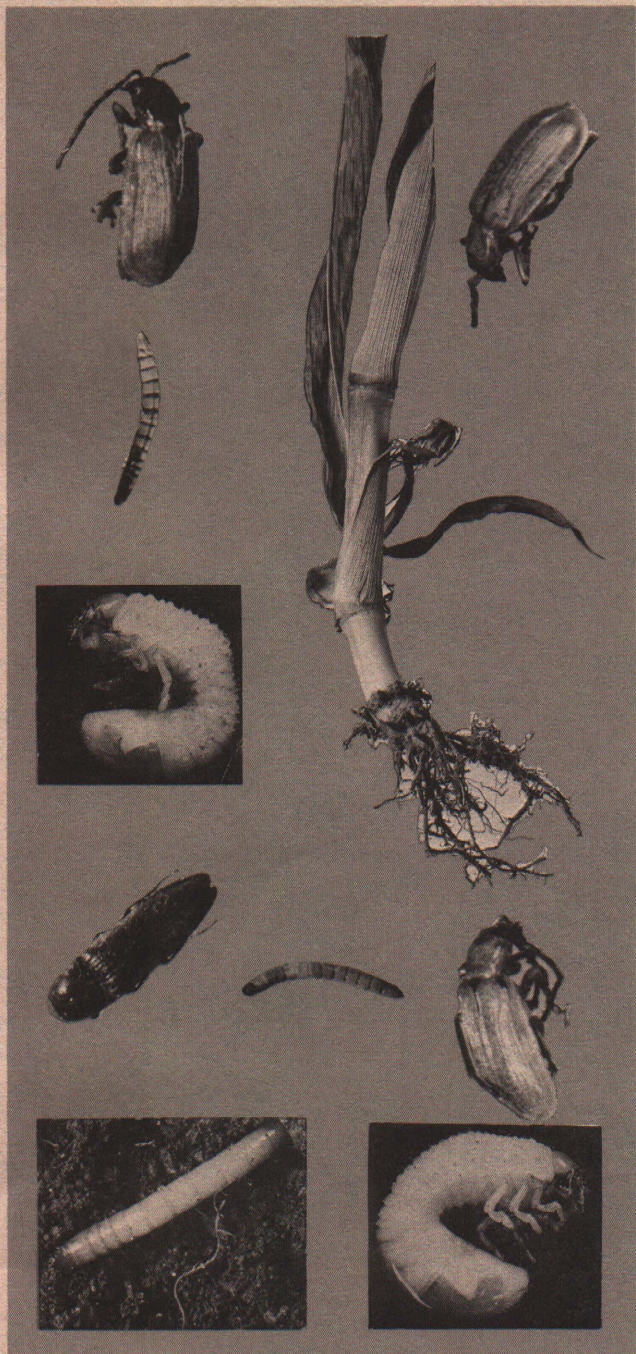


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# INSECT CONTROL

## IN FORAGES, FIELD CORN AND SMALL GRAINS



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# INSECT CONTROL

## IN FORAGES, FIELD CORN AND SMALL GRAINS

By Robert Ruppel and Ray L. Janes  
Department of Entomology

**I**NSECT CONTROL on forage (alfalfa, clover, pasture), field corn and small grains (barley, oats, rye, wheat) involves a number of different methods. 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 forage, field corn and small grain 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 alfalfa, clover, field corn, pasture, barley, oats, rye, and wheat.

### FOLLOW DIRECTIONS

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 forage and small grain crops, do not increase the recommended dosage. Measure all materials carefully.

*Apply chemicals 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 pesticide chemicals safely on forage and small grain crops.*

All 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. As changes occur, we will attempt to inform you through our regular channels of communication.

### WATER USE

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

When forage, field corn and small grain plants are small (up to 12 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 insect control in alfalfa, clover, pasture, barley, oats, rye, and wheat, except for spittlebugs, leafhoppers, and early infestations of aphids. The use of this equipment for field corn insects is even more limited than for the other crops listed herein. Grasshoppers are easily controlled with these sprayers, *providing the crop is short when the application is made*. Armyworms are extremely difficult to control under any circumstances with weed sprayers. Height of crop is an important hindrance to the use of the equipment.

Warnings about the use of the chemicals are in bold face type in the column "Warnings." Read these before using any insecticide.

To be able to prove that you followed label directions in your pest control program, keep a record of the pesticide, the formulations and the amount per acre, the date of application of each treatment, and date of harvest.

### PESTICIDE DRIFT

Pesticide drift from aircraft and ground equipment contaminates neighboring crops and premises. Hay and pasture crops are particularly exposed to pesticide drift from nearby fields. Chlorinated hydrocarbons\* are the most hazardous, although drift from some phosphate-type insecticides such as parathion must not be overlooked.

Since few chemicals are allowed on forage for all types of livestock and there is no allowance for any pesticide in milk, extreme caution must be exercised to avoid contamination of hay, pasture and clover. *Chlorinated hydrocarbons are especially dangerous since they store in animal fat and are secreted in milk for considerable periods of time.*

Where problems of pesticide drift exist, use only registered phosphate or carbamate insecticides on alfalfa, clover, pasture, barley, oats, rye, and wheat. Always read the label for instructions. If the name of a crop does not occur on the label, you can assume it is not registered for use on that crop.

For dangers of fish and wildlife poisoning from insecticides and nematocides applied to water or areas other than crop lands, get information from your county agricultural agent.

\* DDT, aldrin, dieldrin, heptachlor, lindane, benzene hexachloride, etc.

## PESTICIDE STORAGE AND CONTAINER DISPOSAL

Store all pesticide chemicals away from the reach of children (preferably locked up). A separate storage area (well marked with an appropriate sign) away from the home, barn, or tool shed is recommended. This protects firemen and other individuals in case of fire, for pesticide chemicals can create a smoke-fume hazard.

Carefully dispose of empty containers. The label for each pesticide can be a source of directions for proper and safe disposal of pesticide chemicals. Your county agricultural agent also has literature concerning this problem. For further information, get United States Department of Agriculture's publication, entitled "Safe Disposal of Empty Pesticides Containers and Surplus Pesticides."

## INTERPRETING DIRECTIONS

What is meant by the term "actual pounds" or "amounts of actual chemical" or "ingredients" per acre?

Insecticides and other pesticide materials are prepared commercially in varying strengths. Insecticide "A," for example, can be purchased in at least two

different strength dusts such as "4 percent," and "5 percent." Those terms simply mean that in every 100 pounds of commercial dust you purchase, the actual amount of insecticide chemical "A" is 4 or 5 pounds, respectively.

A suggestion for the control of a pest given in *actual pounds or ingredient* refers only to the *active or killing* part of the chemical formulation, and not to any other part. In this way, the amounts for any pesticide can always be specified accurately, regardless of manufacturers' relative strengths.

Again, taking insecticide "A": For a certain insect, the suggested control reads "1½ pounds of actual insecticide 'A' to the acre." This means that you could use either 37½ pounds of a commercial "4 percent dust" or 30 pounds of "5 percent dust" — and still have a correct application of only 1½ pounds of *actual insecticide chemical* to the acre. Or in the case of a "50 percent wettable insecticide 'A' powder," it would take only 3 pounds to make 1½ actual pounds, because each pound of the powder contains ½ pound of insecticide "A" chemical. In the case of emulsifiable concentrates, 1½ pounds of insecticide "A" would be contained in 3 quarts of a 25% liquid containing 2 pounds of active ingredient per gallon. Or in the case of granular insecticides, 1½ pounds of insecticide "A" would be contained in 15 pounds of a 10 percent formulation.

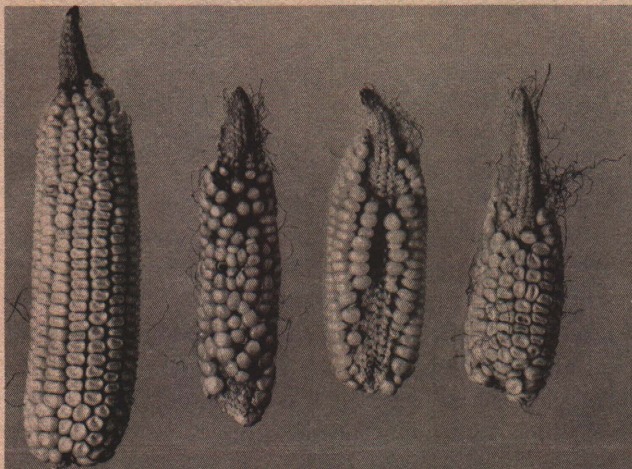
On pages 3-4 is a key to the important insect damage on forage, field corn and cereal crops.

### Abbreviations used in this bulletin are:

- WP means wettable powder
- SP means soluble powder
- EC means emulsifiable concentrate
- SC means suspension concentrate
- D means dust
- G means granule



Corn billbug



These ears of corn have been seriously damaged by northern corn root worm, and indicate a serious economic loss.



Cereal leaf beetle damage (right); healthy, unfested plants (left).

## KEY TO INSECT DAMAGE ON FORAGE, FIELD CORN AND CEREAL CROPS

Place of Damage	Description of the Insects and Their Damage	Name of Insect and Crop Damaged
<b>SEED</b>	Seed fails to sprout or sprouted seedlings are weak and sickly. Often dirty-colored (yellowish white), legless, tough-skinned maggots are found boring in the seed. These have a pointed head and are ¼ inch long when mature. Most damaging in damp soils with high organic matter.	<b>Seed corn maggot</b> Other species of maggots may occur. Affects corn primarily.
<b>SEED AND ROOTS</b>	Seed fails to germinate; germ of the seed eaten or the seed hollowed, leaving sometimes only the coat. Roots may be cut off abruptly and young seedlings under these conditions may die completely, having the feel and appearance of well-cured grass. Smooth-skinned, dark-brown to yellowish, hard-bodied, wire-like worms (up to 1½ inches long) feeding on the seed or in soil surrounding the seed.	<b>Wireworms</b> Corn and wheat are most affected, but barley, oats, and rye are also damaged, especially if wireworm numbers are heavy.
<b>ROOTS BUT SELDOM SEED</b>	Small roots eaten; skin of larger roots stripped; larger root tips missing. Affected plants may show considerable stunting compared with undamaged plants in the same field. A noticeable yellowing of plants often accompanies the stunting. Unusual for stalks to be elbowed. Large (up to 1½ inches long), white-curved grubs with brown heads and legs, may be found in the soil.	<b>White grubs (June beetles)</b> Corn and cereal crops damaged, especially following sod.
<b>SEEDLINGS</b>	Seedlings showing various symptoms of stunting malformations and "lack-of-water" conditions. Seedling corn plants with the outer leaf curled over or keeping the other leaves from unfolding properly; plants usually stunted (a common symptom of too deep planting). For other problems, see the sections on "Seed," "Seed and Roots," and "Roots but Seldom Seed."	<b>Too deep planting</b> , especially of corn. Seed corn maggot, wireworms, and white grubs can cause this symptom also. But with these, identify the damage by other symptoms.
<b>PLANTS AT SOIL LEVEL</b>	Dead and wilted plants occur in stretches of rows or over the field in scattered spots, especially in the morning. Plants may be cut through at or near ground level. Thick-set, greasy appearing, curved-bodied, thick-skinned, yellowish, greenish, or blackish worms may be found near or up to a foot or more away from damaged plants. These insects are usually found buried at least an inch in the soil during the day. They feed mostly at night and occur on the surface of the soil at this time.	<b>Cutworms (many kinds)</b> These insects are especially damaging to corn, and all forage and cereal crops are eaten under stress of food getting.
<b>FOLIAGE</b>	Long strips of plant tissue eaten between the veins (that is, up and down the leaves). When enough of this feeding occurs on such crops as oats (all small grains, except corn), the leaves of the damaged plants turn white at the tips, and upon drying turn rust-colored. The white-tipped condition is, for the most part, a blanching of the color in the leaves. In addition to the plant damage, black, slime-covered larvae and 3/16-inch long adult beetles (with metallic-blue-black heads and orange upper wing covers, legs, and front part of thorax) are found on the plants during April, May, June, and July.	<b>Cereal leaf beetle</b> Especially damaging to small grains, but only mildly so to corn, and no problem on alfalfa and clovers.
	Small (up to 1/12-inch long) light or dark green, greenish-yellow, or pinkish, long-legged, wingless or winged insects feeding in clusters on the underside of leaves, along the stems, in the buds, or on the tassel and silk of corn. Occasionally oat plants are whitened or blanched. A sticky substance called "honey-dew" is often present, especially when the insects are high in numbers.	<b>Aphids</b> Corn leaf aphid on corn, green bug on oats and other cereals, pea aphid on alfalfa and clover. Also other aphid species may be present.
	Alfalfa and clover plants showing loss of leaf size and shorter internodes. Leaf color tending to yellowish-green or yellow on alfalfa. Also the tip of alfalfa leaves burnt or "drought-scorched." This condition on clover turns the leaves red. Note: Drought conditions (especially on alfalfa) can give some of the same symptoms. Hence, insect damage must be associated WITH THE PRESENCE OF THE INSECTS.	<b>Potato leafhopper</b> (sometimes called the alfalfa leafhopper).

## KEY — CONTINUED

Place of Damage	Description of the Insects and Their Damage	Name of Insect and Crop Damaged
<b>CORN LEAVES ONLY</b>	Circular holes or oblong slits eaten through the leaves. When the plants are small, these holes are normally small, but they increase in size with the growth of the plants. The holes are arranged in a straight row or line.	<b>Billbugs</b>
	Small, circular holes eaten through the leaves. These do not enlarge much with the growth of the plant as is the case with billbug damage. In addition to the small holes in the leaves, tunnels of small diameter occur across the veins of the leaves.	<b>European corn borer</b>
	Large, ragged holes occur, especially at the edge of the leaves. This damage is accompanied by accumulations of frass in the whorl. Occasionally, dark-green worms with a broken white line down the back are present in the whorl.	<b>Armyworm</b>
<b>CORN STALKS ONLY</b>	Stalks broken over where a "boring" tunnel occurs inside the stalk. Round, darkened holes enter at any position on the stalk and travel for some distance inside it. Pink-colored worms with spots may be in these tunnels. On occasion, leaves are severed at the place where they join the stalk.	<b>European corn borer</b>
	Stalks lodged but not broken. These stalks are usually elbowed (bent) a short distance above the ground. A number of factors can cause this condition, including wind. But if the elbowing is accompanied by damaged roots, the problem is insects and not wind. If the insect damage to the roots causes brace root growth, this is very moderate (negligible) compared to herbicides. After about July 15, silk cutting occurs by light green to yellow-green adult beetles.	<b>Northern corn rootworm</b>
<b>WHEAT STRAW AND TO A LESSER EXTENT, BARLEY, RYE, OATS</b>	Small holes appear in the straw near the ground level. Inside the straw small, curve-shaped worms may be present. Whether the worm (grub) is present or not, the tunnel is packed tightly with frass. Developing heads of small grains often are short, small in diameter and light in color.	<b>Billbugs</b>
	Plants stunted. Wheat heads, especially, reduced in size and light colored (yellowish, or sometimes white). Small, white or greenish-white pointed-headed shiny maggots (up to 3/16-inch long) or brown "flax-seed like puparia" — either or both behind the leaf sheaths, especially next to the ground.	<b>Hessian fly</b>
<b>CORN ROOTS ONLY</b>	All sized roots may be missing, often to within an inch or two of the crown. Before about July 15, thread-like larvae (up to 1/2-inch long) with wrinkled skins, and yellowish-brown heads, can be found in the soil around the roots. This root damage should be correlated with stalk bending and silk damage.	<b>Northern corn rootworm</b>

## ALFALFA AND CLOVERS — HAY PRODUCTION

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given
<b>FOLIAGE — FIRST CUTTING:</b>		
<b>Alfalfa Weevil</b> It only affects alfalfa; very little damage on clovers and other legumes.	Methyl parathion, ½ pound EC. or Imidan, 1 pound WP or EC. or	15 days. Follow all use instructions on the label. Keep out of sprayed fields for at least two days following application.  7 days, for both cutting and grazing. Apply only once per cutting.
<b>EGGS</b> — Oval-shaped, about 1/25 inch long, bright, lemon-yellow when first laid, turning darker near the time they hatch. Some are laid in the alfalfa stems or in the hollow stems of other plants, but most are deposited in growing alfalfa. They hatch in one to two weeks, depending mainly on temperature.	Azinphosmethyl (Guthion), ½ pound EC. or Malathion, 1 pound EC plus methoxychlor, 1 pound EC. or	16 days. Apply only once per season. Follow all use instructions on the label.  7 days.
<b>LARVAE</b> — When first hatched, larvae are about 1/20 inch long, and white to yellowish-white. As they grow, they turn green and acquire a single white stripe along the top of their backs. Their heads are black. There are no true legs on the undersurface of the body, only fleshy ridges. Larvae mature in 3 to 4 weeks, and are about ⅜ inch long at this stage.	Diazinon, 6/10 pound EC plus methoxychlor, 1 6/10 pounds EC. (Alfa-Tox mixture) or Malathion, 1¼ pounds EC. or	10 days.  0 days. No restrictions, except for dosage rate.
<b>PUPAE</b> — The larvae spin round, net-like cocoons, mainly in litter under alfalfa plants where they gradually change to adult weevils in 10 to 14 days.	Methoxychlor, 1½ pounds EC. or	7 days.
<b>ADULTS</b> — Adults are rather common-looking snout beetles, about ¼ inch long, with slender snouts, and usually brown. A wide, black band begins at the head end and runs down the middle of the back almost to the center of the wings. Newly emerged adults are chestnut to light-brown in color. They darken with age, with many older adults being a nearly uniform brown to black.	Carbaryl (Sevin), 1 6/10 pounds WP.	0 days. Effective only on larvae.

Begin inspecting fields for alfalfa weevil larvae during late April and early May by: (a) walking through the fields looking for tattered and whitened (skeletonized) new growth; (b) examining such growth for cylindrical thick-bodied larvae that are (1) about ¼ to ⅜ inch long; (2) green with a white stripe down the back (3) black-headed; (4) have fleshy ridges instead of legs (a hand lens is needed for this determination).

### Timing of Insecticide Treatments

Proper timing of insecticide application can be made by scouting the fields periodically during May. Select at random the tips of 10 alfalfa plants from each of five widely separated areas of the field. This makes a total of 50 plants for each field. Apply a spray when about 25 to 50 percent of the tips (15 to 25 tips of the sample) show feeding by the larvae of the alfalfa weevil. A second spray may be needed when the larvae are abundant in the first cutting. A spray to the stubble following the first cutting may be needed to prevent damage to the regrowth. Note: *Late treatment* for alfalfa weevil when the alfalfa crop is in bloom, only kills bees and gives no appreciable return for money spent on control.

## ALFALFA, CLOVERS — HAY CONTINUED

PROGRAM	MATERIALS	WARNINGS
<p><b>Treatment — Pests</b> When to control</p>	<p>Amount of actual chemical to apply per acre (unless otherwise directed)</p>	<p>Apply chemical no closer to harvest than number of days given</p>
<p><b>Pea Aphid</b> This insect is green and feeds in groups on tender leaves and stems. When mature, it is about 1/8 inch long and may or may not be winged. Apply treatment when colonies of 5 or more aphids are on individual alfalfa or clover stems (not clumps or clones). Note: If spittlebugs and aphids are both present, choose a material that will control both.</p>	<p>Demeton (Systox), 1/4 pound EC. or Malathion, 1 1/4 pounds EC; 1 1/2 pounds D. or Diazinon, 1/2 pound EC.</p>	<p>21 days of harvest or grazing. Apply only one treatment per cutting. No restrictions, except for dosage rate. 4 days for grazing alfalfa; 7 days for grazing clover. 7 days before cutting for hay. Do not treat livestock directly. <b>General warning:</b> When a pesticide drifts onto a crop, allow as many days before harvest of that crop as for direct application to the same crop.</p>
<p><b>Spittlebugs — Immature Forms</b> Yellowish, wingless, sucking insects inside the spittle (foam) mass. Spittle masses usually occur by May 5 in the southern part of the Lower Peninsula and by May 10 in the northern part. Exact time will vary with the season, however. For best yields, allow at least 30 days between treating and harvest. Apply chemicals about 7 days after the first spittlebugs hatch. Spittlebugs usually cause more damage to alfalfa and clovers grown on sandy soils than on heavy, mineral soils. Use the following as a guide for treating: (1) On sandy soil: treat when one or more spittle masses occur to each 5 stems. (2) On heavy soils: treat when one or more spittle masses occur to each 3 stems.</p>	<p>Methoxychlor, 1 pound EC. or Malathion, 1 1/4 pounds EC.</p>	<p>7 days. No restrictions, except for dosage rate.</p>
<p><b>Sweet Clover Weevil</b> The adult weevil is dark gray, has a blunt, short snout and is 3/16 inch long. It feeds destructively on sweet clover in the spring, eating crescent-shaped holes in the leaves. The larva feeds on the roots. Treat at time sweet clover seed is sprouting or no later than 2-leaf stage. Treatments may be needed both seeding and second year.</p>	<p>Carbaryl (Sevin), 1 pound SC. or Malathion, 1 1/4 pounds EC. or Methoxychlor, 1 1/4 pounds EC.</p>	<p>No restrictions, except for dosage rate. No restrictions, except for dosage rate. 7 days. Avoid use of methoxychlor where there is any chance of contaminating feed of dairy cattle, or milk.</p>
<p><b>STUBBLE — BETWEEN FIRST AND SECOND CUTTING:</b></p>		
<p><b>Alfalfa Weevil</b> If infested first crop alfalfa is cut early for best hay quality, it may not be necessary to treat for the insect on this cutting. However, it will be absolutely a must to treat the second crop. Do so immediately following removal of hay, using the same insecticides as listed under foliage — first cutting.</p>	<p>Carbaryl, 1 pound SC. or Malathion, 1 1/4 pounds EC; or 1 1/2 pounds D.</p>	<p>No restrictions, except for dosage rate. No restrictions, except for dosage rates. Spray is preferred to dust.</p>
<p><b>Grasshoppers</b> Immediately after harvesting of the first crop. Treating field borders helps, but general treating of borders and the field proper is best.</p>	<p>Carbaryl, 1 pound SC. or Malathion, 1 1/4 pounds EC; or 1 1/2 pounds D.</p>	<p>No restrictions, except for dosage rate. No restrictions, except for dosage rates. Spray is preferred to dust.</p>



## ALFALFA, CLOVERS — HAY CONTINUED

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given

### FOLIAGE — SECOND CUTTING:

#### Leafhoppers (generally the potato leafhopper)

Small (only 1/8 inch long when mature), wedge-shaped, greenish-yellow insects that run sideways when disturbed. They suck juices from the plant, and while doing so, they poison the plant by injecting saliva into it.

Malathion, 1 pound EC.

No restrictions, except for dosage rate.

or  
Carbaryl, 1 pound SC.

No restrictions, except for dosage rate.

or  
Methoxychlor, 1 pound EC.

7 days. If grasshoppers are also to be controlled, use other materials than methoxychlor.

Tarnished plant bug, alfalfa plant bug, meadow plant bug, spittlebug adults, and others also injure alfalfa and clover, but control, if needed, is best indicated by the presence of the potato leafhopper.

Treat at time second cutting clover and alfalfa is 2 to 4 inches tall, preferably at 2 inches. Note: Leafhoppers are more damaging in dry years than in those having adequate moisture for good alfalfa and clover growth.

## ALFALFA AND CLOVERS — SEED PRODUCTION

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given

### FOLIAGE — EITHER FIRST OR SECOND CUTTING:

Insects involved in seed production are: leafhoppers, tarnished plant bug, alfalfa plant bug, meadow plant bug, spittlebug adults and others. All are important in seed production and should be controlled as a group.

Malathion, 1 1/4 pounds EC.  
or

No restriction as to feeding threshed straw to dairy cattle.

Toxaphene, 1 1/2 pounds EC.

Feed no treated alfalfa or clover to dairy animals or livestock being finished for slaughter. Avoid drift onto feed for dairy animals.

Apply treatment when flowers are in bud stage. At least no later than when flower color first shows on the florets, and before bees start working the fields for pollen and nectar.

Insect control in alfalfa and clover seed fields has given more returns in quality seed (less seed is shrunken) than increase in yield. Insect control has not increased seed yield more than 25 percent in most cases, and two insecticide treatments on the same field have been no better than one. Good pollination of clover and alfalfa (especially alfalfa) is hard to get in Michigan. Competition by tame and wild flowering plants is one of the problems. Generally fields near woodlots and other places where bees live produce the most seeds.

## PASTURES

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given
<b>ARMYWORM AND CUTWORMS:</b>		
<p><b>Armyworm.</b> See soil surface and foliage (barley, oats, rye and wheat section) for description and control of this insect.</p> <p><b>Cutworms</b> may also affect pasture. This may occur alone or with the armyworm problem. Cutworms belong to the same family as the armyworms. They both resemble each other, except the cutworms tend to be thicker-bodied, more rough skinned, and greasy-appearing. The same insecticides are suitable for both insects, except the cutworms tend to hide in the top inch or two of soil, making control, on an average, harder for them.</p>	<p>Carbaryl, 1½ pounds WP or SC.</p> <p style="text-align: center;">or</p> <p>Malathion, 1¼ pounds EC; or 1½ pounds D.</p> <p style="text-align: center;">or</p> <p>Parathion, ½ pound EC.</p>	<p>No restrictions, except for dosage rate.</p> <p>No restrictions, except for dosage rate.</p> <p>15 days. Only trained operators should use parathion. Apply only in areas where it creates no hazard to livestock, man or wildlife. Do not enter pastures until 72 hours after treating. NOTE: From the time parathion is applied to a pasture until it can be grazed again is 15 days.</p>

<b>GRASSHOPPERS:</b>		
<p>Immediately they appear in the pasture. It is best to control grasshoppers when they are small (the insecticide is normally more effective). Treating field borders helps if the insects are migrating into the pasture from outside areas, but general spraying or dusting of borders and the field proper gets the best results.</p>	<p>Carbaryl, 1 pound SC.</p> <p style="text-align: center;">or</p> <p>Malathion, 1¼ pounds EC; or 1½ pounds D.</p>	<p>No restrictions, except for dosage rate.</p> <p>No restrictions, except for dosage rate.</p>

<b>LEAFHOPPERS, PLANT AND MEADOW BUGS:</b>		
<p>A number of small, active insects occasionally invade or propagate in pastures, especially during dry seasons. These are leafhoppers, plant and meadow bugs, adult spittlebugs, and others. If these insects are abundant and stunt the growth of the pasture, control of them, in most cases, is advisable.</p>	<p>Malathion, 1¼ pounds EC; or 1½ pounds D.</p> <p style="text-align: center;">or</p> <p>Parathion, ½ pound EC.</p>	<p>No restrictions, except for dosage rate.</p> <p>15 days. Only trained operators should use parathion. Apply only in areas where it creates no hazard to livestock, man or wildlife.</p>

## BARLEY, OATS, RYE, WHEAT

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given
<b>BEFORE PLANTING:</b>		
<p><b>Wireworm and White Grubs</b></p> <p>Wireworms are smooth, brown or reddish-brown, and wirelike in appearance. White grubs are ¾ to 1½ inches long, and white with brown heads and curved bodies.</p> <p>Before barley, oats or wheat are planted, apply the treatment evenly to the soil surface and springtooth or disc immediately into the top 4 inches of soil.</p>	<p>Parathion, 4 pounds, G, EC or WP. (This is 16 pounds 25% WP, or 2 gallons of 2 pounds per gallon EC, or 40 pounds 10% G.)</p> <p><b>Note:</b> Wireworms (especially) damage wheat when planted to lands that have been in sod for a long time. Other crops may be more profitably grown than wheat under these circumstances. For example, see the Field Corn section of this bulletin on how to control wireworms and white grubs on this crop.</p>	<p><b>Special Warning:</b> When applying parathion and other similar phosphate-type insecticides, take extreme care to prevent skin, lung and mouth uptake of the chemicals. See the label for instructions on how to use safely any material. Keep all animals and people out of parathion-treated areas for 48 hours. Do not contaminate streams or ponds. Do not use on rye.</p>

**BARLEY, OATS, RYE, WHEAT — CONTINUED**

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given

**PLANTING TIME:**

**Hessian Fly**

Damage by this insect causes lodging, shrunken and light-colored (occasionally white) heads. The small maggot feeds between the stalk and the leaf sheaf near the ground. It is white to greenish-white in color, 3/16 inch long when mature, shiny, legless, and has a pointed head.

**Control:**

While systemic phosphate chemicals are being tested against this insect, the only recommended control at this time is the "fly free date." This date is a period in the fall after which the female adult Hessian fly ceases to lay eggs. Certain weather conditions, especially lower temperatures, are responsible for this condition. The dates will vary for each county (see table) and will be earlier for the northern part of the Lower Peninsula than for the southern part. For example, the "fly free date" for Ingham County is September 17; for Monroe County, September 21; and for Alpena County, September 9.

**HESSIAN FLY-FREE DATES FOR MICHIGAN**

County	Earliest Seeding Date	County	Earliest Seeding Date	County	Earliest Seeding Date
Alcona	Sept. 6	Hillsdale	Sept. 19	Montmorency	Sept. 7
Allegan	Sept. 20	Huron	Sept. 13	Muskegon	Sept. 18
Alpena	Sept. 9	Ingham	Sept. 17	Newaygo	Sept. 15
Antrim	Sept. 4	Ionia	Sept. 16	Oakland	Sept. 16
Arenac	Sept. 13	Iosco	Sept. 7	Oceana	Sept. 16
Barry	Sept. 18	Isabella	Sept. 11	Ogemaw	Sept. 10
Bay	Sept. 14	Jackson	Sept. 16	Osceola	Sept. 10
Benzie	Sept. 16	Kalamazoo	Sept. 20	Oscoda	Sept. 7
Berrien	Sept. 23	Kalkaska	Sept. 5	Otsego	Sept. 6
Branch	Sept. 19	Kent	Sept. 18	Ottawa	Sept. 19
Calhoun	Sept. 19	Lake	Sept. 13	Presque Isle	Sept. 8
Cass	Sept. 22	Lapeer	Sept. 15	Roscommon	Sept. 7
Charlevoix	Sept. 3	Leelanau	Sept. 8	Saginaw	Sept. 16
Cheboygan	Sept. 4	Lenawee	Sept. 25	Sanilac	Sept. 15
Clare	Sept. 12	Livingston	Sept. 16	St. Clair	Sept. 16
Clinton	Sept. 17	Macomb	Sept. 18	St. Joseph	Sept. 23
Crawford	Sept. 6	Manistee	Sept. 13	Shiawassee	Sept. 16
Eaton	Sept. 16	Mason	Sept. 13	Tuscola	Sept. 15
Emmet	Sept. 4	Mecosta	Sept. 12	Van Buren	Sept. 22
Genesee	Sept. 17	Midland	Sept. 15	Washtenaw	Sept. 18
Gladwin	Sept. 12	Missaukee	Sept. 9	Wayne	Sept. 18
Grand Traverse	Sept. 8	Monroe	Sept. 21	Wexford	Sept. 9
Gratiot	Sept. 15	Montcalm	Sept. 15		

## BARLEY, OATS, RYE, WHEAT — CONTINUED

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given
<b>SOIL SURFACE AND FOLIAGE:</b>		
<b>Armyworm Larvae</b>		
<p>Green to dark-green worms, usually with a sleek-glassy appearance, up to 2 inches long. A white line runs down the back. This line is unbroken near the head, but toward the tail-end the line is broken into short segments. Other stripes — of various colors, including orange — occur on the sides.</p> <p>Small larvae are generally more susceptible to insecticides, but usually are covered with lodged grain, clods and other coverings, offsetting this advantage.</p> <p>Apply the insecticide during as warm temperature as possible. However, larvae are more apt to be active during the evening, night and morning hours of the day when temperatures decline. Repeat the treatment if needed.</p>	<p>Dylox, 1 pound SP.</p> <p style="text-align: center;">or</p> <p>Carbaryl, 1 pound WP or SC.</p> <p style="text-align: center;">or</p> <p>Malathion, 1¼ pounds EC.</p> <p style="text-align: center;">or</p> <p>Parathion, ⅓ pound EC.</p>	<p>21 days. Do not treat clover, rye or pastures directly or by drift. Do not graze treated fields or feed treated straw to dairy animals.</p> <p>Do not apply after boot stage (when grain heads are first visible) of barley, oats, rye or wheat. No problem from drift of carbaryl onto alfalfa, clover or pasture.</p> <p>7 days. No problem from drift of malathion onto alfalfa, clover or pasture.</p> <p>15 days. Do not use on rye. Only trained operators should use parathion. Use only in areas where it creates no hazard to livestock, man or wildlife.</p>
<b>FOLIAGE TREATMENT:</b>		
<b>Greenbug and other aphids</b>		
<p>The greenbug is light green, 1/16 inch long when mature, and has a dark green stripe down the back. Infested fields have areas of <i>whitened</i> or dead plants.</p> <p>Apply treatment when the aphids first appear during early spring. Aphids are especially damaging in cool, dry weather.</p> <p>Apply these materials when air temperature is 65° F. or above. When temperature is below 50° F., little is gained using these insecticides.</p>	<p>Demeton (Systox), ¼ pound EC.</p> <p style="text-align: center;">or</p> <p>Malathion, 1¼ pounds, EC.</p> <p style="text-align: center;">or</p> <p>Parathion, ⅓ pound EC.</p>	<p>45 days for grain; 21 days for hay or pasture; use only twice per season; allow 14 days between applications. Do not use on rye.</p> <p>7 days. No problem from drift of malathion onto alfalfa, clover or pasture.</p> <p>15 days. Do not use on rye.</p> <p><b>General Warning:</b> Only trained operators should apply parathion and demeton.</p>
<b>Cereal Leaf Beetle</b>		
<p><b>EGGS</b> — They are elongate-oval shaped, about one-sixteenth inch long, yellowish when first laid, almost black at hatching. They are laid on their sides on the upper surface of the leaves of host plants.</p> <p><b>LARVAE</b> — Mature larvae are about three-sixteenths inch long, hump-backed with brown-black heads and legs and yellow bodies. The body is usually covered with an "inky" liquid material.</p> <p><b>PUPAE</b> — The membranes covering the pupae are thin and transparent. Similar to the eggs, the pupae are bright yellow when first formed and are dark-colored like the adults when mature. The soil cells in which the cereal leaf beetle pupates are lined with a secretion which hardens to form a tough-smooth cell.</p> <p><b>ADULTS</b> — These are three-sixteenths inch long. The head and hard, upper wing covers are metallic-blue-black and the legs and front part of the thorax (just behind the head) are orange-red.</p> <p>The cereal leaf beetle is controlled by: (1) date of planting cereal crop, and (2) treating with insecticides.</p>	<p>Sprays applied by ground equipment:</p> <p>Carbaryl (Sevin), 1 pound WP or SC.</p> <p style="text-align: center;">or</p> <p>Malathion, 1 pound EC. Apply either material in 7 to 15 gallons of water.</p> <p style="text-align: center;">or</p> <p>Azinphosmethyl (Guthion), ½ pound EC or WP.</p> <p>Apply in 7 to 15 gallons of water.</p>	<p>Do not apply after the heads begin to form. (This allows for treating up to the time the tip of the head begins to show.) Carbaryl is very toxic to bees. Avoid using it where it will harm them. The insecticide presents no residue problem from drift onto alfalfa, clover, or pastures.</p> <p>7 days. Malathion presents no residue problem from drift onto alfalfa, clover or pastures.</p> <p><b>Note:</b> When applying malathion, air temperatures should be 65° F. or higher; for carbaryl 55° or higher. For the most part, rising temperatures are preferred to falling temperatures when applying these chemicals.</p> <p>30 days. This includes grazing. Use only once per season. Allow 16 days between drift of the insecticide onto alfalfa and clover and harvest or grazing of these crops. See warnings under malathion for information on temperatures regarding azinphosmethyl (Guthion).</p>
<p>See also Date of Planting next page for additional in formation on control of cereal leaf beetle.</p>		

## BARLEY, OATS, RYE, WHEAT — CONTINUED

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given

### DATE OF PLANTING:

#### Cereal Leaf Beetle

1. Plant fall wheat immediately after the Hessian fly free date for each county. The reasons for this early planting are twofold:
  - a. Early fall planted wheat (and barley) is more advanced in growth when cereal leaf beetle adults appear in the spring, making the wheat less attractive for egg laying. Normally, the insect prefers laying eggs on young, tender cereals, usually less than six inches high.
  - b. Early fall planted grains will be larger, and more mature, thereby more able to tolerate feeding by the adults and larvae.

The time to apply the treatment is critical. If the adults are numerous in early May, a spray is needed to protect spring-planted small grains and may be needed for heavily infested, late-planted fall grains. Carbaryl is especially valuable for this early spray, as it kills eggs, adults, and larvae (grubs) of the cereal leaf beetles. Malathion can be used, but it does not kill the eggs, nor give extended protection against the adults.

On all grains, whether planted in the fall or spring, a treatment will be needed when the larvae are numerous. This usually occurs the latter part of May and the first week of June. Malathion is suggested for this late application as it will give control of other pests.

Sprays applied by aircraft:

Because of the danger of contaminating nearby crops with more persistent and highly toxic insecticides, only carbaryl (Sevin) and malathion can be recommended for aircraft application for control of cereal leaf beetles.

Apply one actual pound of either insecticide in one gallon of water. Carbaryl is preferred for control of adults in early May and malathion for the larvae at the end of May or the early part of June.

Apply the aircraft treatment at no more than 10 feet above the crop and when the wind is less than 8 miles per hour.

Warning: Use the same warnings for aircraft application of carbaryl and malathion as given for ground equipment.

Warning: Carbaryl may cause an increase in aphids and is not suggested for this late spray when the insects are present in fields.

### STRAW DAMAGE:

#### Billbugs

Infested small grains show deadened stalks and shortened heads just before harvest or the stalks may lodge in the same way that Hessian fly-infested wheat does. Tunnels inside the stalk are packed tight with sawdust. Short, white, legless, curved grubs with brown heads may be found in the tunnels.

When to Control — Generally the billbugs infesting wheat are not damaging enough to require insecticide control. Damage from these insects is usually greatest on sod ground, in low areas of a field (low lands), or about the margin of fields.

A number of cultural practices help reduce damage to wheat and other cereals by:

1. Crop rotations (planting other crops than grains).
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. This is especially important for oats and other small grains if planted in the spring.

## FIELD CORN

PROGRAM	MATERIALS	WARNINGS
<p>Treatment — Pests When to control</p>	<p>Amount of actual chemical to apply per acre (unless otherwise directed)</p>	<p>Apply chemical no closer to harvest than number of days given</p>
<b>APHIDS (corn leaf aphid)</b>		
<p>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.</p> <p>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.</p> <p>However, aphid populations centered on the tassel are not as critical to corn production as those same numbers on the silk and ear.</p> <p>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.</p>	<p>Malathion, 1 pound EC or WP; or 1½ pounds D.</p> <p><b>Aircraft application</b> — use malathion, 1½ pints of 5 lbs. per gallon EC in 1 gallon of refined fuel oil or 2 gallons of water per acre.</p>	<p>5 days. Use only one malathion formulation at a time. It can be used on grain, livestock and dairy farms.</p> <p><b>Note:</b> 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.</p> <p>This aphid carries (transmits) Maize Dwarf Mosaic in corn. The disease has not occurred in Michigan to date. If it does, resistant varieties will be used — not necessarily insecticides — as far as is possible to combat the disease. When possible, plant aphid-resistant varieties.</p>
<b>ARMYWORMS (both true and fall types)</b>		
<p><b>True armyworm larvae</b> 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.</p> <p><b>The fall armyworm</b> 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.</p> <p>Neither of these insects overwinter in Michigan in large numbers. Outbreak conditions are normally due to migrations from the south and southwest in summer.</p> <p>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.</p> <p>Both insects have marching habits; hence their common names—true armyworm and fall armyworm.</p> <p>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.</p> <p>The fall armyworm lays eggs on the leaves of grasses and other plants. Infestations originate right in corn fields.</p>	<p><b>On Grain and Livestock Farms (Other Than Dairy Farms),</b> Use trichlorfon, toxaphene, carbaryl, or parathion.</p> <p>Trichlorfon (Dylox), 1 pound SC.</p> <p style="text-align: center;">or</p> <p>Toxaphene, 2 pounds EC.</p> <p><b>On Dairy Farms Apply Carbaryl or Parathion, not Trichlorfon or Toxaphene.</b></p> <p>Carbaryl (Sevin), 1½ pounds WP or SC (flowable).</p> <p style="text-align: center;">or</p> <p>Parathion, ¾ pound EC.</p> <p><b>Suggestion for applying the treatment</b> — 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.</p>	<p>28 days. Make only one application per season. Read label for further directions.</p> <p>No limits for use on grain. Do not feed toxaphene-treated forage to dairy animals or animals being finished for slaughter.</p> <p>0 days, for either grain or ensilage.</p> <p>12 days. Parathion should be applied only by an experienced operator. Read label for other instructions on safe use.</p> <p><b>Note:</b> Not all insecticides control armyworms equally well or to the same extent with each new infestation.</p>

## FIELD CORN — CONTINUED

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given
<b>BILLBUGS</b>		
<p>These large beetles measure from 1/5 to 3/5 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.</p> <p>Their damage to corn consists of twisted leaves on young plants, stalk tunneling and feeding by grubs.</p>	<p>Carbaryl (Sevin), 1 pound WP or SC (flowable).</p> <p>Chemical control of billbugs is not really practical at this time. See the suggestions in the column on Warnings and Instructions.</p> <p><b>Note:</b> If billbugs and flea beetles are bothering the same field, use carbaryl as suggested for flea beetles, or the chemical can be used for billbugs alone.</p>	<p>0 days for either grain or ensilage.</p> <p>A number of cultural practices help reduce damage to field corn by the maize billbug, the curlew, and other billbugs. They are:</p> <ol style="list-style-type: none"> <li>1. Crop rotations (planting other crops than corn).</li> <li>2. Elimination of weeds, especially sedges and grasses.</li> <li>3. Proper soil drainage.</li> <li>4. Clean fall plowing, if practical.</li> <li>5. Planting in a well-prepared seedbed to get rapid germination and growth of the crop.</li> </ol>
<b>CEREAL LEAF BEETLE</b>		
<p>This insect is still relatively 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.</p> <p>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.</p> <p>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.</p> <p>Adult feeding may go through the entire leaf tissue. Larvae leave the lower epidermis or skin of the plant intact.</p>	<p>Chemical control of the insect is not generally 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.</p>	
<b>EUROPEAN CORN BORER</b>		
<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The full-grown worm is nearly 1 inch long, pinkish, with round brown spots on the body.</p> <p><b>Note:</b> In recent years, the number of corn borer larvae per stalk of corn has been less than 1/2 borer in most Michigan fields.</p>	<p>Carbaryl (Sevin) 1 1/2 pounds WP and SC (flowable) plus parathion, 1/2 pound WP. or Parathion, 1/2 pound WP or EC. or Carbaryl (Sevin), 2 pounds WP or SC (flowable). or EPN, 1/2 pound EC or WP, or 15 pounds of 5 percent granules.</p> <p>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.</p>	<p>12 days (parathion); 0 days (carbaryl). Combinations follow the limitation of the most restricted insecticide (the largest number of days before harvest).</p> <p>12 days for either grain or ensilage.</p> <p>0 days for either grain or ensilage.</p> <p>14 days.</p> <p>For all insecticide uses, observe the proper time to treat for the borer which is much longer before harvest than the restrictions just given.</p> <p><b>Cultural practices</b>— A number of practices (other than the use of chemicals) can be used to help control European corn borer.</p> <p>They are:</p> <ol style="list-style-type: none"> <li>1. Plant resistant hybrids.</li> <li>2. Before May 15, bury by deep plowing all cornstalks and weeds (disking and shallow plowing are not satisfactory).</li> </ol>

## FIELD CORN — CONTINUED

PROGRAM	MATERIALS	WARNINGS
<p>Treatment — Pests When to control</p>	<p>Amount of actual chemical to apply per acre (unless otherwise directed)</p>	<p>Apply chemical no closer to harvest than number of days given</p>
<p>Heavy leaf feeding does not always result in heavy borer numbers in the stalks. Hence, yearly inspection of your fields will indicate the need for treatment.</p> <p>More important than even this is to check the hybrid currently planted for corn borer resistance.</p>	<p><b>Suggestions for applying the treatment:</b></p> <p>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.</p>	<p>3. Rotate crops (the worst corn borer damage usually comes on corn planted year after year on the same land).</p> <p>4. Ensilage corn (this destroys the borers except those left in the field. Hence, cut stalks as low as possible).</p>
<p><b>CORN EARWORM</b></p>		
<p>The corn earworm, has a wing expanse of 1½ 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.</p> <p>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 strips running lengthwise of the sides of the body.</p> <p>This insect does not over-winter effectively 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.</p> <p>Because armyworms, fall armyworms, and corn earworms are in the same insect family, the larvae resemble each other. For information concerning armyworms turn to that Section on page 12.</p>	<p>Chemical control of this insect on field corn is for the most part too costly to be practical. If the insect is bothering enough to warrant attention, plant corn early or plant varieties which silk before August 15, for cultural approach to its control.</p> <p>However, if it is thought desirable to treat for the insect use one of the following chemicals:</p> <p>Carbaryl (Sevin), 2 pounds WP or SC (flowable).</p> <p style="text-align: center;">or</p> <p>Carbaryl (Sevin), 1½ pounds WP or SC plus parathion, ½ pound WP.</p>	<p>0 days for either grain or ensilage.</p> <p>12 days (Carbaryl-parathion mixture) for both grain and ensilage.</p>
<p><b>CUTWORMS</b></p>		
<p>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.</p>	<p><b>On Grain and Livestock Farms</b> (other than dairy farms), use either toxaphene or parathion or carbaryl as suggested for armyworms. Follow all use restrictions given in that Section.</p> <p><b>On Dairy Farms</b>, use either parathion or carbaryl as suggested for armyworms. Follow all use restrictions given in that Section.</p> <p>Apply treatment to the soil surface as soon as damage is noticed and preferably in the afternoon or early evening.</p>	<p>Follow all directions given in this column under the section on armyworms, page 12.</p>
<p><b>FLEA BEETLE</b></p>		
<p>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) smartweed flea beetle.</p> <p>Adult flea beetles eat small holes in the leaves. If not controlled, eventually the whole plant looks bleached or scorched.</p>	<p>Carbaryl (Sevin), 1 pound WP or SC (flowable).</p> <p><b>Note:</b> Keeping fields free of weeds is important to flea beetle control. Rapid germination and growth of young plants also help reduce flea beetle numbers.</p>	<p>0 days for either grain or ensilage.</p>



## FIELD CORN — CONTINUED

PROGRAM	MATERIALS	WARNINGS
<p>Treatment — Pests When to control</p>	<p>Amount of actual chemical to apply per acre (unless otherwise directed)</p>	<p>Apply chemical no closer to harvest than number of days given</p>
<b>NORTHERN CORN ROOTWORM</b>		
<p>The adult is about ¼ inch long, and light green to yellowish-green. It is readily found in silk in July.</p> <p>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 larvae.</p> <p>Infested plants are often undersized and frequently lodge after a heavy rain or wind. They can easily be pulled from the ground and the stalks are often bowed or bent.</p> <p>Adult beetles feed on silk of corn and the pollens of this and other plants.</p> <p>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.</p> <p>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:</p> <p>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.</p>	<p><b>On Grain and Livestock Farms</b> (other than dairy farms), do the following:</p> <p>Chlordane, 2 pounds (10 pounds of 20 percent granular).</p> <p><b>Note:</b> The insecticides under the Dairy Farm section below may be used also.</p> <p><b>On Dairy Farms use one of the following Phosphate Insecticides:</b></p> <p>Diazinon, 1¼ (9 pounds of 14 percent granular). This is for 40-inch rows. For other width rows follow label directions.</p> <p>Dasanit, 1 pound. (This is 6.7 pounds of 15 percent granular). Apply to 40-inch rows; see label for other widths.</p> <p>Phorate, 1 pound (for 40-inch rows).</p> <p>For any row spacing, use 1.2 actual ounce per 1,000 feet of row.</p> <p>Bux-Ten Granular, 1 pound. This for 40-inch rows. See the label for other width rows.</p> <p><b>Instructions for use of any insecticide for control of northern corn rootworm:</b> Apply in a 6- to 8-inch band above the seed at planting. Incorporate in the soil to a depth of one inch. Do not place in contact with the seed. Another method is to place the treatment directly behind the planter shoe but in front of the press wheel.</p>	<p>Apply only as instructed. No restrictions on the use of the grain. Do not feed treated forage to livestock being finished for slaughter.</p> <p>0 days. Apply only as instructed.</p> <p>Apply only as directed.</p> <p>Apply only as directed. Use a granular formulation.</p> <p>Apply only as directed.</p> <p><b>WARNING:</b> Do not put concentrated amounts of any phosphate chemical directly on or in contact with the seed. Read the label on how to use phosphate insecticide safely.</p>
<b>SAP BEETLES (also called picnic beetles)</b>		
<p>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.</p>	<p>Control instructions are given despite no clear cut evidence of what the sap beetle problem is on field corn in Michigan. Use the instructions as a guide if control is thought necessary.</p>	

## FIELD CORN — CONTINUED

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of actual chemical to apply per acre (unless otherwise directed)	Apply chemical no closer to harvest than number of days given
<p>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. However, in 1969 some field corn harbored more than the usual number of sap beetles. A few fields were treated for the insect.</p>	<p>Carbaryl (Sevin), 1 pound WP or SC (flowable). or Malathion, 1 pound EC or WP.</p> <p>Use malathion if aphids are a factor in the fields.</p>	<p>0 days, for either grain or ensilage.</p> <p>5 days.</p>

### SEED-CORN MAGGOT

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

The maggots are about ¼ 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 treated seed cannot be bought, do the following:

Diazinon, 2 actual ounces of WP to 1 bushel of seed.

or  
Dieldrin, 1 ounce of 50% WP to 100 pounds of seed.

**Damp-seed method**— Place the seed in a cement mixer or other suitable mixing equipment. Spray the seed lightly with water and then add the diazinon or dieldrin. Dry the seed before bagging or planting.

**Slurry method**— To suggested wettable powders add enough water to make a sloppy paste or slurry. Treat by stirring or swirling seed in the slurry until thoroughly coated. Dry the seed before planting.

Slurries are preferred to dusts, since they adhere to the seed better and are less irritating to the user.

**Dust method**— Place the seed and suggested wettable powders in a closed container and agitate vigorously for several minutes or until seed is coated with dust. For best results, use a container with twice the capacity of the seed treated.

**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.

## FIELD CORN — CONTINUED

PROGRAM	MATERIALS	WARNINGS
<p>Treatment — Pests When to control</p>	<p>Amount of actual chemical to apply per acre (unless otherwise directed)</p>	<p>Apply chemical no closer to harvest than number of days given</p>
<p><b>SLUGS</b></p>		
<p>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.</p> <p>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.</p>	<p>Carbaryl (Sevin), 1 pound WP or SC (flowable).</p> <p>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.</p> <p>Slugs on field corn are not a yearly problem, occurring only occasionally.</p> <p>Soil drainage and clean cultivation help materially in reducing damage done by the pest.</p>	<p>0 days, for either grain or ensilage.</p>
<p><b>WIREWORMS AND WHITE GRUBS</b></p>		
<p>Wireworm larvae are up to 1½ inches long, wire-like in appearance and brown or reddish brown. The smooth skin is tough, leathery, segmented.</p> <p>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.</p> <p>The larvae of white grubs are white with brown heads and curved bodies. They are ¾ to 1½ inches long and feed on the roots of corn.</p>	<p><b>On Grain and Livestock Farms</b> (other than dairy farms, apply only one chemical as follows:</p> <p>Chlordane, 4 pounds (for sand, sandy loam or light mineral soils).</p> <p style="text-align: center;">or</p> <p>Chlordane, 6 pounds (for peat or muck soils).</p> <p><b>Note:</b> The insecticides suggested for dairy farms can also be used on grain and livestock farms.</p> <p>Apply (broadcast) to the surface of the soil and spring-tooth or disc immediately 4 inches deep.</p> <p><b>On Dairy Farms, use one of the following Phosphate Insecticides:</b></p> <p>Diazinon, 4 pounds.</p> <p style="text-align: center;">or</p> <p>Parathion, 3 pounds (for mineral soils).</p> <p style="text-align: center;">or</p> <p>Parathion, 4 pounds (for muck soils).</p> <p><b>General Instructions for Use</b> (any insecticide):</p> <p>Apply (broadcast) to the surface of the soil and spring-tooth or disc immediately 4 inches deep.</p>	<p><b>WARNING:</b> Use chlordane only as directed for wireworms and white grubs.</p> <p>Apply only as directed. If white grubs are the most important problem, use parathion instead of diazinon.</p> <p>Apply only as directed.</p> <p>Read the package label for instructions on how to use parathion safely. Keep all persons and animals out of treated area for 72 hours after treating.</p>

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1P—15M—3:70—SW