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Corn Rootworm Control

in South Dakota
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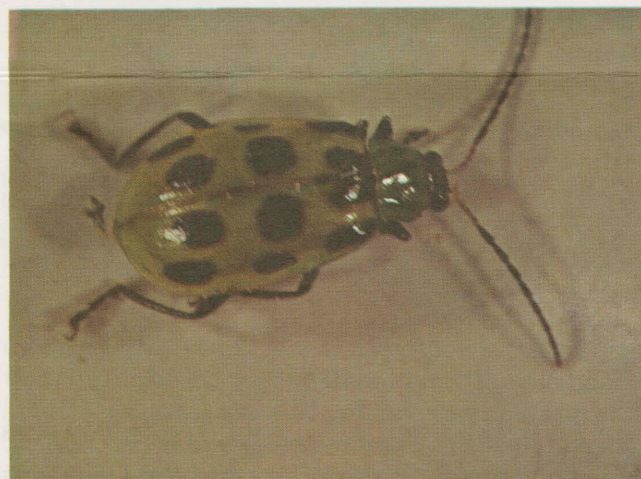
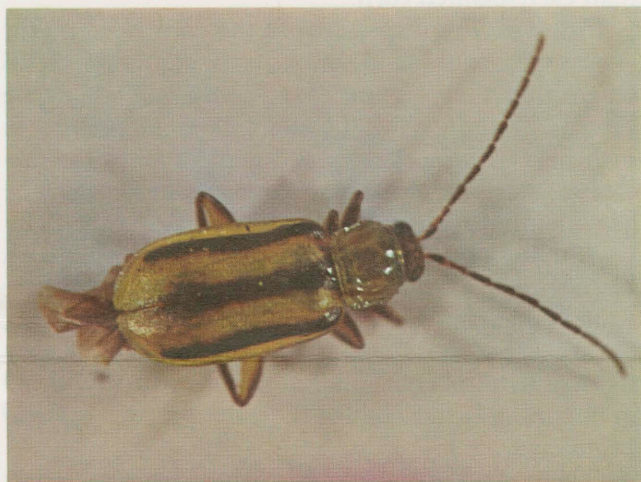


COOPERATIVE EXTENSION SERVICE
SOUTH DAKOTA STATE UNIVERSITY
UNITED STATES DEPARTMENT OF AGRICULTURE

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

FS 428

by B. H. KANTACK and W. L. BERNDT, extension entomologists;
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TOP: Western Corn Rootworm
MIDDLE: Northern Corn Rootworm
BOTTOM: Southern Corn Rootworm

Resistant strains of the western corn rootworm are 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 were 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 resistant rootworm problem. All areas of the state are now infested with the resistant strain. Adult specimens of the western corn rootworm have been collected in all corn-growing areas of the state.

AREAS OF INFESTATION

Farmers in South Dakota can expect damaging corn rootworm infestations in fields where corn is grown continuously. Surveys show the western corn rootworm to be well established in all 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 very 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 most cases where this occurred, adult populations were at extremely high levels the previous year.

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 six inches of soil, although they also have been found to depths up to 15 inches.

The life cycle of the western corn rootworm is shown in Figure 1. This insect passes the 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).

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 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 3). 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 three 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: 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.

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, disking 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.

CHEMICAL CONTROL OF LARVAL POPULATION

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

Table 1. Insecticides Recommended for Control of Corn Rootworm Larvae

Insecticide	Actual Insecticide Rate/Acre	Formulation and Amount/Acre of Row
Thimet	1.0 lb.	6.5 lbs. of 15% granules
Bux Ten	0.75 lbs.	7.5 lbs. of 10% granules
Dyfonate	0.75 lbs.	7.5 lbs. of 10% granules
Dasanit	1.0 lb.	6.5 lbs. of 15% granules
*Diazinon	1.0 lb.	7.0 lbs. of 14% granules

*DIAZINON IS NOT RECOMMENDED FOR CORN ROOTWORM CONTROL SOUTH OF U. S. HIGHWAY 16, IN SOUTH DAKOTA, AS APPARENT RESISTANCE OR INCREASED TOLERANCE TO DIAZINON BY THE WESTERN CORN ROOTWORM MAY BE PRESENT IN THIS AREA.

Two other insecticides which have been tested in South Dakota and found to give effective corn rootworm control as planting time treatments are Furadan and Landrin. These materials will be recommended as planting time treatments when full USDA registration is obtained. Recommended rates for Furadan will be 0.75 lbs. actual or 7.5 lbs. of 10% granules per acre of row. Landrin will be recommended at 1.0 lbs. actual or 10 lbs. of 10% granules per acre of row.

Other insecticides which have USDA registration for corn rootworm control include: Sevin (Carbaryl), Di-Syston, and Parathion (Niran, Stathion, P-10 Aldrex, Parahep etc.).

None of these insecticides are recommended for corn rootworm control because sufficient satisfactory efficacy data is lacking and/or unsatisfactory field performance in South Dakota.

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 four to seven 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 pounds of 10 percent granules per 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. **Do not drag treated fields crosswise or diagonally — this will displace the chemicals in the treatment band.**

Post-planting time — Although SDSU entomologists are not recommending cultivation treatments in 1969, 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, incorporate the insecticide by 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 also have 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 percent control. Ineffective control also may be encountered when extremely dry conditions prevailing during late June

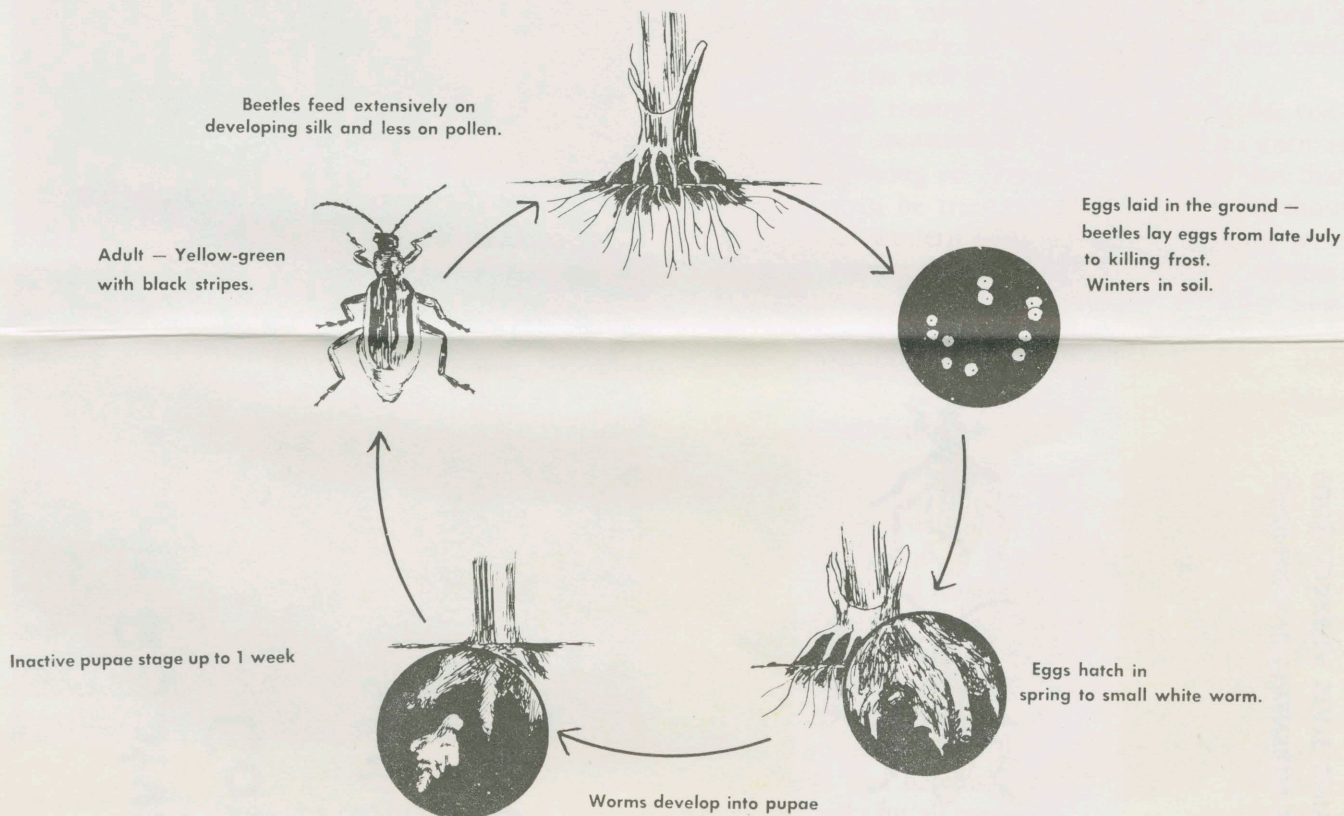


Figure 1. Life cycle of the western corn rootworm

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; control at this time is not considered practical for reducing the next year's infestation. Begin control measures before silks are damaged to the point where less than 1/2 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.

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, who have the necessary safety equipment.** Farmers should not use toxic sprays such as ethyl or methyl parathion.

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

Table 2. Insecticides for Use Either by High-Clearance Ground Equipment or Aerial Applicators for Control of Adult Corn Rootworm

Insecticide	Actual Insecticide Rate/Acre	Interval Before Harvest or Ensilage
Malathion	1.0 lb. (1 3/4 pints 57% emulsifiable concentrate)	5 days
Carbaryl (Sevin)	1.0 lb. (1.25 lbs. 80% sprayable)	0 days

Table 3. Insecticides Recommended for Use by Experienced Aerial Applicators Only for Control of Adult Corn Rootworms

Insecticide	Actual Insecticide Rate/Acre	Interval Before Harvest or Ensilage
Malathion (ultra-low-volume concentrate)	4 ounces	5 days
Ethyl parathion	4 ozs. (1/2 pint 4.0 lbs. emulsifiable concentrate)	12 days
Methyl parathion	4 ozs. (1/2 pint 4.0 lbs. emulsifiable concentrate)	12 days

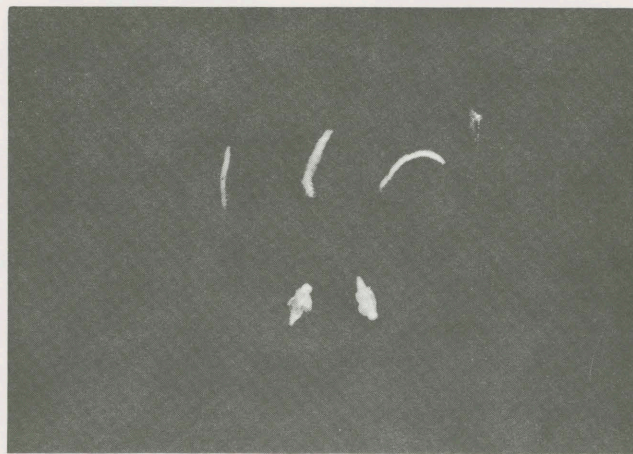


Figure 2. Above: larvae of the western corn rootworm; below: inactive pupae stage.

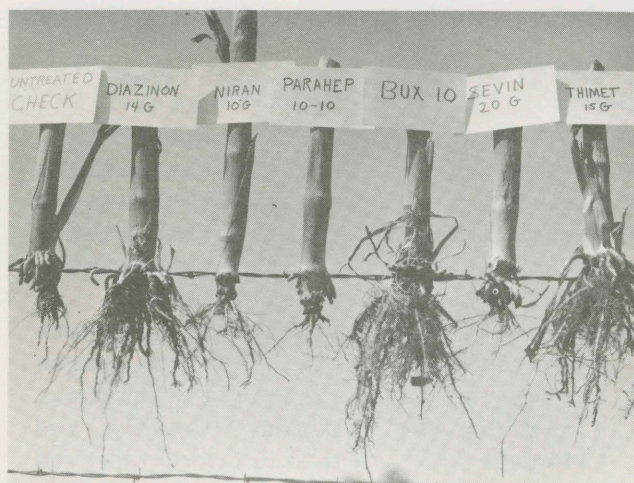


Figure 3. Typical corn roots examined July 24, 1967, from a demonstration plot on the Howard Kennedy farm (Lincoln County) Beresford, South Dakota. NOTE: Planting-time treatments of BUX 10, Thimet, and Diazinon are giving good control. (Planting date: May 23, 1967)

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 Pre-plant Broadcast Applications

Insecticide	Actual Insecticide Rate/Acre	Formulation and Amount
Heptachlor	2.0	10 lbs. 20% granules or 1 gal. of 2.0 lbs. emulsifiable concentrate per acre
Aldrin	2.0	10 lbs. 20% granules or 1 gal. of 2.0 lbs. emulsifiable concentrate per acre
Chlordane	4.0	16 lbs. 25% granules or 1 gal. of 45% emulsifiable concentrate containing 4.0 lbs./gal.

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

CAUTION: POISON

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

All insecticides recommended for corn rootworm control are toxic and, therefore, dangerous when not handled according to directions. This is true also of Aldrin, Heptachlor, and Chlordane which are used to control other soil insects.

The first rule in working with any of these materials is to read the label until it is under-

stood 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 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

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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.



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