dieldrin at ½ pound, endrin at ½ pound, heptachlor at 1 pound, and toxaphene at 2 pounds to the acre, in granular formulation only, give control equal to that of DDT. When the label on the container shows that the above chemicals can be used for corn borer control they may be substituted for DDT.

The only insecticide recommended for controlling second-generation corn borers and corn earworms is DDT applied at the rate of 1½ pounds to the acre. To spray an acre, mix 3 quarts of 25-percent DDT emulsion concentrate with 2½ gallons of highly refined horticultural oil of a mineral type (viscosity 45 to 90 Saybolt). Then add enough water to make 25 gallons of spray.

What equipment to use for spraying for first-generation borers

Standard pull-type, tractor-mounted, or hi-clearance sprayers are effective units. The machine must be equipped with a boom, have three nozzles per row, and be capable of maintaining constant pressure. The pressure used will vary depending on the type of nozzles, the gallons of liquid applied per acre, and the speed of the sprayer, but pressures of 50 to 100 pounds per square inch are satisfactory. Adjust all three nozzles to spray into the whorl and onto the upper third of the corn plant. For best results, operate sprayers at not more than 4 miles an hour.

What equipment to use for applying granules for first-generation borers

For applying granules for first-generation borers, pull-type granular applicators, tractor-mounted applicators, and applicators mounted on hi-clearance equipment are suitable.

On single-outlet applicators, adjust the outlet directly over the row. On multi-outlet applicators, plug all the outlets except the two or three directly over each row. The extra outlets can be easily plugged with masking tape. To get the best results, release the granules 8 to 10 inches above the whorl of the plant and don't travel more than 4 miles an hour. Caution: Do not use conventional row-crop dusters for applying granules. They are not suitable.

Airplanes well adapted for applying granules for first-generation borers

Aerial application of granules has proved just as effective as ground applications of granules or sprays. Air-seeding devices apply
granules better than crop-dusting equipment. However, most conventional crop dusters when equipped with seeder-type gates give good distribution. Aircraft should fly 35 to 50 feet above the ground. At this height, good coverage can be expected on 11 to 15 rows of corn, depending on the equipment.

For spraying for second-generation borers, use a hi-clearance self-propelled sprayer

The sprayer must be able to maintain 50 to 150 pounds of pressure with all its nozzles in operation. Constant mechanical agitation of the spray solution is absolutely necessary. The machine should be equipped with 4 to 6 nozzles per row, preferably 3 nozzles on each side of the row. Direct the nozzles at the ear zone. A coil spring attached where the drops and boom join will keep the drops from breaking. The sprayer in the photograph on the front cover is ideal for use in tall corn for controlling borers and earworms.

Some words about spraying or dusting by airplane

When either spraying or dusting by airplane, the width of the swath may vary with the kind of equipment used, but it should not be wider than the wing span. Planes should fly 4 to 6 feet above the corn. Note that the use of air borne equipment is not recommended for the control of second-generation corn borers or earworms on sweet corn. However, under the circumstances described on page 6, treating skipped fields by airplane may be the only thing left to do.

CONTROL ON MARKET CORN

Corn borer and corn earworm present a serious problem in the production of market sweet corn of high quality. Both pests must be considered in planning an effective control program.

To get good control, apply 1½ pounds of DDT per acre as a spray when the first corn borer eggs begin to hatch. Make additional applications every 4 to 5 days until all egg masses have hatched. If the corn silks during this period and earworms are present, discontinue the corn borer spray schedule and begin regular earworm sprays of DDT and oil. When corn borers are the only problem, treatments can be stopped when the corn will be ready for harvest in 10 days. When earworm infestations are heavy, continue treatments to within 5 days of harvest.