

# AGRICULTURAL GUIDE

Published by the University of Missouri-Columbia Extension Division

MAR 03 1983  
Insect Control

## 1983 Control of Wireworms and Other Corn Soil Insects

George W. Thomas, Armon J. Keaster, and  
Judy A. Grundler,  
Department of Entomology  
College of Agriculture

**Note.** Refer to UMC Guide 4150 for 1983 Corn Cutworm Control information, to Guide 4151 for 1983 Corn Rootworm Control information, to Guide 4906 for Soil Insect Pest Control In Reduced Tillage Cropping Systems, and to Picture Sheets, numbers 4 and 5 for insect identification.

This guide recommends management practices and insecticides for reduction of the following corn soil insect pest problems: wireworms, white grubs and annual grubs, billbugs, sod webworms, seed damaging insects, bird and rodent damage to seed and seedlings and insect pest control in no-tillage sod plantings.

### Wireworms

Some 12 to 14 species of wireworms are known to attack corn in Missouri; however, only six species are considered major pests. Wireworms have been gradually increasing in both numbers and average size of larvae during the past seasons. They are expected to cause even more injury in 1983.

Wireworms cause three types of injury to corn:

- They cause poor germination by eating the germ and hollowing the remainder of the seed.
- The larger wireworm larvae bore into the underground stem just above the roots, and once the growing point is destroyed, the plant withers and dies.
- During the remainder of the season, wireworm larvae feed on the smaller, more tender roots of the corn plants.

Wireworms are most apt to be problems on corn following long-standing meadows, pastures, small grains, and forage sorghums.

No postemergence wireworm controls are available. Therefore, if control efforts are necessary, they must be used before or at planting time.

#### Determining need for control

Populations of any insect pest whose damaging stage occurs only in the soil are hard to detect and even harder to evaluate. A workable method for evaluating wireworm potential before planting time is available. This is a modified system of baiting.

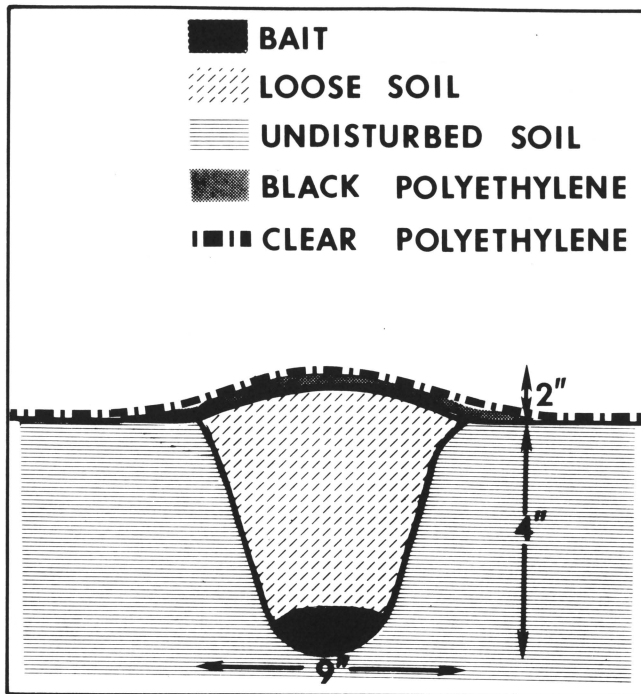
Establish bait stations two to three weeks before anticipated planting date, especially in those fields following grasses, small grain stubble and forage sorghums. Since heavy numbers of wireworms can occur in relatively small and scattered areas throughout the field, randomly locate these bait stations at the rate of two stations per acre. Be certain to bait any grassy spots in the field and any areas where wireworms caused injury last season. Establishing five to 10 bait stations per field is practical. Use more stations when the field size exceeds 25 to 30 acres.

According to the diagram on the next page, dig each bait station about 4 inches deep and about 9 inches wide at the soil surface. Place ½ cup of an equal mixture of untreated corn and wheat into the bottom of each station. Fill and slightly mound each station with soil. Cover each mound with an 18-inch square piece of black polyethylene or similar black plastic. Cover this sheet with a 1-yard square sheet of clear polyethylene or similar clear plastic. Cover the edges of plastic with soil to prevent wind damage. The plastic serves to increase soil temperature, thus allowing for more rapid germination of bait.

A few days before planting, remove the plastic and soil covering the bait, and count the number of wireworm larvae found within and around the bait. Record the number of wireworms found at each station. You may then determine the wireworm population per acre or for the field from these recorded figures. An average of *one* wireworm per bait station signifies an economic infestation.

#### Insecticidal control

No post-planting or post-emergence insecticidal control for wireworms is available because there is no way to mix the insecticide with the soil at the depth at



**Cross Section Of A Wireworm Solar Bait Station**

which wireworms feed. Therefore, if control efforts are needed, they must be employed before or at planting time.

**Preplant, broadcast, incorporated application.** Because the older chlorinated hydrocarbon compounds have been cancelled, this application method has practically been eliminated.

Insecticides currently registered for this method of application include chlorpyrifos (Lorsban 4E) at the rate of 2 pounds active ingredient per acre; diazinon (50W, 14G and AG500) or fonofos (Dyfonate 4E\*) at the rate of 4 pounds active ingredient per acre; and ethoprop (Mocap 10G and 6 EC\*) at the rate of 6 pounds active ingredient per acre. Unless they are used for cutworm control, the cost of these increased dosage rates make them economically impractical for most corn producers.

**Application at planting.** Where economically damaging populations of wireworms are known to occur or have been found using the baiting technique, application at planting time is the best and easiest method of control.

**In-furrow application.** It provides better control than row-band application. Use any of the following rates of formulated product per 1,000 feet of row:

- Carbofuran (Furadan 10G at 12 ounces or 15G at 8 ounces).
- Chlorpyrifos (Lorsban 15G at 16 ounces). Some of this dosage should be placed in open seed furrow.
- Terbufos (Counter 15G at 8 ounces).

**Row-band application.** Use any of the following rates of formulated product per 1,000 feet of row:

- Carbofuran (Furadan 10G at 12 ounces or 15G at 8 ounces).

- Chlorpyrifos (Lorsban 15G at 16 ounces).
- Ethoprop (Mocap 10G at 12 ounces).
- Fonofos (Dyfonate 10G at 12 ounces or 20G at 6 ounces).
- Isofenphos (Amaze 20G\* at 6 ounces).
- Terbufos (Counter 15G at 8 ounces).

**Do not** place either fonofos or ethoprop in the seed furrow or allow granules to contact the seed.

**Seed treatment.** One way producers can protect seed from destruction by light to moderate numbers of wireworms and other seed-damaging insect pests is to add a seed treatment insecticide to all corn seed planted before mid-May. However, seed treatment protects only the seed and will not protect the seedling following germination.

Mix the seed treatment insecticide thoroughly with the seed so each kernel is covered before putting seed in the planter box, or follow label instructions for planter box application. Use either 1.5 ounces actual diazinon formulated with graphite, 1 ounce actual lindane as a seed treater formulation per bushel of seed, or have the seed slurry treated with Lorsban 25SL.

These dry seed treatment formulations do not perform satisfactorily in planters with air metering devices. Therefore, if you use seed treatment insecticides with these types of planters, you must have the seed commercially slurry treated. For commercial seed treatment, use either chlorpyrifos (Lorsban 25 SL) at the rate of 4 ounces formulated product per 100 pounds seed or at the above dosages of diazinon or lindane per bushel of seed.

## White Grubs and Annual Grubs

Numerous species of white and annual grubs may be pests of the corn root system, or they can be found in the vicinity of the roots. Determining the species of grubs is difficult. Some of the major differences in these grubs would be the number of years spent in the larval or root-damaging stage, size of the mature grub, and their primary host preferences.

White grubs (*Phyllophaga spp.*) spend from two to three years as larvae in the soil. As the name implies, the annual grubs complete a single generation each year. They are in the larval stage during early spring and again during late summer, fall, and winter. All of these grub species prefer to feed on the roots of grasses, and the majority of eggs are deposited in grasslands and grassy spots in fields.

Current tillage and other soil management practices provide little relief from white grub problems. Similarly, insecticides for this problem are noticeably lacking. Only four products are registered for this purpose.

**Preplant, broadcast, incorporated application.** On first-year corn following long established sod or for known infested spots within fields, use either chlor-

pyrifos (Lorsban 4E) at the rate of 2.0 pounds or ethyl parathion\* at the rate of 3 to 6 pounds active ingredient per acre. Apply and incorporate immediately before planting.

**Row-band application.** At planting time, use either isofenphos (Amaze 20G\* or 6 EC\*) at the rate of 6 ounces of granules or 1.6 fluid ounces (EC) per 1,000 feet of row or terbufos (Counter 15G) at the rate of 16 ounces formulated product per 1,000 feet of row.

**In-furrow application.** At planting time, use chlorpyrifos (Lorsban 15G) at the rate of 16 ounces formulated product per 1,000 feet of row.

## Billbugs

These large, adult **snout beetles** or weevils were numerous and widespread in seedling corn fields during the past two seasons. Foliar feeding signs, although largely insignificant, were found in a high percentage of fields during the first four to six weeks of corn growth.

There are three or four species of billbugs causing injury to corn. Billbugs overwinter in the adult stage, usually in or under debris or in the soil. These beetles leave their hibernation quarters by the time the average temperature reaches the level at which corn germinates rapidly. They move on foot into fields or areas having established sedges, reeds, or grasses with bulbous root systems. Adults feed by inserting their snouts or beaks into the lower stalk or stem of the host near the soil line. They eat the tissue beneath the point of puncture.

Although most plants continue to grow, billbug presence is shortly evidenced by the appearance of a row of oval to oblong holes across the leaf blade. Each row of such holes is the result of a single puncture that occurred while the leaves were tightly rolled up within the young plants.

Eggs are deposited within the feeding punctures. Larvae feed within stalks, crowns and bulbous root systems of host plants. In the midwest, corn is not a preferred host for egg deposition, and rarely will you find larvae within stalks. Larvae feed for two to three months, pupate in soil near the host plant, and adults of most species emerge during September. Billbugs produce a single generation annually.

Normally, billbugs feed upon only a small percentage of young corn. There are usually only one or two punctures per plant. However, there are times when billbugs feed heavily on first-year corn at the two- to four-leaf stage growing in low, wet bottoms or following timothy. At these times, plants are deformed, they sucker badly, or they die when the growing point is destroyed.

Traditionally, control involves cultural practices, destruction of sedges and reeds and preplant incorporation of high dosages of chlorinated insecticides. However, these methods have all been used with varying degrees of success. A single corn rootworm

insecticide is now registered for control of this problem. This insecticide is chlorpyrifos (Lorsban). As a pre-plant, broadcast, incorporated application, use 13 pounds Lorsban 15G per acre. As no-till, in-furrow at planting, use 16 ounces Lorsban 15G per 1,000 feet of row. As an early postemergence spray, use 1.0 to 1.5 pounds Lorsban 4E per acre applied to give thorough plant and soil coverage.

## Sod webworms

During recent years, mixed populations of several species of webworm larvae have become serious pests of seedling corn following fescue sod. Only the generation overwintering as partially grown larvae damage corn.

Larvae may chew into a leaf from the margin, cut one or more entire leaves, or cut off individual plants near the surface of the soil. Examination around the base of damaged plants usually will show a small hole in the soil leading to a thin, silken web lining a narrow tunnel which extends several inches downward. A tannish-gray larvae with six black spots on each segment of the abdomen may be found in this tube along with bits of leaves, plants and frass.

### Management practices

Avoid planting corn on spring-plowed fescue sod. Fall-plow fescue sod if soil conservation practices permit. If replanting becomes necessary, plant between the rows, leaving remaining old stand undisturbed.

### Insecticidal control

Although several insecticides probably would do an acceptable job of controlling webworm larvae, only one registered product was considered practical for field use. That product was toxaphene, and this use has now been cancelled by EPA. Therefore, there is currently no insecticide labeled for control of this pest.

## Seed damaging insects

The more common insects infesting corn seed in the soil include seed corn maggot, wireworms, seed corn beetle, and slender seed corn beetle. Depending upon the intensity of other corn soil insect pests in a field, a seed treatment insecticide may be the only soil insect control needed.

A seed treatment insecticide is beneficial when added to all corn seed planted before mid-May because it helps protect the more slowly germinating seed. Reduced tillage practices which leave crop residues either on or very near the soil surface tend to increase the problem with both seed corn beetle and maggot.

These seed-damaging insects may also be controlled under favorable performance conditions by a

row-band application at planting time of any of the organophosphate rootworm insecticides.

Over the northern third and east-central areas of Missouri, both the seed corn maggot and the slender seed corn beetle have developed resistance to the chlorinated hydrocarbon insecticides. In these resistant areas, use 1½ ounces active ingredient diazinon seed treater formulated with graphite per bushel of seed. Elsewhere, use either this dosage of diazinon or 1 ounce active ingredient lindane seed treater per bushel of seed. Follow label directions for mixing with seed.

These dry, seed treatment formulations do not perform satisfactorily in planters using air metering devices. Therefore, if you use seed treatment insecticides with these planters, you must have the seed commercially slurry treated. For commercial seed treatment, use either chlorpyrifos (Lorsban 25SL) at the rate of 4 ounces formulated product per 100 pounds seed, or the above dosage of diazinon or lindane per bushel of seed.

Commercial slurry treatment of seed should be performed as near to the time of planting as possible. **Don't use insecticide treated seed for any purpose besides planting.**

## Bird and rodent damage to seed and seedlings

Corn planted within a radius of several miles of blackbird roosting areas is often damaged by birds digging up the seed or pulling up the germinating seedlings. Several fields have been damaged to the point of replanting one or more times. Also, small rodents, particularly meadow and deer mice, frequently cause severe stand loss in no-till sod plantings and around the margins of fields bordering heavy grasslands.

There is a single, state, local needs, registered seed treatment product used for repelling both blackbirds and mice. This product, registered for use on field, pop, and sweet corn seed, is MesuroI\* 50% Hopper Box Treater. Use it at the rate of 1 pound of the formulated product per 100 pounds seed or 9 ounces per bushel.

**Caution:** This product may be phytotoxic (injurious) to corn seed under cool, wet, slow germinating conditions. Refer to the paragraph under *Seed Damaging Insects* for a statement regarding planters with air metering devices.

## Insect control in no-tillage sod plantings

This method of planting often results in severe stand losses from mice, cutworms, armyworms, stalk borers and several other pests. With this method of planting,

the choice of soil insecticides and their method of application is limited. Several of the rootworm insecticides should not be used with this planting method because:

- They are not registered for this type of planting application.
- They should not be placed in the seed furrow in contact with the seed.
- Incorporation provided by most no-till planters is inadequate for effective results.

Soil moisture and tillage should allow the planter to completely close or cover the seed furrow. Otherwise, the insecticide remains exposed and may create an environmental hazard.

Three of the rootworm insecticides, carbofuran (Furadan), chlorpyrifos (Lorsban), and terbufos (Counter) are presently registered for use with this specific planting method. These insecticides are recommended only where soil tillage is such that the seed and granular insecticide can be covered completely with soil immediately after application.

Don't expect any of these insecticides to adequately control all of the soil and seedling insect pests associated with no-till sod planting. Only wireworms and rootworms appear on the labels of all three insecticides, and rootworms should not be a problem the first year following sod. Each of these insecticides claim control or reduction of damage from a varying list of insect pest problems. Some advantages for each of these insecticides are:

1. Carbofuran (Furadan) provides better postemergence control of certain seedling pests, including armyworm, flea beetles, and some reduction of billbugs and stalk borer.
2. Chlorpyrifos (Lorsban) provides protection from seed corn maggot, seed corn beetle, grubs, and some reduction of cutworms and billbugs.
3. Terbufos (Counter) provides protection from seed corn maggot and some reduction of grubs and billbugs.

Place the granular formulation of the insecticide of your choice directly into the seed furrow at the time of planting at the following rates per 1,000 feet of row: carbofuran at 24 ounces Furadan 10G or 16 ounces Furadan 15G; chlorpyrifos at 16 ounces Lorsban 15G; or terbufos at 16 ounces Counter 15G. None of these rates are known to result in any germination problems.

### Pre-plant or pre-emergence cutworm control

Experience indicates that acceptable cutworm and armyworm control can be obtained with toxaphene, or a tank mix of paraquat\* and toxaphene plus a non-ionic spreader. Use toxaphene at the rate of 3.0 pounds active ingredient per acre. Always check compatibility with each mixture of pesticides and with

each carrier (water, liquid fertilizer, etc.) in accordance with supplemental labeling information.

By combining two or more of the pre-plant or pre-emergence, no-till sod planting operations, you will save petroleum energy by eliminating one or more trips across the field. The key to cutworm control success with toxaphene in this situation is **thorough coverage** of all of the grassy vegetation. Depending upon the carrier and amount of vegetation, coverage will require from 20 to 60 gallons per acre. Failure to obtain adequate coverage of vegetation frequently results in reduced performance of one or both of the pesticides.

There are also some disadvantages involved with the use of toxaphene for cutworm and armyworm control in no-till sod plantings.

1. Do not use toxaphene on dairy farmland.
2. The use of toxaphene-treated corn for forage purposes is restricted. Do not allow dairy animals to graze stover. Remove meat animals from access to

treated stover four weeks before slaughter. These restrictions do not apply to the harvested grain.

3. Use does not contribute appreciably to the control of many of the other insect pests associated with no-till sod planting.
4. Since terrain used for no-till sod planting of corn often is rolling or has appreciable slope, heavy rains occurring shortly after toxaphene application may result in runoff, water contamination and fish kill.

Toxaphene is subject to EPA cancellation. Such action would leave no product labeled for broadcast, preplant cutworm control in no-till sod plantings.

#### Seed treatment

Those producers using no-till sod planting of corn should use a seed treatment insecticide where no insecticide application is made at the time of planting (See section under *Seed Damaging Insects*).

\*An asterisk (\*) following any insecticide means that all or some uses of the product have been restricted by the Environmental Protection Agency. Applicators must be certified and licensed before they may purchase restricted products.

Missouri insect control recommendations are revised annually and are subject to possible change during the growing season. Therefore, this guide is intended for use during the 1983 season only.

---

■ Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914 in cooperation with the United States Department of Agriculture. Leonard C. Douglas, Director, Cooperative Extension Service, University of Missouri and Lincoln University, Columbia, Missouri 65211. ■ An equal opportunity institution.