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Corn Rootworm

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The northern corn rootworm has long been a pest of corn in certain Michigan fields. The western corn rootworm (Figure 1), a very similar pest, recently invaded the state and is now established in our area of corn production. Both of these insects can damage only corn that is planted without rotation; a practice that is common in this state. The northern corn rootworm is definitely resistant to the chlorinated hydrocarbon insecticides (such as aldrin and chlordane) in some part of Michigan. The western corn rootworm entered the state already resistant to the chlorinated insecticides. The appearance of the western corn rootworm, the large acreage of constant corn, and the resistance of the worms to certain insecticides strongly indicate increasing problems with these pests in the near future. We must stay alert to avoid damage from these pests to our corn.

Biology

The western and northern corn rootworms are very similar in biology. Adult beetles of the rootworms emerge from the soil in late July and August. They are very active and hard to catch. They can be distinguished from nearly all other hard-shelled beetles found in flowering corn by their long antennae (feelers; see Figure 1). The beetles feed on the silks, tassels, soft kernels at the tips of the ears, and the western corn rootworm also feeds on the leaves. Their feeding on the early silks can result in a poor seed set. They lay their oval, yellowish eggs in the soil near the bases of corn plants. The adults are abundant in corn while it is flowering, and feed on the pollen of a number of plants when the corn matures. They are active in the field until the first hard frost of the fall.

The eggs overwinter in the field and hatch when the soil warms up in the late spring. The larvae (rootworms) that hatch from these eggs are slender, cylindrical, white in color, and have a tan head with six small legs just in back of the head. The larvae vary in size to 1/2 inch when fully grown. The larvae tunnel and prune the roots of corn and can feed only on corn. Their feeding can destroy the roots (Figure 2) and reduce the vigor of the plant. More importantly, the damaged roots cause the stalks to lodge and pull out of the ground at harvest time.

The lodging caused by the rootworm starts at soil level and the plants are commonly curved (goose-necked) at their bases (Figure 3). The greatest damage done by the rootworms is by the lodging and weakened roots that prevent mechanical harvesting of the crop. The larvae transform to a quiet stage (the pupae) in the soil in mid- to late-July and the adults emerge from these pupae. They have only one generation per year.

Detection

Rootworm damage occurs to the roots in the soil and is too often not noted until the corn lodges in late summer. This is after the damage has been done to that crop. Damage can be avoided by **checking your fields** for the pest.



Figure 1. The western corn rootworm adult (above) is yellow with black stripes down its wings. The northern corn rootworm is pale green or yellow without striping. Both the northern and western corn rootworm adults have long antennae (feelers).

Corn rootworms are a problem only where corn follows corn. Reports of damage have been frequent after three years or more of constant corn, with a few reports of damage to second-year corn. Check for rootworms in any corn grown without rotation. Be especially careful if the field has been in corn for more than two years, and even more so if rootworms are prevalent in your area.

To Check Corn for Rootworms

a) Examine tassels and silks for the presence of adults at flowering. This is the best time to detect the pest and prepare for its control during the next season. About one adult per plant indicates a rootworm problem the following year. Identification of the type of rootworm is important. The northern corn rootworm adult is plain pale green or yellow, while the western corn rootworm adult (almost certainly resistant to certain insecticides) is yellow with black markings on the wings. The adults can reduce seed set by trimming off silks. An insecticide application is recommended when the adults are abundant (about four or more per ear) and the percentage of seed set is small.

b) Examine lodged and goose-necked plants when plants are mature for evidence of root tunneling. Smaller

roots may be completely rotted off by this time, but brace roots may still show tunnels. The crop will need protection the following year if plants with goose-necking and tunneled roots are common.

c) Examine plants that are stunted or wilted in late June or early July or are lodged later in the season for larvae and tunnels of the rootworms. A cultivation application of insecticides (described below) may be made to protect the crop if worms are found in time. Carefully recheck the field for adults at flowering time if rootworm damage is suspected.

Control

Rotation

Rootworms are a pest where corn follows corn without rotation. The best way to control the rootworm is to rotate the corn with any other crop. Infested fields should be placed in rotation, unless there are real benefits from growing corn-after-corn in that particular field. The advantages of growing corn without rotation should be reviewed when problems develop with the corn rootworms.



Figure 2. Roots on the right have been severely damaged by corn rootworm larvae; the roots on the left were protected from damage by an insecticide applied at planting time.

Table 1. Insecticides recommended for control of corn rootworm adults.^a

Insecticide	Formulation	Pounds active/acre	Limits ^b
Malathion	5.0 EC	1.0	5 days
Malathion	ULV Conc. ^c	4 liquid ounces	5 days
Diazinon	4.0 EC	0.5	0 days
Sevin	4.0 F, 50 WP, or 80 WP	1.5	0 days
Sevin	4.0 Oil ^c	1.0	0 days

^aApply by air or high clearance ground rigs. Do **not** apply insecticides when honey bees are working in the field.

^bMinimum days between application and harvest.

^cFor ultra-low-volume aerial applications only.

Insecticides

Insecticides should be used to control the rootworms in infested fields where rotation is not feasible. Remember that insecticides are poisonous; handle, store, and apply them with great care. The label on the insecticide container has full instructions for safe, effective use of that specific insecticide. **Read the label** before buying any insecticide.



Figure 3. Lodging of corn caused by destruction of the roots by corn rootworm larvae. The stalks tilt right from soil level and often curve up (goose-neck) near their bases.

Table 2. Insecticides recommended for control of corn rootworm larvae.

Insecticide	Formulation	Pounds active/acre	Limits ^b
<i>For use in 7-inch band at planting time</i>			
Dyfonate	4.0 EC, 10 G, or 20 G	1.0	
Lorsban	15 G	1.0	1 application per season; do not plant subsequent crops within 1 year of application.
Furadan	10 G or 4.0 F	0.75	
Mocap	10 G	1.0	Do not allow <i>Mocap</i> to contact seed
Thimet	15 G	1.0	
Counter	15 G	1.0	Do not plant crops other than corn or soybeans within 365 days after application; cover crops may be planted earlier if they are plowed down.
Dasanit	15 G	1.0	
Diazinon	4.0 EC or 14 G	1.5	

For use in 7-inch bands at post-emergence

Dyfonate	4.0 EC, 10 G, or 20 G	1.0	45 days to harvest
Furadan	4.0 F, or 10 G	0.75	
Mocap	10 G	1.0	
Thimet	15 G	1.0	Do not make later application
Dasanit	15 G	1.0	40 days to harvest; 1 application per season.
Diazinon	4.0 EC or 14 G	1.0	Apply no later than July 1

For use only on non-dairy farms where western corn rootworms or resistant northern corn rootworms are not present

Chlordane (Belt)	8.0 EC or 33 G	4.0	Pre-plant broadcast
Chlordane (Belt)	8.0 EC or 33 G	2.0	Planting band

^aThe amounts given as band applications are for corn grown in 40-inch rows. Adjust this amount when other row widths are used by the equation:

$$\text{adjusted amount} = \frac{40 \times A}{W}$$

where *A* is the pounds active insecticide per acre given in the table and *W* is the row width, in inches, that will be used. For example, if a 32 inch row width is to be used with an insecticide listed at 1 lb. per acre in the table:

$$\text{adjusted amount} = \frac{40 \times 1}{32} = 1 \frac{1}{4} \text{ lb./acre}$$

^bBe sure to cover the insecticide with soil immediately after application.

Adult control. Apply insecticides as a spray using airplanes or high clearance ground rigs. Spray **only if** adults are abundant (4 or more per ear) **and** pollination has not yet occurred. Pollination usually occurs within 7-10 days after silks appear. Silks wilt quickly and dry shortly after pollination. Start checking your fields when silks first appear and apply one of the insecticides in Table 1 if the adults are numerous and the silks have not started to dry.

Larval control. Control larvae of the rootworms by applying insecticides to the soil. Either granules or sprays can be used depending on the equipment available and the insecticide. The insecticides recommended for larval control are shown in Table 2. Not all of the insecticides are available in spray form. Some insecticides are formulated for application in mixture with herbicides or fertilizers. *Read the label* to be sure that the insecticide is compatible with the specific weed-killer or fertilizer. Soil insecticides must be covered with soil immediately after application. This reduces their decomposition from the sun and heat (130° F or more) at the soil surface and exposure to wildlife.

Broadcast applications: the insecticide is applied as spray or granule over the entire surface of the soil prior to planting. Applying the insecticide just before the final discing is a good practice since the discing covers the insecticide. More insecticide is needed for broadcast than for the band applications, noted below. Some growers,

however, have found that broadcast applications fit their operations, even though more expensive.

Planting-time band applications: sprays or granules are placed in a 7-inch band centered over the row at planting time. Note that a 7-inch band is recommended. Narrow bands (sometimes called "furrow applications") are **not** recommended because they have not been consistent in controlling the rootworms in Michigan. Place insecticide above, and out of contact with, the seed. This can be done by placing the insecticide fan or nozzle behind the seed spout on the planter. Be sure that the planter covers the seed with soil before the insecticide is dropped on the seed row. The insecticide also must be covered with soil. The press wheel may do this in some fields. A ridged wheel, chains, a drag, or some other means of covering the insecticide with soil are necessary if your planter does not provide covering of the insecticide.

Post-emergence (or lay-by) applications: a 7-inch band of insecticide is applied to the bases of the growing plants. The insecticide may be covered using a well adjusted cultivator shoe or a rotary hoe. While many growers have found that the planting time band application is most convenient for them, this post-emergence application fits some farm operations. Post-emergence application protects corn from the rootworms when they are not found until after the plants emerge. Make post-emergence applications during June when the plants are still small and before too many roots have been damaged by the worms.