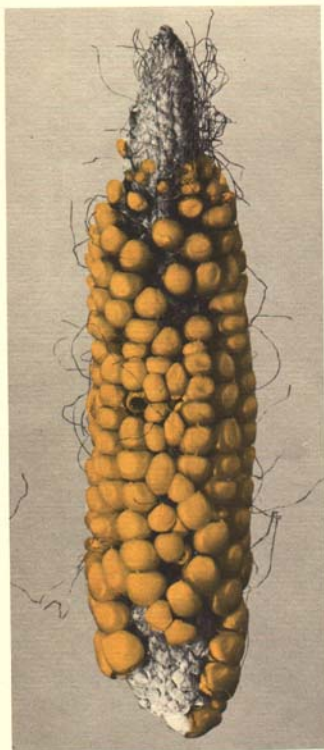


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# INSECT CONTROL

## IN FORAGES AND SMALL GRAINS



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## **INSECT CONTROL IN FORAGES AND SMALL GRAINS**

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**I**NSECT CONTROL on forage (alfalfa, clover, pasture) and small grains (barley, oats, rye, wheat) is accomplished by 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 forage and small grain 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 alfalfa, clover, pasture, barley, oats, rye, and wheat.

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 safely pesticide chemicals 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. 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 foliage and for some soil insects is always a problem. However, the following may be used as a guide:

When forage 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 control of insects affecting alfalfa, clover, pasture, barley, oats, rye, and wheat, except for small insects such as spittlebugs, leafhoppers, and early infestations of aphids. 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 this type of 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 when the crop was harvested.

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 such as DDT 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. *DDT and other 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.

### **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.

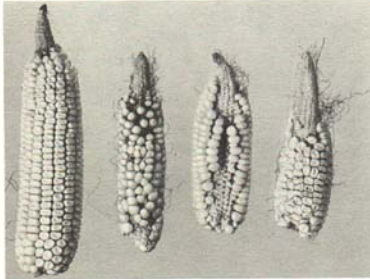
Again, taking insecticide "A": For a certain insect, the suggested control reads "1½ pounds of actual insecticide 'A' to the acre." This means that you could use either 37½ pounds of a commercial "4 percent dust" or 30 pounds of "5 percent dust" — and still have a correct application of only 1½ pounds 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.

Following is a brief key to the important insect damage on forage and cereal crops. Some insect damage to corn is included for comparative and informational purposes. Additional information, including control instructions, for insects affecting field corn is contained in Extension Bulletin 439 (Farm Science Series) entitled "Michigan Corn Production — Insect Control," 1966 revision.

#### 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

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



The corn billbug damages thousands of dollars worth of forage crops each year.



The grasshopper is a familiar pest of forage crops.



## KEY TO INSECT DAMAGE ON FORAGE AND CEREAL CROPS

Place of Damage	Description of the Insects and Their Damage	Name of Insect and Crop Damaged
SEED	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.	Seed corn maggot (but other species of maggots may occur). Affects corn primarily.
SEED AND ROOTS	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.	Wireworms. Corn and wheat are most affected, but barley, oats, and rye are also damaged, especially if wireworm numbers are heavy.
ROOTS BUT SELDOM SEED	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. Large (up to 1½ inches long), white-curved grubs with brown heads and legs, may be found in the soil.	White grubs (June beetles). Corn and cereal crops damaged, especially following sod.
SEEDLINGS	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."	Too deep planting, especially of corn. Seed corn maggot, wireworms, and white grubs can cause this symptom also. But with these, identify the damage by other symptoms.
PLANTS AT SOIL LEVEL	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.	Cutworms (many kinds). These insects are especially damaging to corn, and all forage and cereal crops are eaten under stress of food getting.
FOLIAGE	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.	Cereal leaf beetle. 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.	Aphids: 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.	Potato leafhopper (sometimes called the alfalfa leafhopper).

## KEY — CONTINUED

Place of Damage	Description of the Insects and Their Damage	Name of Insect and Crop Damaged
CORN LEAVES ONLY	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.	Billbugs
	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.	European corn borer
	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.	Armyworm
CORN STALKS ONLY	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.	European corn borer
	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. After about July 15, silk cutting occurs by light green to yellow-green adult beetles.	Northern corn rootworm
WHEAT STRAW AND TO A LESSER EXTENT, BARLEY, RYE, OATS	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.	Billbugs
	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.	Hessian fly
CORN ROOTS ONLY	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.	Northern corn rootworm

## FIELD CORN INSECTS

PROGRAM	MATERIALS	WARNINGS
Treatment — Pests When to control	Amount of chemical to apply per acre	Apply chemical no closer to harvest than:

Some information concerning field corn insects is given in the identification key of this bulletin. Also, the photographs on page 3 shows insects damaging to field corn. For additional information, including control instructions for the insects, see Extension Bulletin 439 (Farm Science Series) entitled "Michigan Corn Production — Insect Control," 1966 revision.

## 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>		
<p><b>Pea Aphid</b> This insect is green and feeds in groups on tender leaves and stems. When mature, it is about ¼ 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>Naled (Dibrom), 1 pound EC; or 1.2 pounds D. or Demeton, ¼ pound EC. or Malathion, 1¼ pounds EC; 1½ pounds D. or Diazinon, ½ pound EC.</p>	<p>4 days. A spray is preferred to a dust.  21 days of harvest or grazing. Apply only one treatment per cutting. No restrictions, except for dosage rate.  4 days for grazing; 7 days before cutting for hay. <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, 1¼ 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, 1¼ pounds EC. or Methoxychlor, 1¼ 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>
<b>STUBBLE — BETWEEN FIRST AND SECOND CUTTING:</b>		
<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 Naled, 1 pound EC. or Malathion, 1¼ pounds EC; or 1½ pounds D.</p>	<p>No restrictions, except for dosage rate  4 days.  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
<b>FOLIAGE — SECOND CUTTING:</b>		
<p>Leafhoppers (generally the potato leafhopper). Small (only <math>\frac{1}{8}</math> 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.</p> <p>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.</p> <p>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.</p>	<p>Malathion, 1 pound EC. or Carbaryl, 1 pound SC. or Methoxychlor, 1 pound EC.</p>	<p>No restrictions, except for dosage rate.</p> <p>No restrictions, except for dosage rate.</p> <p>7 days. If grasshoppers are also to be controlled, use other materials than methoxychlor.</p>

## 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
<b>FOLIAGE — EITHER FIRST OR SECOND CUTTING:</b>		
<p>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.</p> <p>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.</p> <p>Insect control of 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.</p>	<p>Naled (Dibrom), 1½ pounds EC.  or  Malathion, 1¼ pounds EC.  or  DDT, 1¼ pounds EC.  or  Toxaphene, 1¼ pounds EC.</p>	<p>4 days; but treating 4 days before harvest of seed is of no value in seed (or even hay) production.</p> <p>No restriction as to feeding threshed straw to dairy cattle.</p> <p><i>Do not use on dairy farms; or on other farms if they are one mile from a dairy farm (DDT drift can contaminate milk). Do not feed DDT-treated forage to dairy animals or animals being finished for slaughter. Also, do not use DDT on hay to be sold.</i></p> <p>The same limitations apply to toxaphene as for DDT.</p>



## 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>Armyworm. See soil surface and foliage (barley, oats, rye and wheat section) for description and control of this insect.</p> <p>Cutworms 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. or Malathion, 1¼ pounds EC; or 1½ pounds D. or 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>

### GRASSHOPPERS:

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>Carbaryl, 1 pound SC. or Naled (Dibrom), 1 pound EC. or Malathion, 1¼ pounds EC; or 1½ pounds D.</p>	<p>No restrictions, except for dosage rate.</p> <p>4 days. Take the cattle out of the pasture for 4 days.</p> <p>No restrictions, except for dosage rate.</p>
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### LEAFHOPPERS, PLANT AND MEADOW BUGS:

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>Naled (Dibrom), 1 pound EC. or Malathion, 1¼ pounds EC; or 1½ pounds D. or Parathion, ½ pound EC.</p>	<p>4 days.</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>
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## 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

### BEFORE PLANTING:

#### Wireworm and White Grubs

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.

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>Heptachlor, 3 pounds G. or Chlordane, 5 pounds G. or 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>Use heptachlor and chlordane on grain farms only. These materials are not suggested for use on dairy farms.</p> <p>Use only chlordane where potatoes are planted in the rotation.</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.</p>
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## 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

### 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
Calhoun	Sept. 6	Hillsdale	Sept. 19	Montmorency	Sept. 7
Cass	Sept. 20	Huron	Sept. 13	Muskegon	Sept. 18
Charlevoix	Sept. 9	Ingham	Sept. 17	Newaygo	Sept. 15
Alcona	Sept. 4	Ionia	Sept. 16	Oakland	Sept. 16
Allegan	Sept. 13	Iosco	Sept. 7	Oceana	Sept. 16
Alpena	Sept. 18	Isabella	Sept. 11	Ogemaw	Sept. 10
Antrim	Sept. 14	Jackson	Sept. 16	Osceola	Sept. 10
Arenac	Sept. 16	Kalamazoo	Sept. 20	Oscoda	Sept. 7
Barry	Sept. 23	Kalkaska	Sept. 5	Otsego	Sept. 6
Bay	Sept. 19	Kent	Sept. 18	Ottawa	Sept. 19
Benzie	Sept. 19	Lake	Sept. 13	Presque Isle	Sept. 8
Berrien	Sept. 22	Lapeer	Sept. 15	Roscommon	Sept. 7
Branch	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	Shawassee	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
Graziot	Sept. 15	Montcalm	Sept. 15		

**BARLEY, OATS . . . CONTINUED**

PROGRAM	MATERIALS	WARNINGS
<p align="center">Treatment — Pests When to control</p>	<p align="center">Amount of actual chemical to apply per acre (unless otherwise directed)</p>	<p align="center">Apply chemical no closer to harvest than number of days given</p>
<b>SOIL SURFACE AND FOLIAGE:</b>		
<p><b>Armyworm Larvae</b> 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. Small larvae are generally more susceptible to insecticides, but usually are covered with lodged grain, clods and other coverings, offsetting this advantage.  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.  or  Carbaryl, 1 pound WP or SC.  or  Malathion, 1¼ pounds EC. or  Parathion, ½ 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.  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.  7 days. No problem from drift of malathion onto alfalfa, clover or pasture.  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>		
<p><b>Greenbug and other aphids</b> 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.  Apply treatment when the aphids first appear during early spring. Aphids are especially damaging in cool, dry weather. 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.  or  Malathion, 1¼ pounds EC. or Parathion, ½ 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.  7 days. No problem from drift of malathion onto alfalfa, clover or pasture. 15 days. Do not use on rye. General warning: Only trained operators should apply parathion and demeton.</p>
<b>Cereal Leaf Beetle</b>	<p>Sprays applied by ground equipment: Carbaryl (Sevin), 1 pound WP or SC.</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><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 align="center">or</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>Malathion, 1 pound EC. Apply either material in 7 to 15 gallons of water.</p>	<p>7 days. Malathion presents no residue problem from drift onto alfalfa, clover or pastures.  Note: 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><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. The cereal leaf beetle is controlled by: (1) date of planting cereal crop, and (2) treating with insecticides.</p>		
<p>See also Date of Planting next page for additional information on control of cereal leaf beetle.</p>		

## BARLEY, OATS . . . 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.

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