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THE EUROPEAN CORN BORER

by

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# THE EUROPEAN CORN BORER

By

Gerald B. Spahn\*

The European corn borer was first recorded from South Dakota in the summer of 1946. At that time Mr. H. C. Severin and the author found borers in corn in Union, Lincoln and Minnehaha counties. Less than half of one percent of the stalks in the fields were infested at that time.

During the summer of 1948 the infestation had spread over most of the corn producing area of our state. By the fall of that year 36 counties were known to be infested. Several fields in the southeastern part of the state had 100 per cent of the stalks showing borer injury. In the 24 heaviest infested counties of South Dakota last year the U. S. Department of Agriculture estimated, regarding corn harvested for grain, a loss of 2, 235,000 bushels as a result of corn borer damage. This loss was valued at \$2,436,000.00. The loss of sweet corn in these counties in 1948 was estimated at \$6,000.00. The total value of all corn produced in these 24 counties last year was estimated at \$98,707,000.00 while that lost because of corn borer damage was estimated to be \$2,442,000.00 or about 2%. These figures, remember, were for 1948. The loss for 1949 will run considerably higher since the infested area is now greater and the percentage of infestation within the 1948 area is much higher than it was last year. Over the entire corn producing area of the United States, 1949 has been reported as the worst corn borer year ever experienced. This does not mean that the infestation will become progressively more serious in South Dakota. The damage done by corn boeres in our state will probably vary from year to year.

## Life History of European Corn Borer

The corn borer spends the winter as a full grown caterpillar, or "worm"-- the borer stage of its life cycle. At this time they are inside cornstalks, stems of larger weeds, inside ears of corn, and other plants.

With the coming of warmer weather in the spring, ( in late April and May ) the borers begin to resume activity.

Late in May or in June the borer changes into the pupal stage.

The pupa, or resting stage, is more or less cigar-shaped, and is from one-half to three-quarters of an inch long. It ranges in color from a light to dark brown. During this stage, which lasts from 10 to 14 days, the change to the adult form takes place. At the end of this stage the brown case splits and the adult, or moth, emerges.

The color of the moth is variable. The females are from a cream color to light brown. The males are from pale to dark brown, usually much darker than the females. The wing expanse is about 1 inch. The outer third of each pair of wings is crossed by two narrow zig-zag bands.

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Soon after emergence the moths mate and the females begin to lay their eggs. The moths hide during the day, in patches of weeds and grass or under protecting leaves. They fly only at night and have been known to fly from 25 to 50 miles on their own power. When weather conditions are favorable ( 65° F. or above ) they fly from plant to plant laying their eggs in flat, irregularly shaped masses. The number of eggs laid by each female varies considerably but the average is from 400 to 450. The moths live from a few days to three weeks. By late July most of them have died.

The egg masses are usually laid on the underside of corn leaves near the midrib. The egg mass is whitish in color and ordinarily contains from 10 to 25 eggs. There may be a number of masses on each corn plant. Each egg is about half the size of the head of a common pin and the eggs in a mass overlap like fish scales.

The eggs hatch in from 4 to 6 days depending upon weather conditions. The newly hatched borer is about 1/16 of an inch long. It has a blackish head and a pale-yellow body. As it grows in size several rows of black to brown spots become visible on the body. In the process of growing the borer sheds its skin ( molts ) 5 or 6 times, increasing in size with each molt until it finally reaches full growth ( about 3/4 of an inch long ) in which it will pass the winter, if of the single-brooded strain.

If the borer is of the two-brooded strain the larva becomes full grown from mid-July to late-August and goes into the pupal stage. The adults emerge from these pupae from late July ( earlier in South Dakota this year ) to late August or early-September. Within a few days the moths mate and begin to lay eggs for the second brood of borers. These eggs, then, will be laid from late-July to early-September. It is quite likely that the latest emerging moths do not lay nearly as many eggs as do the moths which emerge earlier. Moth activity and egg laying stops at temperatures below about 65 degrees Fahrenheit. The moths are active at night. Since during late August and early September the nights are cool, there will probably be very few eggs deposited after late-August even though the moths may be present.

The borers which hatch from these eggs will feed on the leaves and silks of corn for a few days and will then burrow into the stalks.

Under normal conditions the majority of the borers will become full grown before freezing weather sets in. However, some of the latest hatched larvae will not be full grown and will be killed by freezing. Fully grown larvae seem able to withstand the rigors of our South Dakota winter with little difficulty. Borers found in tunnels in the cornstalks during the winter may be brought into the house and, if not thawed out too quickly, will crawl about upon warming up to the temperature ordinarily maintained in the home. Thus, it is apparent that there is one complete and a partial second generation produced in South Dakota each year.

#### Corn Planting Date Is Important In Borer Control

The earliest planted corn fields will ordinarily receive the heaviest infestation of egg masses from moths which emerge during June and July. They prefer the most advanced and most vigorously growing corn they can find at that time upon which to lay their eggs. Mid-season planted corn seems to be too small to meet the requirements of the first brood moths. The latest planted corn is in the right stage of development to receive the eggs of the second brood adults, while the early and mid-season plantings are farther along than the moths prefer. However, if there are no late planted fields available they will lay eggs in early and mid-season plantings.

From these facts, then, it is apparent that mid-season plantings of corn, both field varieties and sweet corn, will receive the lightest infestation of first brood corn borers. Since the first brood is most damaging in field corn this means considerable in reducing the loss in yield due to corn borers.

It is difficult to tie these terms ( early, mid-season, and late ) down to calendar dates. Much depends upon the weather and whether or not spring comes early or late. These terms will mean different dates in the southern part of the state than they will in the central and northern parts. These dates must be used as they apply to the average planting dates in various parts of the state.

#### Clean Plowing Presents Problem In South Dakota

Clean plowing-under of stalk remains, which has been recommended in states east of ours, should be done with extreme caution in South Dakota. There are several reasons for this statement: (1) Such a practice is likely to create a soil-blowing hazard. We still remember the dust storms of the 1930's and we do not want a repetition of them. (2) We need the stalk cover to hold snow on the fields as a moisture conservation measure. (3) Our state needs fields of standing cornstalks as winter food and cover areas for livestock and upland game. (4) Unless every farmer practiced this control measure the individual farmer would receive little benefit from his efforts since the moths can fly distances up to fifty miles.

#### Shredding the Corn Stalks

The shredding or cutting of stalks into small pieces about one-half inch in length is an effective method of killing a high percentage of the borers in a single field. This also prepares the stalk residue for humous addition to the soil better than when the stalks are left entire.

However, here again, unless community cooperation is obtained on a fairly large scale, the individual farmer who uses this control method will not receive the utmost benefit from his labors.

#### Chemical Control Recommended

From the foregoing discussion it is apparent that not every corn field, even in the heavy infested part of our state, will need chemical treatment for corn borer control. It is quite likely that only the early-planted fields will need spray or dust application.

At the time eggs are being deposited most heavily only those fields which have an average egg mass count of 50 or more egg masses per hundred plants are considered to justify the cost of chemical control. Ordinarily the corn is about 36 inches high, with the tallest leaf extended upward full length, at this time. In the spring of 1949, some of the early planted fields in the southeastern part of South Dakota had egg mass counts which ran as high as 400 masses per hundred plants.

In order to determine the egg mass count in a field the observer simply walks into the field for a distance of about fifty feet and chooses at random a stalk upon which to begin making his count. He carefully examines all the leaves on the next ten plants and records the number of egg masses found. This figure for ten plants is then multiplied by ten to get the average number of egg masses per hundred plants. If the resulting figure is 50 or more, and the corn is 30 to 36 inches or higher with leaves extended, then the farmer should plan to spray the field.

During the time the eggs are being laid the counts should be made at intervals of not more than three days in order to be sure that a heavy infestation is not overlooked. If the egg count is over 100 masses per 100 plants then two spray treatments will probably pay good dividends.

In order to know when to spray the field, the farmer should carefully observe a number of egg masses.

If only one treatment is to be applied then the spray or dust should be put on the corn 10 to 12 days after the first borers start to hatch.

If the egg count is still 50 or more masses per hundred plants a week after the first treatment has been applied, it will pay the farmer to spray or dust the field a second time. If the two-treatment control measure is used, then the second application should follow the first in from seven to nine or ten days.

It is of the utmost importance that any attempted chemical control should be done before the young borers burrow into the stalk. Once they make their way into the stalk they are safe as far as sprays and dusts are concerned.

#### What About Control Of Second Brood Borers?

Ordinarily the control of second brood borers is not recommended for the field corn producer. Exceptions may be made in the case of heavy infestations of eggs (100 or more masses per hundred plants) when control of second brood borers may be advisable.

Control of the second brood is recommended for the grower who produces hybrid seed corn and also for the producer of sweet corn for canning or marketing as green corn.

The sweet corn grower will control first brood borers by the same methods used for field corn.

#### When To Treat Sweet Corn For Second Brood

If sweet corn was planted later than mid-season it will very likely be infested by second brood borers.

For corn to be marketed as green corn, the first application of insecticide should be made about seven days after the eggs start to hatch. Additional treatments should be given at five day intervals until four have been made. Treat any sweet corn that comes into tassel or show the tassel at the whorl at hatching time if there are as many as four egg masses to every 10 plants. Such corn should be treated even though four applications have already been made.

For canning corn treatments should be started a few days after the first sign of hatching if the corn is more than 15 days from harvest and has 40 to 50 egg masses per hundred plants. Fields which do not have this number of egg masses when hatching starts should be examined every other day. If within two weeks after the first count was made the egg mass number reaches or exceeds that stated above, then treatment should be given and should be repeated every five to seven days until about 10 days before the crop is to be harvested or until the count of unhatched eggs averages less than 20 masses per hundred plants.

## Signs of Borer Infestation

The indications of the presence of corn borers in the stalks are as follows: (1) "shot hole" damage to leaves (2) tassels broken over (3) broken stalks (4) leaves broken down at the axil (where blade joins sheath) or along the midrib (5) frass (chewed up cornstalk and droppings massed together by web) along the stalk at holes leading to burrows, and (6) ears on the ground, broken off where borers have chewed and weakened the shank of the ear.

Another indication of borer damage is apparent at harvest time when mechanical pickers are clogged repeatedly by stalks which break off at weakened places instead of remaining attached and properly going through the machine. Much time will be lost and possible injury to the operator of pickers, sustained, during corn harvesting operation. As a personal safety measure, take every precaution against accidents while unclogging a mechanical corn picker or ensilage cutter.

## How Much Insecticide To Use

DDT used at the rate of 1 1/2 pound of actual DDT ( 1 1/2 quarts of 25% emulsion concentrate) per acre of corn is recommended. The proper amount of insecticide should be added to the highest gallonage the sprayer will deliver per acre (up to 100 gallons). Most of the sprayers available are weed sprayers which have been converted for use against corn borers. They will deliver from 10 to 30 gallons of water per acre.

The amount of water delivered per acre by the sprayer depends upon the pressure used, the size of the nozzles used, and the speed at which the machine travels. It is important to know how much water is being delivered per acre so that the right amount of insecticide can be added to that amount of water.

Good results have been obtained with ten gallons of water per acre but higher gallonages produce a better kill.

In a sprayer which has only the by-pass of spray from the pump back into the tank for agitation of the spray it is recommended that emulsion concentrate, instead of wettable powder, be used. The wettable powder may be used successfully in sprayers which have mechanical agitators in the tank and build up a pressure of 50 to 150 pounds. If the 50% wettable DDT powder is used then three pounds of the powder should be used to give the required pound-and-one-half per acre.

Dusters may be used effectively but do not seem to give quite as good results as do sprayers. If a 5% DDT dust is used then 30 pounds of dust should be applied per acre.

## Use Of Aircraft

Both sprays and dusts may be applied by aircraft. According to reports on research conducted in other states, the percentage of kill obtained by this method is not as high as that resulting from the use of ground sprayers and dusters. These reports indicate that spray applied by use of ground equipment gives the best results. Next in order of effectiveness come: dust applied by ground equipment; spray applied by airplane, and, lastly, dust applied by airplane.

While aircraft applications are a little less effective, there are certain advantages over the use of ground equipment. Some of these advantages are as

follows:

- (a) Considerable area can be sprayed or dusted in a short space of time.
- (b) Applications may be made even when fields are muddy.
- (c) Height of the corn is not a limiting factor, whereas it is with most ground machines.

These advantages may at times outweigh the disadvantage of a lower percentage of kill.

#### Corn Will Still Be Produced

The rapid increase in the corn borer population does not mean the end of corn production in South Dakota. Other states have had as heavy and even heavier infestations and they are still producing corn.

People in other states have learned or are learning to live with the corn borer and get a crop in spite of the pest. They have learned what to look for, how to examine stalks to find the various stages, and "what to do and when to do it" by way of control. Corn borer control is accepted as just another one of the many activities on the seasonal calendar of the farmer. He knows he will have to spray some of his fields; he is equipped to do the job and he does it. There is no doubt that this eventually will have to be the case in South Dakota corn producing areas.

#### CAUTION

At present the recommendation is that corn treated with DDT for control of corn borers NOT be fed to dairy cattle or to stock being finished for market. This applies to the stalks, not to the grain. The ears harvested from treated fields are perfectly safe, both for livestock or human food.

The concern felt in the feeding of treated stalks is not for the livestock in question. In properly treated corn an animal could probably not eat enough stalks to cause it serious damage. However, when dairy cows are fed treated stalks they secrete small amounts of DDT in the milk and thus the insecticide may be consumed by human beings. Animals being fattened for market tend to deposit small amounts of DDT in the fat thus providing another way in which the material may be eaten by man.

If corn is to be used for fodder or silage it is suggested that mid-season planted corn be used since it will likely not need treatment. Fields in which the farmer plans to run his stock after the corn is harvested should be planted in mid-season and should not be treated.

These are the present recommendations. Further study of the borer under South Dakota conditions might necessitate slight changes.