Corn Rootworm Control in South Dakota with Notes on Wireworm and Cutworm Control

Cooperative Extension South Dakota State University

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Corn Rootworm Control

in South Dakota

with notes on wireworm and cutworm

CAUTION

Insecticides are poisonous — handle and store them with care. Be sure to read the label and follow directions to the letter. Keep children and pets out of the area where chemicals are stored, mixed, or used. Do not contaminate feed, feed containers, or water troughs. Clean all contaminated planting equipment carefully. Destroy all emptied containers so they cannot be reused for any purpose.
Resistant strains of the western corn rootworm are causing a serious insect problem in South Dakota. The western, northern, and southern species have been present for a number of years. However, the first evidence of resistant strains of western corn rootworm in South Dakota was observed in 1962. Treatment failures using aldrin and heptachlor, later checked by laboratory tests on adult beetles, indicated that the western corn rootworm population in Lincoln County in southeastern South Dakota was becoming resistant.

Resistant populations became well established during the 1963 growing season. The following years showed a steady spread of the problem. The southern and western areas of the state are now infested with the resistant strain (Figure 1).

Adult specimens of the western corn rootworm have been collected in all corn-growing areas of the state. Populations in the northern counties are presently at low levels.

AREAS OF INFESTATION

Farmers in the shaded areas of the map in Figure 1 can expect damaging corn rootworm infestations in fields where corn is grown continuously. Surveys show the western corn rootworm to be well established in these areas.

Insecticide treatments are recommended for control of corn rootworm on all fields where corn is planted following corn. It also is recommended that first-year corn be treated with insecticides in those areas where western corn rootworm numbers were high during the previous August and September. Western corn rootworm has seriously infested first-year corn on fields previously planted in small grains, legumes, sorghum, etc.

In the remainder of the counties western corn rootworm populations are not as well established; the northern corn rootworm species predominates in these areas.

LIFE CYCLE

Adult corn rootworm beetles lay eggs in the soil of corn fields and to a lesser extent in other fields where weeds and flowering plants are present. They deposit eggs during late summer and fall. Most eggs are found in the first 6 inches of soil, although they also have been found in depths up to 15 inches.
The life cycle of the western corn rootworm is shown in Figure 2. This insect passes winter in the egg stage, and hatching begins in June. It requires several weeks for all eggs to hatch, so larvae of all sizes can be found during late June and early July (Figure 2).

The larvae feed on the root system, eating smaller roots and tunneling into larger ones. Even the base of the stalk below the soil surface often is severely damaged. When the larvae are full grown they change into an inactive stage and are called pupae.

Following pupation in the soil, the western corn rootworm adults begin to emerge in early July and continue to emerge until early September.

The northern corn rootworm's life cycle is similar to that of the western species, but usually the eggs hatch and the adult beetles emerge a little later in the season.

The southern corn rootworm—commonly known as the spotted cucumber beetle—overwinters as an adult in southern states and deposits eggs in the corn fields in spring. There may be several generations of this insect in a year. This species has been found to attack sorghum in Nebraska. Serious economic populations of southern corn rootworm have not been encountered on South Dakota sorghum.

LARVAL DAMAGE

Root injury results from larval feeding; smaller roots often are consumed completely, and larger roots are tunneled severely (Figure 4). Disease organisms often follow injury by rootworm larvae, causing further destruction of the root system. The most severe damage usually occurs during the latter part of June and the first 3 weeks in July. The entire root system often is destroyed.

Losses resulting from a rootworm infestation may range from a light yield reduction to total loss of the crop, depending on a number of factors. Among these are number of larvae per plant, time of planting, moisture conditions during and following rootworm attack, and general growing conditions.

Yield losses are considerably greater when moisture is deficient during the period of maximum larval feeding. Under these conditions it is hard for the plants to grow new roots. Infested fields often become severely lodged, making mechanical harvesting operations difficult and inefficient.

POLLINATION AFFECTED BY ADULT BEETLES

Adult beetles, upon emergence from the soil, prefer to feed on corn silks, but also are attracted by leaves and pollen. When large numbers of beetles are present during the pollination period, the damage to silks often results in poorly filled ears. Fields with late-silking plants usually are most severely affected. When populations of beetles are high during the pollination period, it may be necessary to practice adult control measures to protect the silks.

CONTROL MEASURES

Cultural Control of Larval Populations

Cultural practices that promote good root systems will help reduce yield loss and lodging. Plant as early as feasible. Experience in the rootworm areas shows that late-planted corn is often more severely damaged than early-planted corn.

Adult beetles disperse from the corn fields as the season progresses and move into adjoining fields where flowering legumes, sorghums, and weeds are present. If high adult populations were present in such fields during August and September of the preceding year, corn planted in these fields may be heavily infested the following year. If corn is not planted the following year in these fields the larvae will perish after hatching.

Although the western corn rootworm has not been successfully controlled by crop rotation in areas where adult beetle populations are at a high
level, evidence indicates that this practice will reduce western corn rootworm numbers. This reduction in turn will aid in obtaining better control with the proper chemical treatments.

There is not sufficient data available on the effect of fall tillage versus spring tillage, disk versus plowing, etc., and their subsequent effects on rootworm infestations. However, any tillage methods which improve the seedbed and promote good root development are recommended. Do not drag treated fields crosswise or diagonally—this will displace the chemicals in the treatment band.

Table 1. Insecticides Recommended for Control of Corn Rootworm Larvae

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Rate/Acre</th>
<th>Formulation and Amount/Acre of Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUX 10</td>
<td>0.75 lbs</td>
<td>7.5 lbs. of 10% granules</td>
</tr>
<tr>
<td>Thimet</td>
<td>1.0 lbs.</td>
<td>6.5 lbs. of 15% granules</td>
</tr>
<tr>
<td>Diazinon</td>
<td>1.0 lbs.</td>
<td>7.0 lbs. of 14% granules</td>
</tr>
<tr>
<td>Parathion</td>
<td>1.0 lbs.</td>
<td>10.0 lbs. of 10% granules</td>
</tr>
<tr>
<td>Parathion +</td>
<td>1.0 + 1.0 lbs.</td>
<td>10.0 lbs. of 10-10% granules</td>
</tr>
<tr>
<td>Aldrin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parathion +</td>
<td>1.0 + 1.0 lbs.</td>
<td>10.0 lbs. of 10-10% granules</td>
</tr>
<tr>
<td>Heptachlor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. Life cycle of the western corn rootworm

Chemical Control of Larval Population

Insecticides recommended for control of corn rootworm larvae, on the basis of performance in research experiments in South Dakota State University test plots, are given in Table 1.

Other experimental organic phosphate and carbamate insecticides are being tested each year by the South Dakota Agricultural Experiment Station. It is possible that several of these formulations may be registered for use in the near future. Check with your county agent or extension entomologist on the efficacy data of new materials.

Organic phosphate insecticides mixed with fertilizers are on the market, but are not recommended under any circumstances for rootworm control in South Dakota. Performance data obtained in South Dakota using recommended materials is available at county extension offices or through the extension entomologist at South Dakota State University.

Application of Granular Insecticides

Planting time — The insecticides recommended for larval control are suggested for application in the granular form only and are to be applied with a granular applicator. Apply in 4- to 7-inch bands over the rows (not with the seed) at planting time, and incorporate the insecticide into the upper ½ inch of the soil. Make the granule application in front of press wheels, covering disks, or by dragging...
chains behind the planter. To avoid granule drift-off the row when treatments are made during windy weather, provide plastic guards on each side of the banders. Adequate control of corn rootworm will not be obtained if excessive drift of insecticide from the row is allowed during application.

Carefully calibrate the application equipment to obtain the correct dosage. Recommended applications are based on 40-inch row spacings; narrower row spacings require a proportionately higher rate. Basically, apply 10 lbs. of 10 per cent granules for every 13,080 linear feet of row. It is important that the recommended amount of active ingredient be applied in the correct manner and in the proper place when using row treatments.

Post-planting time — Some of the recommended insecticides are registered for side-dressing treatments at first or second cultivation. Special attachments for the cultivator can be purchased or constructed for this purpose. Apply treatments at the base of the plants and incorporate into the soil immediately. When post-planting applications are made, incorporation of the insecticide may be accomplished using a rotary hoe or by covering with the cultivator shovels. If the corn is small, applications can be made over the row or as a band on each side of the row. Emergency treatments have also been applied at lay-by time using high-clearance machines to place the insecticide at the base of the plants and disk hillers on a cultivator to incorporate the insecticide into the soil.

Rootworms still will be present in treated fields, particularly outside the treatment band, since none of the insecticides will provide 100 per cent control. Ineffective control also may be encountered when extremely dry conditions prevailing during late June and early July prevent local dispersion of the insecticide. Control with insecticides also may be reduced in spots where water remains standing in a field for extended periods of time.

Control of Adult Beetles

As the adult beetles emerge they seek attractive plants on which to feed. Since corn silks and pollen are among their favorite diets, feeding damage on the silks sometimes interferes with proper pollination. Adult control measures are suggested only when interference with pollination appears likely, since they are not practical for reducing the next year's infestation. Implement control measures before silks are damaged to the point where less than ½ inch of the silk is protruding from the tip of the ear and while viable pollen is available in the field. Do not apply insecticides for adult control until the bulk of the plants in the field are in silk.

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Actual Insecticide Rate/Acre</th>
<th>Interval Before Harvest or Ensilage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malathion</td>
<td>1.0 lb. (1¼ pints 57% emulsifiable concentrate)</td>
<td>5 days</td>
</tr>
<tr>
<td>Carbaryl</td>
<td>1.0 lb. (1.25 lbs. 80% sprayable)</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 3. Above—larvae of the western corn rootworm; below—inactive pupae stage

Figure 4. Damaged corn roots mean reduced yield.

Insecticides recommended for adult control are listed in Tables 2 and 3.

Aircraft used for application of ultra low-volume malathion must be properly equipped and calibrated to disperse the insecticide accurately. Ethyl and methyl parathion are recommended for use by experienced aerial applicators ONLY. Farmers should not use toxic sprays such as ethyl or methyl parathion.
Table 3. Insecticides Recommended for Use by Experienced Aerial Applicators Only for Control of Adult Corn Rootworms

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Actual Insecticide Rate/Acre</th>
<th>Interval before Harvest or Ensilage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malathion</td>
<td>4 oz.</td>
<td>5 days</td>
</tr>
<tr>
<td>(ultra low-volume concentrate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethyl Parathion</td>
<td>4 oz. (1/2 pint 4.0 lbs. emulsifiable concentrate)</td>
<td>12 days</td>
</tr>
<tr>
<td>Methyl Parathion</td>
<td>4 oz. (1/2 pint 4.0 lbs. emulsifiable concentrate)</td>
<td>12 days</td>
</tr>
</tbody>
</table>

Post warning signs on fields treated with ethyl or methyl parathion. Do not enter fields for five days after treatment.

**CUTWORMS AND WIREWORMS**

In addition to the insecticides recommended for corn rootworm control, heptachlor, aldrin, and chlordane are recommended as a soil treatment in fields where wireworms and cutworms are expected to be a problem. Corn planted on land previously in sod, legume, soil bank, or other diverted acres frequently is subject to wireworm or cutworm attack.

Insecticide treatments recommended for wireworm and cutworm control may be applied while preparing the soil for spring planting. Special equipment is not required for broadcast treatments; a farm sprayer or fertilizer spreader may be used. Insecticides recommended and rates of application are listed in Table 4.

Table 4. Insecticides Recommended for Control of Cutworms and Wireworms, Applied as Preplant Broadcast Applications

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Actual Insecticide Rate/Acre</th>
<th>Formulation and Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heptachlor</td>
<td>2.0</td>
<td>10 lbs. 20% granules or 1 gal. of 2.0 lbs. emulsifiable concentrate per acre</td>
</tr>
<tr>
<td>Aldrin</td>
<td>2.0</td>
<td>10 lbs. 20% granules or 1 gal. of 2.0 lbs. emulsifiable concentrate per acre</td>
</tr>
<tr>
<td>Chlordane</td>
<td>4.0</td>
<td>16 lbs. 25% granules or 1 gal. 45% emulsifiable concentrate containing 4.0 lbs./gal.</td>
</tr>
</tbody>
</table>

When applying liquid insecticides, use sufficient water to obtain uniform distribution. Work both liquid and granular applications into the soil immediately by diskimg to prevent loss of the insecticide.

**Row Treatments**

Row treatments generally arc less effective than broadcast applications for the control of wireworms and cutworms. On row treatments apply 1/2 the amount of insecticide recommended for broadcast application (1.0 lb. actual aldrin or heptachlor or 2.0 lbs. actual chlordane per 13,080 feet of linear row).

If a sprayer is used on the planter for row treatments, place the spray nozzle in each planter shoe to spray a band on the soil as it falls over the seed. If corn is listed, spray the band behind the moldboard but ahead of the packing wheel. The band should be about 4 to 7 inches wide both for spray and granular applications. Apply granular insecticides in the same manner at dosages recommended.

**CAUTION: POISON**

All insecticides used for rootworm control are poisonous both to man and animals. This is especially true of organic phosphate and carbamate formulations. They are safe to use in granular form when all safety precautions prescribed on the labels are followed strictly.

Thimet, Parathion, Di-syston, Diazinon, and BUX-10 are toxic and, therefore, dangerous when not handled according to directions. This is true also of Aldrin, Heptachlor, and Chlordane.

The first rule in working with any of these materials is to read the label until it is understood completely. Second, follow the manufacturer's safety precautions to the letter.

Wear protective equipment when opening containers and filling insecticide hoppers — rubber gloves, long-sleeved shirt or coveralls, goggles, hat, and a proper respirator if working in the wind.

Remove protective clothing as soon as possible after use. If any insecticide is spilled accidentally on clothing or parts of the body, remove clothing and wash any parts of the body that the insecticide may have contacted.

Always stand upwind and away from the insecticide hoppers when filling. Never breathe dust or fumes. Do not haul containers in your automobile since fumes often are inhaled. Store all insecticides or contaminated equipment away from children and pets. Be sure to burn containers immediately after they are emptied. Bury unused or spilled granules.

Never attempt to sift or break-up lumpy, granular insecticides — the personal hazard is too great! If you find lumps or excessive amounts of fine powder in the granular formulation, return the insecticide to your dealer for replacement or refund.

If there is any chance that you may have
been poisoned accidentally, consult your doctor. Insecticides can gain entry into a human body in a number of ways—absorption through the skin; inhalation of vapors, fumes, or dust; smoking while hands or face are contaminated with dust; or entry into the eyes.

Take all precautions to avoid accidental poisoning.

If ACCIDENTAL POISONING occurs, direct contact can be made with:
South Dakota Poison Information Center
Vermillion, South Dakota
Telephone (605) 624-3432