



Michigan Corn Production

INSECT CONTROL

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY

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INSECT CONTROL on field corn is made up of a number of different methods. Note especially that cultural practices (including weed control) and crop rotations can be as beneficial as insecticides in protecting plants from insect damage (or even more so in some cases). The ideal field corn growing operation on any farm considers a unified program of both cultural and chemical use for insect problems. This bulletin points out the important methods of reducing or eliminating insect damage to field corn.

All insecticides are poisonous in varying degrees. Handle them cautiously so that they will not poison livestock, children, or the user. When using insecticides on field corn, do not increase the recommended dosage. Measure all materials carefully.

Apply chemicals to field corn no closer to harvest than the time given in this bulletin. These are minimal days before harvest. Earlier treating if applicable, is much better. Meat and milk can be seized if they contain more insecticide than allowed.

Read the package label for additional instructions on how to use safely pesticide chemicals on field corn.

All corn insect control suggestions issued by the Entomology Department of Michigan State University are based on insecticide tolerances established by the Federal Food and Drug Administration and the U. S. Department of Agriculture. If changes occur in these, we will attempt to inform you through our regular channels of communication.

Determining the amount of water to use per acre to apply insecticides to corn foliage and for some soil insects is always a problem. However, the following may be used as a guide:

When corn plants are small (up to 12 to 18 inches), 15 to 50 gallons of water may be enough. Larger plants normally require more water (50 to 125 gallons) for satisfactory control. Water requirements will also vary according to the type of equipment used. The amount of water or oil is stated specifically in the recommendations for aircraft application.

Generally, weed sprayers are not suitable for control of field corn insects, except flea beetles, billbugs, and soil insects.

Warnings about the use of the chemicals on field corn are in bold face type in columns: "Control Instructions" and "Insecticides Per Acre." Read these before using any insecticide.

Do not allow insecticides, fungicides, and nematocides to drift onto pastures, hayfields, food crops, wood lots, non-crop areas, lakes, or ponds *unless there is no danger involved*. Certain restrictions placed on chemicals when used on animal or human food crops are listed in this bulletin. When applied to water or wildlife areas, some of the materials listed may kill fish or wildlife.

To determine the dangers of drift, read the label on the package. Follow the same restrictions for insecticide and miticide drift as for direct application of the same materials to food crops. For dangers of fish and wildlife poisoning from insecticides, fungicides, and nematocides applied to water or areas other than crop lands, get information from your county conservationist.

Abbreviations used in this bulletin are:

WP means Wettable Powder

EC means Emulsifiable Concentrate

Insects and Damage

Control Instructions

Insecticides per acre

APHIDS (corn leaf aphid)

Populations come from southern migrations or possibly from overwintering eggs on winter barley. Greenish to greenish-blue aphids are found on stalks, tassels, silk, and in the curl of leaves.

Corn leaf aphids produce a sugary material called honeydew. Corn earworm moths prefer to lay eggs on honeydew-covered silk. Heavy aphid numbers destroy young corn silk, resulting in poor kernel set and often soft ears at harvest. Insect control may be needed under these conditions.

Cool nights and warm dry days bring on high aphid populations. High humidity is a detriment to them.

Apply insecticide when the first tassels appear, but no later than when the first ears silk.

NOTE: When possible, plant aphid-resistant varieties.

Malathion Spray—Use 1½ pints of 5 lbs. per gallon EC or 4 lbs. of 25% WP.

Malathion dust—Use 30 lbs. of a 5% material.

Aircraft application—Use malathion, 1½ pints of 5 lbs. per gallon EC in 1 gallon of refined fuel oil or 2 gallons of water per acre.

WARNING:—Use malathion only as directed or no closer than 5 days before harvest. Use only one malathion formulation at a time.

NOTE: Other phosphate-type insecticides control corn leaf aphid. They are not suggested for use because they are generally more hazardous and often kill more aphid parasites than malathion.

ARMYWORMS (both true and fall types)

True armyworm larvae are usually dark-green and up to 2 inches long when mature. They have single white stripes on the sides and back; the back stripe is broken (discontinuous), especially toward the tail end.

The fall armyworm ranges from black to green to yellow. Three narrow, yellowish-white lines run down the back from head to tail. The fall armyworm has larger body hairs than the true armyworm, and the tubercles at the base of the hairs are darker and more prominent in the fall armyworm. The inverted Y on the head of the fall armyworm is also more prominent. The feeding holes of the true armyworm are ragged (irregular), those of the fall armyworm, smooth.

Neither of these insects overwinter in Michigan. They migrate from the south and southwest in summer.

The true armyworm feeds only at night and during cloudy days; the fall armyworm feeds both day and night. The true armyworm hides during the day under weeds, clods of soil, and at the base of corn plants. Because of this, control is hardest for this insect.

Both insects have marching habits; hence their common names—true armyworm and fall armyworm.

Eggs are often laid in lodged grains, especially in shaded and moist areas. For this reason, armyworms often invade corn fields from near-by wheat and oat fields.

The fall armyworm lays eggs on the leaves of grasses and other plants. Infestations originate right in corn fields.

Suggestion for applying the treatment—If insects are marching (moving from small grains to corn) apply the spray to the margins of the corn fields and also directly on the corn. Get specific instructions for use on small grains.

NOTE: Not all insecticides control armyworms equally well or to the same extent with each new infestation.

Dieldrin—Use 2¼ pints of 1.6 lbs. per gallon EC. Apply to margins of corn fields (if the insects are known to be marching) and directly to the corn.

WARNING:—Stop using dieldrin 60 days before harvest or cutting for ensilage.

Parathion—Use 1 pint of 2 lbs. per gallon EC. Apply directly to the corn. Read label for other instructions on how to use parathion safely.

WARNING: Stop treatments 12 days before harvest. Parathion should be applied only by an experienced operator.

Toxaphene—Use 2½ pints of 6 lbs. per gallon EC.

Do not feed toxaphene treated forage to dairy animals or animals being finished for slaughter. No limit for use on grains.

BILLBUGS

These large beetles measure from ¾ to ¾ inch. In the adult the mouth parts are at the end of a long curved snout or beak. The beak may be as much as one-half the length of the rest of the body.

Adults feed on young corn plants still in the whorl stage. When the leaves in the whorl unfold, rows of holes are seen across the blade of the leaves.

Their damage to corn consists of twisted leaves on young plants, stalk tunneling and feeding by grubs.

A number of cultural practices help reduce damage to field corn by the maize billbug, the curlew, and other billbugs. They are:

1. Crop rotations (planting other crops than corn).
2. Elimination of weeds, especially sedges and grasses.
3. Proper soil drainage.
4. Clean fall plowing, if practical.
5. Planting in a well-prepared seedbed to get rapid germination and growth of the crop.

Chemical control of billbugs is not practical at this time. See the suggestions in the column on "Control Instructions."

NOTE: If billbugs and flea beetles are bothering the same field, use dieldrin as suggested for flea beetles, or the chemical can be used for billbugs alone.

WARNING: Follow the same restrictions for billbugs as given for the use of dieldrin on flea beetles.

CEREAL LEAF BEETLE

This insect is new to Michigan. The immature form is found mainly on cereals, other than corn. It is sluglike and covered with a dark slime-like material.

Adults are about 3/16 inch long; the head and wing covers are bluish-black; the legs and body region just behind the head are red.

So far in Michigan the cereal leaf beetle has not laid eggs on field corn to any extent. Hence, only adult feeding damage occurs, usually in July. This consists of long narrow feeding areas between the veins of the leaves.

Adult feeding may go through the entire leafy tissue.

Larvae leave the lower epidermis or skin of the plant intact.

Chemical control of the insect is not now advisable because adult cereal leaf beetle feeding on field corn comes early in the growth of the crop and does not last very long. As plants reach the tasseling stage, they grow rapidly out of any feeding damage by the insect. Good soil fertility, accompanied by sufficient moisture, helps the plants do this.

Insects and Damage**Control Instructions****Insects and Damage**

EUROPEAN CORN BORER

The moths have a wing expanse of about one inch. Females are light brown with dark wavy bands across the narrow part of the front wings. Males are noticeably darker (almost olive) than the females and are much harder to identify correctly.

Eggs of the first brood are laid in scale-like clusters on the underside of the leaves, primarily in June. Second brood eggs are laid on the flag leaves of the ears, usually in August. The center of single eggs in the cluster become darker as incubating larvae reach hatching time.

The eggs hatch in about a week into dark-headed worms which for about 10 to 14 days live in silks, tassels, beneath husks, between the stalk and the ear, and if the corn is young enough, in the whorl without boring to any extent into any of these plant parts.

At the end of this period, the half-grown worms start their true boring habits by first mining through the veins of the leaves, and advance into the stalks, tassels, and ears.

The full-grown worm is nearly 1 inch long, pinkish, with round brown spots on the body.

It normally does not pay to treat for the borer until an average of one caterpillar is found in each corn stalk in a field. (The average of 100 caterpillars to 100 stalks of corn can be made up of a situation where some plants are infested with more than one borer and others not at all). This amount of infestation reduces yield about 3 percent.

NOTE: In recent years, the number of corn borer larvae per stalk of corn has been less than 1/2 borer in most Michigan fields.

Heavy leaf feeding does not always result in severe borer numbers in the stalks. Hence, yearly inspection of your fields will indicate the need for treatment.

More important than even this is to check the hybrid currently planted for corn borer resistance.

Cultural practices—A number of practices (other than the use of chemicals) can be used to help control European corn borer.

They are:

1. Plant resistant hybrids.
2. Before May 15, bury by deep plowing all cornstalks and weeds (disking and shallow plowing are not satisfactory).
3. Rotate crops (the worst corn borer damage usually comes on corn planted year after year on the same land).
4. Ensilc corn (this destroys the borers except those left in the field. Hence, cut stalks as low as possible).

Suggestions for applying the treatment:

Use it when 75% of the plants show leaf feeding in the whorl (usually between June 15 and July 1), or when one egg mass per plant is on the flag leaves in August. August is the beginning of the second brood.

Apply only one of the following insecticides per acre.

DDT ground spray—Use three quarts of 2 lbs. per gallon EC, or three lbs. of 50% WP.

DDT granules—Use 1 1/2 actual lbs. of chemical per acre. Apply over the row (into the whorl) with a granular applicator.

WARNING: Do not apply DDT sprays or dusts to corn fodder that will be fed to livestock or dairy animals.

Note: DDT does not contaminate the grain. Fodder treated with DDT granules can be fed to animals within 90 days of slaughter, but not at all to dairy animals.

EPN ground spray—Use one pint of 4 lbs. per gallon EC or 2 lbs. of 25% WP.

EPN granules—Use 15 lbs. of 5% granules. Apply over the row with a granulator applicator.

WARNING: EPN can be used up to 14 days before harvest, but observe the proper time to treat for the borer which is much longer before harvest than the 14 days of restriction on EPN.

Carbaryl (Sevin) ground spray—Use 3 lbs. of 50% WP.

WARNING: Do not apply carbaryl contact to harvest than 7 days. But 7 days before harvest is too late for control of corn borer.

CORN EARWORM

The corn earworm, has a wing expanse of 1 1/2 inches. On the moths, a single dark-curved spot occurs near the central front margin of each fore wing. The hind wings have each a rounded light yellow area or window near the tip, surrounded by brown or olive green color.

The larvae are thick set, rough skinned, greasy in appearance, and from yellow to green to gray or brown. When mature they may reach 2 inches long and have alternating dark and light stripes running lengthwise of the sides of the body.

This insect does not over-winter in Michigan. It is brought to the state usually during periods of hot dry winds out of the West or Southwest. Fresh corn silk is preferred for egg laying. Hence, field corn silking after August 15 is more apt to be damaged than that silking before this time.

Because armyworms, fall armyworms, and corn earworms are in the same insect family, the larvae resemble each other. For information concerning armyworms, turn to those Sections.

Chemical control of this insect on field corn is impractical. If the insect is bothering enough to warrant attention to it, plant corn early or plant varieties which silk before August 15.

CUTWORMS

The larvae cut young corn plants off close to the ground. At night greasy, gray, gray-green, brownish, or black, thick-set, often striped worms come to the soil surface and feed. In the daytime they hide below the surface of the soil often several inches away from severed plants.

Apply treatment to the soil surface as soon as damage is noticed and preferably in the afternoon or early evening.

Use either dieldrin or toxaphene as suggested for armyworms. Follow all use restrictions given in that Section.

Insects and Damage**Control Instructions****Insecticides per acre****FLEA BEETLE**

The corn flea beetle is probably the most damaging of this type of insect to field corn. It is a small, round, black, brown, or grayish jumping beetle. It carries the organism that causes bacterial wilt of corn. Other flea beetles on corn are: (1) sweet potato flea beetle; (2) pale striped flea beetle; (3) smart flea beetle.

Adult flea beetles eat small holes in the leaves. If not controlled, eventually the whole plant looks bleached or scorched.

Keeping fields free of weeds is important to flea beetle control. Rapid germination and growth of young plants also help reduce flea beetle numbers.

DDT—Apply 1 to 3 applications, 5 to 7 days apart, beginning as the plants emerge.

Dieldrin—Apply to small corn plants.

DDT spray—Use three pints of 2 lbs. per gallon EC or 3 lbs. of 50% WP.

DDT dust—Use 30 lbs. of a 5% material. Apply only one DDT formulation at a time, and only as directed.

WARNING: Do not apply DDT to corn fodder to be fed to livestock or dairy animals. No restriction on grain for food or feed.

Dieldrin spray—Use 2½ pints of 1.6 lbs. per gallon EC or 1 lb. of 50% WP.

Dieldrin dust—Use 35 lbs. of 1½% material.

Apply only 1 dieldrin formulation at a time, and only as directed.

WARNING: Fodder treated in this way with dieldrin can be fed to dairy animals and beef stock, providing no treatment is applied closer than 60 days of harvest or cutting for ensilage.

NORTHERN CORN ROOT WORM

The adult is about ¼ inch long, and light green to yellowish-green. It is readily found in silk in July.

The larva is thread-like and about ½ inch long when mature. It has a slightly wrinkled skin, a yellowish brown head, with six small legs on the under part of the body. It is found in the soil around the roots. Small roots are destroyed and the larger ones tunneled by the larva.

Infested plants are often undersized and frequently lodge after a heavy rain or wind.

Affected plants can easily be pulled from the ground and the stalks are often bowed or bent.

Adult beetles feed on silk of corn and the pollens of this and other plants. Beetles are very numerous at times and their feedings may result in deformed and smaller ears, due to pollination failure. Corn is the preferred host.

The following summary on the life history of the northern corn root worm will help understand it:

Eggs are deposited in late summer and early fall (late August, September and October) in the ground around the roots of corn and seldom in any other situation. They hatch late the following spring. Larvae (worms), reach maturity during late June. The worms change to the adult in the soil during early July and the adults are active usually after mid-July.

Research in Michigan shows no or little resistance as yet to such insecticides as aldrin and heptachlor. These materials provide better control than phosphate chemicals suggested where resistance is a problem. For these reasons, Michigan growers are encouraged to use aldrin or heptachlor until specific problems with control arise.

Because corn is the only important food of this insect, planting corn-after-corn for a number of years on the same land increases the possibility of damage. Thus the simplest means of control is to avoid planting corn two years in a row on the same land.

NOTE: Continuous use of aldrin or heptachlor without need only creates an unnecessary northern corn root worm resistance situation.

If rotation is not possible, or practical, use an insecticide at planting time as follows:

(1) Band treatment:

Apply aldrin or heptachlor at the rate of 1 lb. of actual toxicant to the acre in a 6 to 8 inch band just above the seed (5 lbs. of 20% or 10 lbs. of 10% granulated material). This can best be applied with specific application equipment. In one operation, bury the control material at least ½ inch into the soil, but not on the seed.

(2) Broad cast treatment:

For an alternative method, use 3 actual lbs. of heptachlor or aldrin to an acre. (Emulsion, wettable powder, dust or granular formulations can be used as the source of the 3 actual lbs.).

Apply evenly to the surface of the soil and disk or spring tooth 3 to 4 inches deep (no more), immediately after application.

The broadcast treatment is not preferred to the banding method.

WARNING: Use the treatments as directed. Band application of less than 6 to 8 inches, normally is less effective. When insect numbers are heavy, poor application methods usually result in less control.

SAP BEETLES

(also called picnic beetles)

Small flat-appearing beetles with four red or yellow spots on the upper or hard wings. The antennae have single clubs at the tips. These insects feed primarily on the exuding sugary juices of ripening fruits, vegetables and damaged tissues of other crops, including field corn.

In field corn, the sap beetle feeds in tunnels made by the European corn borer, and in silk on the honeydew secreted by aphids. Normally this pest indicates other insect problems rather than damage done by itself, although the dusky sap beetle damages the ears directly.

Control instructions are not given because of no clear cut evidence of what the sap beetle problem is on field corn in Michigan.

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SEED-CORN MAGGOT

Larvae of this insect bore into corn seed. The damage prevents sprouting or produces sickly plants.

The maggots are about $\frac{1}{4}$ inch long, dirty to yellowish white, and have pointed heads.

Soil Preparation—Cold, wet weather favors this insect. Plow fields top dressed with manure and organic materials to avoid attracting flies.

If possible, buy insecticide-fungicide treated seed. However, seed can be treated with the damp-seed or slurry method. (See Appendix, Extension Bulletin 312 for instructions on how to use the slurry seed treatment). Both the damp seed and slurry methods are preferred to a dust treatment.

Dieldrin—If treated seed cannot be bought, do the following: Use 1 ounce of 50% WP plus 2 ounces of 50% Thiram or 50% captan to 100 lbs. of seed.

Place 100 lbs. of seed in a cement mixer or other suitable mixing equipment. Spray the seed lightly with water and then add the dieldrin and Thiram or captan. Dry the seed before bagging or planting.

For a dry dust seed treatment use the chemicals without the water.

WARNINGS: Do not use treated seed for food or feed or sell it. All seed treated with a poison must be dyed pink (or with some color that indicates the seed has been treated) before it is sold. Seed already treated when bought should not be treated again. Determine this before using the instructions in this column. If a fungicide has been used but not an insecticide, then use only the insecticide.

SLUGS

They are slimy, fleshy, and grayish or brownish in color. Their bodies have no segmentation and no legs. They crawl by elongating and contracting their bodies which may be up to 3 inches long when mature.

Slugs are readily identified by the slime trails they leave while crawling over the ground and plants. Plant damage by slugs consists almost entirely of feeding on the leaves. Three types of this occur: (1) round holes eaten in the leaves; (2) large patches of outer leaf tissue removed; (3) riddling or feathering of the corn leaves. This latter condition is usually the most severe because the leaves turn brown.

Since slugs injure field corn during wet periods in the early part of the growing season, either they or their damage is usually not seen until after it is done. Hence, slug damage is not correctable in most cases.

Slugs on field corn are not a yearly problem, occurring only occasionally.

Soil drainage and clean cultivation help materially in reducing damage done by the pest.

No suitable chemical is now available for control of this pest on field corn.

WIREWORMS AND WHITE GRUBS

Wireworm larvae are up to $1\frac{1}{2}$ inches long, wire-like in appearance and brown or reddish brown. The smooth skin is tough, leathery, segmented.

Wireworm larvae damage newly-planted seeds, preventing them from coming up; they also injure the growing crop, especially in the early stages. The adults are click beetles. They get the name from the ability to flip from a position on their backs to their feet. They are brownish, blackish, or grayish with the body tapering slightly at both ends.

Soil treatment—Apply one of the materials evenly to the surface and spring tooth or disk immediately into the top four inches of soil. Seed treatments will not satisfactorily control heavy wireworm populations in field corn.

Use preplant treatments only (treatments applied after seeding are not generally successful).

Apply only one chemical as follows:

Heptachlor—for sand, sandy loam or light mineral soils. Use 12 lbs. of 25% WP or $1\frac{1}{2}$ gallons of 2 lbs. per gallon EC.

Use 5 actual lbs. of heptachlor for muck or peat soils.

Dieldrin—for sand, sandy loam, or light mineral soils. Use 6 lbs. of 50% WP or $2\frac{1}{2}$ gallons of 1.6 lbs. per gallon EC per acre. Double this amount for muck soils.

Aldrin—for sand, sandy loam or light mineral soils. Use 12 lbs. of 25% WP or $1\frac{1}{2}$ gallons of 2 lbs. per gallon EC.

Double this amount for muck soils.

WARNING: USE HEPTACHLOR, DIELDRIN OR ALDRIN ONLY AS DIRECTED FOR WIREWORMS AND WHITE GRUBS.

WHITE GRUBS

The grubs are white with brown heads and curved bodies. They are $\frac{1}{4}$ to $1\frac{1}{4}$ inches long and feed on the roots of corn.

Other publications dealing with corn production are: Bulletin 436, Corn Hybrid Selection and Cultural Practices; Bulletin 437, Fertilization; Bulletin 438, Weed Control; Bulletin 440, Disease Control; and Bulletin 441, Harvesting and Storing.