

Corn Rootworm

By Robert F. Ruppel, Department of Entomology

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.

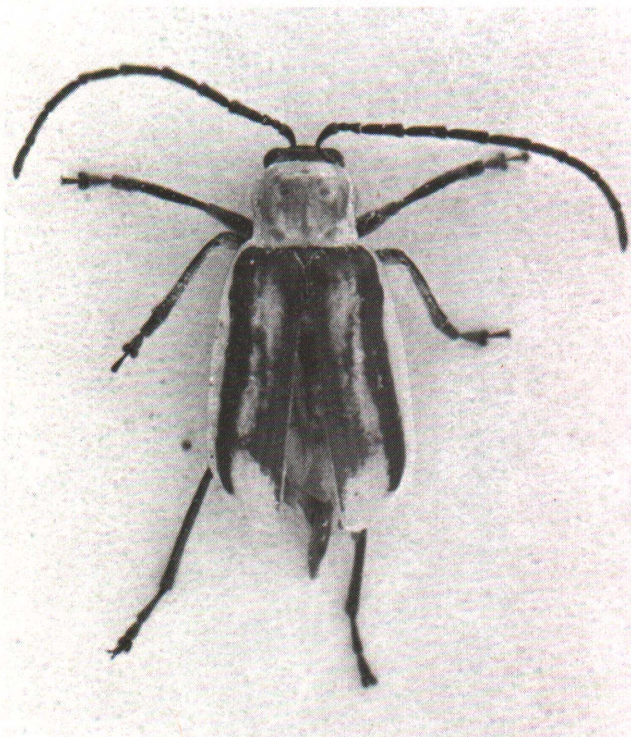


Figure 1. The western corn rootworm adult (above) is yellow with black stripes down its wings. The northern corn rootworm is pale green or yellow without striping. Both the northern and western corn rootworm adults have long antennae (feelers).

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 two or more per ear) and the percentage of seed set is small. Insecticides recommended for adult control are given in Table 1. These applications can be made by airplane or by high clearance ground rigs.

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.

If you are still unsure of the need to protect against corn rootworm, use this simple test:

a) Treat two or three separate swaths of four to eight rows wide across the field with an insecticide if you suspect that you may need to control the rootworm. Compare the treated rows for larvae, lodging, and harvest problems with the adjacent, untreated corn.

b) Leave similar swaths untreated and compare them with adjacent treated rows if you are now using an insecticide for rootworm control and suspect that you do not need it.



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	Lb. active/rate	Limits ^b
Malathion (Cythion)	5.0 EC	1	5 days
Malathion	95% ULV ^c	4 liq. oz.	5 days
Diazinon	50 WP or 4.0 EC	1/2	0 days
Carbaryl (Sevin)	4.0 F or 80 WP	1	0 days; hazardous to bees

^aFor application by air or by high clearance ground rigs.

^bMinimum days between application and harvest. Do **not** apply carbaryl if honey bees are working in or around the field.

^cFor ultra-low volume aerial application only.

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.

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. Insecticides used to protect corn from rootworm larvae are applied to the soil. They should be covered with some soil immediately after application to prevent their exposure to high soil surface temperatures and to people, livestock and wildlife. The equipment used to apply the insecticide should be carefully calibrated to deliver the exact amount of insecticide desired. Insecticides recommended for use are given in Table 2.

Pre-plant broadcast applications are made by spraying the liquid insecticide or applying a granular insecticide to the entire field prior to planting. A good practice is to apply the insecticide immediately before the final disking. Broadcast applications require more insecticides, and are, therefore, more expensive than band applications.

Planting band applications are made by spraying a liquid insecticide or applying a granular insecticide in a seven-inch band centered over the seed row. The band application may be made at planting or between the time of planting and seed germination. Apply the insecticide above, and out of contact with, the seed. Place the insecticide nozzle or spout between the seed spout and covering wheel of the planter. Make sure that the insecticide is covered with soil. A modified covering sheel or a light harrow in back of the insecticide applicator can be used. The planting band application is the least expensive and most convenient method of rootworm control on most farms.



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.

Cultivation band applications are made by spraying a liquid insecticide or applying a granular insecticide in three- to four-inch bands on both sides of rows of growing corn. This requires special equipment, but is the

only practical way to apply insecticides for rootworm control in growing plants. A cultivator shoe should be used to cover the insecticide immediately after application.

Table 2. Insecticides recommended for control of corn rootworm LARVAE^a.

Insecticide	Formulation	Lb. active/rate	Note
For use as broadcast application prior to planting^b			
BUX	2.0 EC or 10 G	4	
For use in 7-inch bands at planting time			
BUX	2.0 EC or 10 G	1 ^c	
Dasanit	15 G	1 ^c	Hazardous
Di-Syston	15 G or 6.0 EC	1 ^c	Hazardous
Furadan	10 G or 4.0 F	3/4 ^c	Hazardous
Diazinon	14 G or 50 WP	1 1/2 ^c	
Thimet	15 G	1 ^c	Hazardous
Dyfonate	4.0 EC, 10 G or 20 G	1 ^c	Hazardous
prophos (Jolt, Mocap)	10 G or 15 G	1 ^c	
For use in 7-inch bands at cultivation^d			
BUX	10 G	1 ^c	
Dasanit	15 G	1 ^c	Hazardous
Di-Syston	15 G or 6.0 EC	1 ^c	Hazardous
Furadan	10 G	3/4 ^c	Hazardous
Diazinon	14 G or 50 WP	1 ^c	
Thimet	15 G	1 ^c	Hazardous
Dyfonate	4.0 EC, 10 G or 20 G	1 ^c	Hazardous
prophos (Jolt, Mocap)	15 G or 10 G	1 ^c	
For use only on non-dairy farms where western corn rootworm or resistant northern corn rootworms are not present			
Chlordane (Belt)	33 G or 8.0 EC	4 lb	broadcast ^b
Chlordane (Belt)	33 G or 8.0 EC	2 lb ^c	planting band

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

^bCover the entire surface of the soil with the insecticide just before the final disking.

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

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

; where A is the amount of 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 / acre:

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

^dApply no later than July 1. Apply in 3-4 inch band on either side of the bases of the plants.