1982 Insect Pest Management Guide

FIELD and FORAGE CROPS

You must be certified as a pesticide applicator to use restricted-use pesticides. See your county Extension adviser in agriculture for information.

FEDERAL AND STATE LAWS

The U.S. Environmental Protection Agency is classifying pesticides for "general" or "restricted" use. Anyone applying a restricted-use pesticide must be certified. Only a few pesticides have been classified.

Commercial applicators who apply restricted-use pesticides must be certified. Commercial applicators include not only persons applying a pesticide for hire but also governmental personnel, chemical company representatives, and others involved in demonstrational, regulatory, and public health pest control. Certification as a commercial applicator requires passing a written examination administered either by the Illinois Department of Agriculture or the Department of Public Health.

Private applicators who use restricted-use pesticides "for the purpose of producing any agricultural commodity on property owned or rented by him or as exchange labor (no compensation) on the property of another" must also be certified, either by attending an educational training program or by passing an examination.

Educational training programs for farmers (private applicators) and commercial pesticide applicators are conducted by the Cooperative Extension Service to prepare persons for certification. For additional information, consult your county Extension adviser in agriculture. The actual certification and the issuing of permits or licenses are handled by the Illinois Department of Agriculture or the Illinois Department of Public Health.

Special Local Need Registrations

Section 24(c) of the amendments to the Federal Insecticide, Fungicide, and Rodenticide Act of 1972 allows states the right to register pesticides for use within the state to meet special local needs (SLN). The authority for state registration of pesticides is the Illinois Department of Agriculture. A special label, which lists the new 24(c) uses, is printed by the formulator. A copy of this label must be in the possession of the operator during application of the pesticides.

In the following pages, all SLN, or 24(c), registrations are indicated by this sign: †.

Insecticides and Classifications

At the time this publication was in preparation, only a few of the insecticides listed below had been classified for either "restricted" or "general" use by the EPA. Additional insecticides are expected to be classified before the

Table 1. Insecticide Classifications

Common name	*Trade name*	*Classification*
acephate	Orthene	unclassified
azinphos-methyl	*Guthion	restricted[a]
Bacillus thuringiensis	Dipel, Thuricide, Bactur, SOK	unclassified
carbaryl	Sevin, Savit	unclassified
carbofuran	*Furadan	restricted[a]
carbophenothion	Trithion	unclassified
chlorpyrifos	Lorsban	unclassified
diazinon	Diazinon	unclassified
dimethoate	Cygon, De-Fend	unclassified
disulfoton	*Di-Syston	restricted[a]
endosulfan	Thiodan, Tiovel	unclassified
ethion	Ethion	unclassified
ethoprop	*Mocap	restricted[a]
fenvalerate	*Pydrin	restricted[b]
fonofos	*Dyfonate	restricted[a]
isofenphos	*Amaze	restricted[b]
malathion	Cythion, malathion	unclassified
methidathion	*Supracide	restricted[b]
methomyl	*Lannate, *Nudrin	restricted[c]
methoxychlor	methoxychlor	unclassified
methyl parathion	*Methyl parathion	restricted[b]
methyl parathion (microencapsulated)	*Penncap-M	restricted[b]
oxydemeton-methyl	Metasystox-R	unclassified
phorate	Thimet	unclassified
phosmet	Imidan	unclassified
terbufos	Counter	unclassified
toxaphene	Toxaphene	unclassified
trichlorfon	Dylox, Proxol	unclassified

[a] Liquid formulations are restricted.
[b] All formulations are restricted.
[c] All formulations except water-soluble packages, 25% wettable powder, and granulars are restricted.

Asterisks (*) are used throughout this circular to indicate insecticides classified for "restricted" use.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
In cooperation with ILLINOIS NATURAL HISTORY SURVEY CIRCULAR 899 (revised annually) November, 1981

1982 planting season. Your county Extension adviser will have additional information on insecticide restrictions.

The chemical names used in this circular may be unfamiliar to you. These names are the common, coined chemical names and as such are not capitalized (for example, terbufos). Trade names are capitalized (for example, Counter). In the table of limitations (Table 14), the trade names are listed first, with the common name in parentheses following the trade name. In the tables of suggestions, the trade name is also listed first and the common name is in parentheses. For questions, refer to Table 1 or to Table 14.

POLICY STATEMENT

The *Illinois Insect Pest Management Guide: Field and Forage Crops* (Circular 899) is revised annually and is intended for use during the current calendar year only. Not all registered insecticides for crop pests are included in this circular. Insecticides that are effective and do not present an undue hazard to the user are suggested whenever possible.

Trade names have been used for simplicity, but their usage does not imply endorsement of one product over another, nor is discrimination intended against any product.

This guide for insect control is based on research results from the Illinois Natural History Survey, the University of Illinois Agricultural Experiment Station, other experiment stations, and the U.S. Department of Agriculture.

Requested label clearances for a few uses of some insecticides, carriers, and solvents are uncertain for 1982 because many requests have not yet been officially cleared. Be sure to check with your county Extension adviser in agriculture if you are in doubt about an insecticide you plan to use. We will make announcements of label changes through the news media to keep you up to date.

REFERENCES

This circular lists only suggested uses of insecticides for the control of many pests in Illinois field crops and is not designed to discuss other methods of control. Fact sheets discussing nonchemical control methods, descriptions of specific insects, and their life history and biology (designated by NHE numbers) can be obtained from the office of the county Extension adviser in agriculture or by writing to Entomology Extension, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, IL 61820.

PEST-MANAGEMENT SCOUTING PROGRAMS

In recent years, "pest-scouting" programs have been initiated by several pest-management consulting firms to serve growers. Scouts monitor fields for outbreaks of pests and keep a close watch on potential problems. Identifying and controlling pest outbreaks through scouting programs could save a farmer thousands of dollars. The scout's observations can also be used to determine the need for applying a rootworm soil insecticide the following year.

PESTICIDE SAFETY

Certain precautionary steps should be taken when handling insecticides. Some of the insecticides suggested in this publication can be poisonous to the applicator. The farmer is expected to protect himself, his workers, and his family from needless exposure.

When using insecticides, apply all the scientific knowledge available to make sure that there will be no illegal residue on the marketed crop. Such knowledge is condensed on the label. READ THE LABEL CAREFULLY AND FOLLOW THE INSTRUCTIONS. The label should be recent and not from a container several years old. Do not exceed the maximum rates suggested. Observe the interval between application and harvest. Apply only to crops for which use has been approved. Keep records of pesticide use for each field. Record the product used, the trade name, the percentage content of the insecticide, the dilution, the rate of application per acre, and the date or dates of application.

Always handle insecticides with respect. The persons most likely to suffer ill effects from insecticides are the applicator and his family. Accidents and careless, needless overexposure can be avoided. Following these rules will prevent most insecticide accidents:

1. Wear rubber gloves when handling insecticide concentrates.
2. Do not smoke while handling or using insecticides.
3. Keep your face turned to one side when opening, pouring from, or emptying insecticide containers.
4. Leave unused insecticides in their original containers with the labels on them.
5. Store insecticides out of the reach of children, irresponsible persons, or animals; store preferably in a locked building. Do not store near livestock feeds. Better yet, buy no more pesticide than you will use, thus eliminating a pesticide storage and disposal problem.
6. Triple rinse, bury, or burn all empty insecticide containers or take them to an appropriate sanitary landfill.
7. Do not put the water-supply hose directly into the spray tank or blow out clogged nozzles or spray lines with your mouth.
8. Wash with soap and water exposed parts of the body and clothes contaminated with insecticides.
9. Do not apply to fish-bearing or other waters.
10. Do not leave puddles of spray on impervious surfaces or apply insecticides near dug wells or cisterns.
11. Do not apply insecticides, except in an emergency, to areas with abundant wildlife.
12. Do not spray or dust when weather favors drift.
13. To avoid bee kill, apply insecticides after bee activity has been completed for the day; use the least toxic materials. *Warn beekeepers that you are applying insecticides.*

PREDICTING THE NEED FOR SOIL INSECTICIDES ON CORN

The type of crop rotation greatly influences whether a soil insect problem will occur and what kind it will be. Some guidelines follow for predicting soil insect problems in corn and for determining the need to use a soil insecticide at planting time. Exceptions can be expected occasionally because soil insect problems are influenced by a variety of things unrelated to crop rotation, such as the weather, soil type, planting date, hybrid, tillage, and natural enemies. Knowledge about soil insect damage in a particular field during previous years is also helpful because infestations tend to occur in the same fields and in the same area.

Corn After Soybeans. The potential for soil insect problems in corn after soybeans is generally low, and the use of soil insecticides rarely pays. In most fields, a diazinon planter-box seed treatment will be adequate to protect against attack by seedcorn beetles and seedcorn maggots. *Corn rootworms* rarely cause damage to corn after soybeans. An exception may occur when corn rootworm beetles are attracted to, and deposit their eggs in, soybean fields that are weedy or contain volunteer corn. When such fields are planted to corn the following year, economic damage may occur. Good weed control will reduce the attractiveness of soybean fields to rootworm beetles and permit soybean-corn rotations with noneconomic damage from corn rootworms.

White grubs are an occasional problem in east-central Illinois in corn after soybeans.

Corn After Corn. The potential for rootworm damage is moderate to severe in the northern two-thirds of Illinois. A rootworm insecticide may be needed in most fields of corn after corn. Wireworms are occasionally a problem in the southern part of Illinois.

Corn After Grass Sod. Wireworms and white grubs are potential problems. Apply a labeled soil insecticide at planting time.

Corn After Legumes. Grape colaspis, grubs, wireworms, and cutworms are potential problems in corn after clover and alfalfa. In northern Illinois, rootworms are occasionally a problem in corn following clover or alfalfa. Apply a soil insecticide at planting time.

Corn After Small Grain. There is a slight potential for damage by wireworms, seedcorn beetles, and seedcorn maggots in corn after small grain. In most instances, a diazinon planter-box seed treatment will be adequate. If wireworms are present, use a soil insecticide at planting time.

CORN ROOTWORM SITUATION

Problem Area

The potential for rootworm damage to corn following corn is greatest in the northern two-thirds of the state. Although in most counties populations of northern and western corn rootworm beetles were lower during 1981 than 1980, moderate to severe damage to corn roots by rootworm larvae may occur in continuous corn anywhere in Illinois.

Determining Potential

Corn growers should base the need for using a rootworm soil insecticide in 1982 on the abundance of rootworm beetles in cornfields during late summer of 1981. If beetle numbers reached or exceeded one per plant at any time during late July, August, or September, 1981, plan to apply a rootworm soil insecticide if the field is to be replanted to corn in 1982.

Fields of corn planted in late May or June, 1981, may have extensive rootworm damage if replanted to corn in 1982. During August and September, rootworm beetles are especially attracted to late planted or late maturing fields. Seeking fresh pollen and silks to feed on, the beetles lay millions of eggs in these fields. The heavy infestations may overwhelm even the most effective soil insecticide. Planting the fields to a crop other than corn in 1982 is suggested to reduce the overall rootworm population.

SUGGESTIONS FOR ROOTWORM CONTROL, 1982

Crop Rotation

Crop rotation is an extremely effective way to prevent damage by northern and western corn rootworm larvae. If feasible, do not grow corn two years in succession in the same field. First-year corn following soybeans will generally *not* require a soil insecticide for corn rootworm control. Researchers at the Illinois Natural History Survey and University of Illinois have confirmed that a soybean-corn-soybean-corn rotation is still effective in suppressing corn rootworms in Illinois.

Although rootworm beetles can be found in "clean" or weed-free soybean fields, and may even lay a few eggs there, the number of eggs is not great enough to warrant the use of a soil insecticide on corn the following season. In a few instances, rootworm larval damage has occurred to corn planted after soybeans when the bean field had been heavily infested with volunteer corn or weeds during August. Adult northern and western corn rootworms were attracted to these weedy soybean fields to deposit eggs. As a result, root damage by larvae occurred the following season. Good weed control in soybeans will prevent rootworm damage in corn following soybeans. Soybean fields with 5,000 or more volunteer corn plants per acre will usually warrant treatment for rootworm control the following year if planted to corn.

Corn rootworm beetles deposit the vast majority of their eggs in cornfields. The larvae cannot survive on the roots of broadleaf crops (soybeans or alfalfa) or broadleaf weeds. Consequently, when a crop other than corn, soybeans for example, is planted in a field with soil containing millions of rootworm eggs, the rootworm larvae die before becoming egg-laying beetles.

Corn following alfalfa may benefit from a soil insecticide treatment, because rootworm beetles may be attracted into blooming alfalfa fields and lay eggs there during August and September.

Soil Insecticides

During the past seven years, instances of erratic rootworm control with soil insecticides have increased. Many factors interacting with one another can affect the performance of a soil insecticide. Heavy rains immediately following planting hasten the decomposition of soil insecticides and reduce control. Lack of rainfall may prevent the activation and movement of the insecticide from the soil surface to the area where rootworm larvae are feeding. Early planting is another problem, because soil insecticides applied in early to mid-April may have lost much of their potency by the time rootworm eggs hatch in late May and June. Hence, late hatching larvae have a high survival rate, and ultimately the number of beetles is large. These factors, coupled with insecticide rates that are too low, often cause poor or marginal rootworm control. In addition, some research indicates that the erratic performance is due to microbial degradation of the soil insecticide and to increasing tolerance of rootworm larvae.

Consequently, there is some uncertainty about how well a soil insecticide will control corn rootworm larvae in a particular field or area. The suggestions for rootworm control that follow are based on research conducted by entomologists in Illinois and other states.

At Planting. Apply isofenphos (Amaze 20G, 6E), terbufos (Counter 15G), fonofos (Dyfonate 20G, 4EC), carbofuran (Furadan 10G, 15G, 4F), chlorpyrifos (Lorsban 15G), ethoprop (Mocap 10G, 6EC), or phorate (Thimet 15G, 20G) in a 7-inch band ahead of the planter press wheel at the suggested rate (see Table 2). IMPORTANT: **Note the suggestions in the sections on using Furadan and on alternating insecticides.**

Soil insecticides will give 50- to 70-percent control of corn rootworm larvae. This degree of control is adequate to prevent economic levels of larval damage in most fields. But in some heavily infested fields, enough larvae may survive to cause economic levels of root damage, and beetle populations may be large enough to interfere with pollination.

Planting-time treatments applied in early April may provide only marginal control. Consider a cultivator application in late May or early June in such fields, rather than a treatment at planting time.

Liquid formulations: Isofenphos (Amaze 6E), fonofos (Dyfonate 4E), or carbofuran (Furadan 4F) may be mixed with water and applied as a spray in a 7-inch band ahead of the press wheel. They may also be mixed with liquid fertilizer and used with a split-boot applicator at planting. Ethoprop (Mocap EC) is labeled only as a band spray mixed with water.

Incompatibility or crop injury may be a problem in treatments using a liquid insecticide with a liquid fertilizer at planting. The insecticide *must* be compatible with the fertilizer. Conduct a test before planting to make certain that the two are physically compatible. Maintain agitation in the tank after mixing and during application to prevent separation. **Use caution when handling liquid insecticide formulations.**

At Cultivation. Apply isofenphos (Amaze 20G, 6E), terbufos (Counter 15G), chlorpyrifos (Lorsban), fonofos (Dyfonate 20G), ethoprop (Mocap 10G), carbofuran (Furadan 10G, 15G), or phorate (Thimet 20G) on both sides of the row at the base of the plants just ahead of the cultivator shovels. Cover the insecticides with soil. The best time to apply a basal treatment of a soil insecticide by cultivator is in late May or early June, near the beginning of egg hatch. Such treatments may be more effective than treatments at planting time in early April.

Table 2. Soil Insecticides Suggested For Rootworm Control, Illinois, 1982

Insecticide[a]	Time of application	Ounces of product per 1,000 ft. of row	Amount of product needed per acre			
			40″ rows	38″ rows	36″ rows	30″ rows
Amaze 20G	At planting or cultivation	6	5.0 lb.	5.3 lb.	5.6 lb.	6.7 lb.
Amaze 6E	At planting or cultivation	1.6 fl. oz.	1⅓ pints	1⅜ pints	1½ pints	1¾ pints
Counter 15G	At planting or cultivation	8	6.7 lb.	7.0 lb.	7.4 lb.	8.7 lb.
Dyfonate 20G	At planting or cultivation	6	5.0 lb.	5.3 lb.	5.6 lb.	6.7 lb.
Dyfonate 4E	At planting	2.4 fl. oz.	2 pints	2⅛ pints	2¼ pints	2¾ pints
Dyfonate 4E	Preplant	Broadcast	3 quarts	3 quarts	3 quarts	3 quarts
Furadan 10G	At planting or cultivation	12	10.0 lb.	10.5 lb.	11.1 lb.	13.3 lb.
Furadan 15G	At planting or cultivation	8	6.7 lb.	7.0 lb.	7.4 lb.	8.7 lb.
Furadan 4F	At planting	2.4 fl. oz.	2 pints	2⅛ pints	2¼ pints	2¾ pints
Lorsban 15G	At planting or cultivation	8	6.7 lb.	7.0 lb.	7.4 lb.	8.7 lb.
Mocap 10G	At planting or cultivation	12	10.0 lb.	10.5 lb.	11.1 lb.	13.3 lb.
Mocap 6EC	At planting	1.6 fl. oz.	1⅓ pints	1⅜ pints	1½ pints	1¾ pints
Thimet 15G	At planting or cultivation	8	6.7 lb.	7.0 lb.	7.4 lb.	8.7 lb.
Thimet 20G	At planting or cultivation	6	5.0 lb.	5.3 lb.	5.6 lb.	6.7 lb.

[a] Consult text for more information. LIQUID FORMULATIONS ARE HIGHLY TOXIC.

Table 3. Labeled Uses of Soil Insecticides on Corn

Insecticide	Field corn	Popcorn	Sweet corn	silage	Harvest interval
Amaze	yes	yes	yes	yes	75
Counter	yes	yes	yes	yes	*
Dyfonate	yes	yes	yes	yes	45
Furadan	yes	yes	no	yes	*
Lorsban	yes	yes	yes	yes	*
Mocap	yes	no	yes	yes	*
Thimet	yes	no	yes	yes	30

* No restriction when used according to label.

Suggestions For Using Furadan. Rootworm control with carbofuran (Furadan) has been erratic in recent years. Furadan has performed effectively at some research locations and has been marginal or ineffective at others in recent years, including 1981. Problems with Furadan in Illinois were first reported in 1975, and have continued to occur since then. Practically all instances of poor control have occurred in fields or areas where Furadan has been used intensively. Research indicates that poor control may be caused by a combination of microbial degradation of the insecticide and insect tolerance. Laboratory research indicates an increase in the beetles' tolerance to Furadan, compared with toxicity levels seven years ago. In addition, the breakdown or disappearance of Furadan applied at planting time is generally more rapid in fields where the product has been used previously. Preliminary research suggests that soil microbes may be responsible for the degradation.

Consider the following suggestions for using Furadan in rootworm control:

1. If Furadan was used in 1981, switch to an organophosphate (Amaze, Counter, Dyfonate, Mocap, Lorsban, or Thimet) in 1982.

2. Do not use Furadan if rootworm control with Furadan was poor or marginal in recent years.

3. Rootworm control with Furadan should be satisfactory in fields where it has never been used before.

Suggestions For Alternating Insecticides. The suggestions that follow might help to improve rootworm control.

1. Consider alternating an organophosphate with a carbamate. Keep in mind, however, that growers generally have had no advance warning of poor control where problems with Furadan (a carbamate) have occurred.

2. The advantages of switching from an organophosphate to a carbamate are not apparent from the research, even where an organophosphate has been used for several consecutive years. But switching from one organophosphate to another may have some merit. The continuous use of any one insecticide may create problems with insect resistance. To avoid this possibility, consider switching rootworm insecticides occasionally rather than using one product year after year. A word of caution, however, about rotating soil insecticides: in some instances, rotation of soil insecticides has not given good results. The performance of an insecticide that gives only fair control of rootworms will not be improved by rotation with other insecticides.

Rootworm Control Research

The relative effectiveness and consistency of rootworm control with various soil insecticides is investigated each year in approximately seven or eight replicated tests to keep abreast of any changes that might be taking place. The tests from 1977 to 1981 indicate that Amaze and Counter have given the most consistently effective control of corn rootworms. In general, rootworm control with Mocap and Thimet was erratic in the 1981 research tests. Although mediocre or poor control has been noted with organophosphate insecticides in some fields each year, the cause does not seem to be related to insect resistance or microbial degradation.

Control of Rootworm Beetles

Use insecticides to control rootworm beetles where pollination damage may occur because of silk clipping. Research on spraying the beetles to prevent egg laying, thereby eliminating the need for a soil insecticide the next spring, has produced varying results. A single soil-insecticide treatment has usually been as effective as treating to control beetles in late July or early August and applying a soil treatment the following spring.

Some growers may use the management concept of spraying rootworm beetles to prevent egg laying. In this case, the objective is to eliminate next year's larval infestation and the need for a soil insecticide. We encourage growers who make this decision to use the scouting services of a pest management consultant to monitor fields. A properly managed adult-suppression program will require weekly scouting during July and August. Even proper timing and application of an adult-suppression spray do not guarantee success. Factors beyond the control of the operator, such as weather and beetle migration, may minimize the treatment's effectiveness.

Scouting to Determine Rootworm Potential

The abundance of rootworm beetles in a cornfield in July and August is an excellent indicator of future rootworm problems. Corn growers can determine the potential for rootworm damage in 1983 by counting western and northern corn rootworm beetles from mid-July through August, 1982, in this way:

1. Make 3 or more counts for western and northern corn rootworm beetles at 7- to 10-day intervals between mid-July and late August in fields to be replanted to corn.

2. Examine 10 plants selected at random in each of 5 areas of the field. Count all of the western and northern corn rootworm beetles on 50 plants each time. The counts take about 45 minutes in a 40-acre field.

3. As you approach a plant, move quietly to avoid disturbing the beetles. Count the beetles on the entire plant, including the ear tip, tassel, leaf surface, and behind the leaf axils.

4. Record the number of beetles you find per plant. If the average is more than one beetle per plant for any sampling date, plan to apply a rootworm soil insecticide in 1983. If average populations range from ½ to 1 beetle per plant, the probability of economic damage the following year is low, and a soil insecticide is likely to be unnecessary. If populations do not exceed an average of ½ beetle per plant for any sampling date, a soil insecticide will not be needed the following season.

Rootworm Life Cycle

Western and northern corn rootworm beetles deposit their eggs in the soil at the base of the corn plants or between rows during August and September. The eggs overwinter in the soil and begin hatching in late May. Egg hatch usually takes place over a period of 3 to 5 weeks. Consequently, in July and August all stages of the corn rootworm — egg, larva, pupa, and adult — may be found. The rootworm larvae feed on the roots of corn plants during June, July, and August. When a larva is fully grown (½ inch), it builds a cavity in the soil and goes into the pupal or resting stage. After 5 to 10 days, the beetle emerges from the soil. The development from egg hatch to adult emergence takes 27 to 40 days. After the females emerge from the soil and mate, 14 days or more elapse before they begin laying eggs. Rootworm beetles may deposit as many as 1,000 eggs; an average of 500 per female is probably common. Most egg laying in Illinois occurs after August 1.

CORN CUTWORMS

The occurrence and extent of cutworm infestations are difficult to predict each year. *Sandhill, dingy,* and *claybacked cutworms* all overwinter in Illinois as partially grown larvae, but their populations are seldom widespread. As a result, they cause damage early in the growing season in scattered areas. Sandhill cutworms are a problem in sandy areas almost every year. Dingy and claybacked cutworms occur more frequently in corn planted after sod or forage legumes than in other crop rotations.

Black cutworms do not overwinter in Illinois, so outbreaks are difficult to forecast. Infestations of black cutworm larvae arise from eggs laid by moths that are blown into Illinois in the early spring. A statewide program of monitoring black cutworm pheromone traps provides information about the time and intensity of spring moth flights. But this program is still in the preliminary stage, and predicting infestations from moth catches is risky.

Certain factors favor black cutworm outbreaks, however. These factors include late planting, infestations of broadleaf weeds before planting, excess crop residue, and corn following soybeans. The most important factors may be late planting and preplant weed infestations. Fields that are planted late are more likely to develop a preplant weed infestation than fields that are planted early. These late planted fields with weeds are more attractive to cutworm moths as a site on which to deposit their eggs.

As a result of the mild winter, many fields in northern Illinois had broadleaf weed infestations before spring tillage in 1981. These ideal egg-laying conditions, coupled with an early spring moth flight, gave rise to widespread larval infestations. Many fields required replanting, and many more were treated with postemergence insecticides.

Currently, three options are available for cutworm control: preplant or planting-time applications of soil insecticides to prevent damage and rescue treatments after the infestation appears. All have limitations.

Because of the uncertainty in predicting which fields will have light, moderate, or heavy infestations of cutworms, it may be more feasible to use rescue treatments for cutworm outbreaks rather than to use a preplant or planting-time treatment unnecessarily.

Based on the relatively low incidence of cutworm problems over the past 25 years, a grower may find an economic advantage to the wait-and-see system, which involves field scouting, rather than a costly always-apply program in which the soil insecticide is routinely applied at or before planting for a problem that may not exist.

Rescue (or emergency) treatments to control outbreaks of cutworms include sprays of chlorpyrifos (Lorsban), carbaryl (Sevin), microencapsulated methyl parathion (Penncap-M), or trichlorfon (Dylox), or carbaryl pelletized bait. Broadcast the pelletized bait on the surface, but do not incorporate. Chlorpyrifos and Penncap-M sprays should also be broadcast. Sprays of carbaryl may be banded over the row or broadcast, but the rates per acre need to be increased if the sprays are broadcast. Trichlorfon sprays should be banded.

The keys to effective cutworm control with the rescue treatments are the amount of surface moisture and the movement of the worms. Control may be poor, regardless of the insecticide used, if the topsoil is dry and crusted and the worms are working below the soil surface. Cutworm control under hot, dry soil conditions may be enhanced by cultivating or running a rotary hoe over the field soon after spraying. This disruption may cause the worms to move around and come into contact with the insecticide. When the soil is dry, the high rate of chlorpyrifos is recommended.

To determine the need for rescue treatments, scout the fields during plant emergence, particularly those fields considered to be high-risk. **Early detection of leaf-feeding or of cutting by cutworms is vital.** When the corn plants are beginning to emerge, check the fields for leaf-feeding, cutting, wilting, or missing plants. Small cutworm larvae (less than ½ inch) feed on the leaves and do not begin cutting plants until they are about half grown.

A control measure is needed on corn in the 2-leaf stage if 3 percent or more of the plants are cut and if there are 2 or more cutworms per 100 plants. At the 4-leaf stage, control is justified if 3 percent or more of the plants are cut and if there are 4 or more worms per 100 plants. A single cutworm will cut fewer of the 4-leaf plants than those in the 2-leaf stage.

Planting-time treatments of chlorpyrifos (Lorsban 15G), ethoprop (Mocap 10G), and fonofos (Dyfonate 20G) are registered for the control of cutworms in corn. The Mocap label states that Mocap will "control light to moderate infestations of cutworms"; Dyfonate is labeled for "suppression of black cutworms." Some growers may want to use one of these products in fields with a history of cutworm problems or in high-risk fields. Lorsban has provided the best cutworm control in research trials during the past few years. Research also indicates that planting-time treatments are relatively effective in controlling light to moderate infestations, but control may be unsatisfactory for heavy infestations.

Preplant broadcast treatments of chlorpyrifos (Lorsban 4E) and fonofos (Dyfonate 4E) are also registered for corn cutworm control. Lorsban is labeled at rates of 1 to 2 quarts per acre; the higher rate is suggested. Dyfonate is labeled for "suppression of black cutworms" at 4 quarts per acre. Both insecticides should be incorporated into the top 2 to 4 inches of soil immediately after application.

Replanting may be required if cutworm damage is extremely severe. Before replanting apply chlorpyrifos (Lorsban 4E) as a broadcast spray at 3 to 4 pints per acre, and incorporate the insecticide into the top 2 to 4 inches of soil. Or you can apply a granular insecticide (Lorsban 15G, Mocap 10G, Dyfonate 20G). If the cutworm infestation is heavy, the Lorsban spray will be more effective.

WIREWORMS

Wireworms may attack the seed or drill into the base of the stem below ground level, damaging or killing the growing point. Damage will show up as wilted, dead, or weakened plants and spotty stands. Wireworm larvae are yellowish-brown and wirelike; several species are known to attack corn. They live for two to five years in a field in the larval stage, feeding on the roots of grasses and crops. There is often a relationship between crops that were in the field two to four years before damage to the corn. Most reports of damage to corn have been in fields where corn follows soybeans or where there has been a corn-soybean-small-grain rotation.

Presumably the adult (a click beetle) prefers to deposit its eggs in small-grain stubble or in grassy fields of soybeans. Attempts to control wireworms with an insecticide rescue treatment after the damage appears are usually not very successful. Therefore, if an infestation is known to be present, insecticides must be applied at planting.

Wireworms are usually most damaging in bottomlands or in poorly drained areas on upland soils. Low spots in the field often have the heaviest populations.

The proportion of fields of corn affected by wireworms in Illinois is small (less than 1 percent) and does not justify the widespread use of a soil insecticide on first-year corn after soybeans. A diazinon planter-box seed treatment at planting may help deter the wireworms from attacking the seed, but this treatment will not protect the seedling.

Checking for Wireworms

A technique using baits has been developed for evaluating wireworm potential before planting. The bait stations should be established 2 to 3 weeks before the anticipated planting date. Fields where small grain or grasses have been grown the preceding 2 or 3 years are the best candidates for bait stations.

Since wireworm infestations are often localized within a field, it will be necessary to place the bait stations randomly throughout the field. One bait station per acre is desirable. As a minimum, place 2 bait stations at the highest elevation in a field, 2 on a slope, and 2 in the lowest area.

Follow this procedure for baiting:

1. Use a mixture of 1 cup of untreated wheat and 1 cup of untreated shelled corn at each station.
2. Bury the bait about 4 inches deep. It is also desirable to cover the ground over each bait station with an 18-inch square of black plastic. The plastic collects solar heat and speeds germination of the corn and wheat, which entices overwintering wireworms.
3. Mark each station with a flag or stake.
4. Dig up the bait stations in 10 to 14 days and count the number of wireworms.

Need for Treatment

If you find an average of one wireworm per bait station, use a labeled soil insecticide. In some instances, several wireworms may be found in one bait station and none in others. Wireworm infestations tend to concentrate in some locations. It may be possible to limit treatment to areas of the field where the concentration is heaviest.

WHITE GRUBS

Three species of economically important white grubs have 3-year life cycles. Peak years of damage usually occur during the year following large flights of May beetles, the adult stage of white grubs. The beetles prefer to lay their eggs in ground covered with vegetation, such as weedy soybean fields and sod.

The C-shaped white grub larvae chew on the roots and root hairs of corn seedlings. During peak years of damage, the grubs feed all season long. Damage to a cornfield is

most apparent in the spring. Symptoms of white grub injury visible aboveground are irregular emergence, reduced stands, and stunted or wilted plants. The damage is usually spotty throughout the field.

There are no established thresholds for white grub damage and no effective rescue treatments after the damage appears. However, if plants show symptoms of injury, dig around the root system of several corn plants. If white grubs are causing the problem and replanting is warranted, a soil insecticide should be applied. Terbufos (Counter 15G) is registered for the reduction of white grubs at the rate of 2 pounds of active ingredient per acre. Isofenphos (Amaze) is labeled for control of light to moderate infestations at 1 pound of active ingredient per acre. In high-risk fields, such as corn following sod, a soil insecticide is justified.

PLANTER-BOX SEED TREATMENTS

Corn. A planter-box seed treatment with diazinon will protect germinating corn against attack by seedcorn beetles and maggots. Chlorpyrifos (Lorsban 50-SL) is labeled as a slurry treatment on seed before planting to protect germinating seed against injury by seedcorn maggots. Use a seed treatment in fields that do not receive a soil insecticide at planting time, or when carbofuran (Furadan) is applied at planting time. The diazinon planter-box seed treatment is not needed if terbufos (Counter), fonofos (Dyfonate), chlorpyrifos (Lorsban), ethoprop (Mocap), isofenphos (Amaze), or phorate (Thimet) is applied at planting. NOTE: Excess dust from the seed treater may interfere with the electronic monitor in air planters.

Soybeans. Use a diazinon seed protectant to prevent damage to germinating soybeans from seedcorn maggots. Follow the label directions for application. The potential for damage is greatest during cool, wet springs when germination is slow.

EUROPEAN CORN BORERS

Corn borer moths begin to emerge in late May in southern Illinois and mid- to late June in the central and northern regions. The females lay most of their eggs in the evening. They spend the daylight hours in fencerows and other protected areas.

First-generation borers reduce yields by stalk-tunneling, which weakens the plant and destroys the tissue used to transport food within the plant.

Corn that is planted early (the fields with the tallest corn) should be monitored closely for signs of whorl-feeding by corn borer larvae from mid-June to early July. The fields with the tallest corn are the most attractive for egg laying by first-brood moths. Control is warranted if 50 percent or more of the plants have fresh whorl-feeding, if live borers are present, and if plants are 24 or more inches tall (with the leaves extended).

Corn hybrids have varying degrees of tolerance or resistance to leaf-feeding by first-generation borers. Consider this trait when selecting varieties for 1982.

Corn planted late is most attractive to moths laying eggs for the *second generation.* Yield losses caused by second-generation borers are a result of stalk breakage and ear drop, as well as physiological damage. Corn-borer entrance holes also provide avenues for stalk rot organisms. Monitor fields from mid-July to mid-August for egg masses or newly hatched larvae of the second brood.

To assess the potential for second-generation corn borer, start checking for egg masses when moth flight is underway. Examine a minimum of 25 plants, selected at random throughout the entire field, and count the number of egg masses that are found on each plant. Although the moths usually lay their eggs on the two or three leaves above or below the developing ear, you should check all the leaves. One technique is to remove the leaves one by one, starting at the bottom of the plant, and carefully scan them for egg masses.

The eggs, which are deposited in masses of 15 to 30, overlap like the scales of a fish. Calm nights favor egg deposition by the moths. The absence of hard, beating rains during moth emergence also increases the potential for infestations.

Egg masses are flat and about half the size of your little fingernail. Newly deposited eggs are white, then turn pale yellow, and become darker just before hatching. Eggs that are about to hatch have distinct black centers. These are the black heads of the larvae that are visible through the translucent eggshell. The eggs hatch in 3 to 7 days, depending on the temperature. The female moth hides in grass and weeds during the day. Noncrop areas that border cornfields may harbor large numbers of corn borer moths during the day. Check these areas for moths as you enter the field to determine the amount of corn borer infestation.

Treatment is warranted when you find an average of 1 or more egg masses per plant. Because peak egg-laying generally occurs over a period of 2 to 4 weeks, it will be necessary to resample fields if egg counts do not reach or exceed 1 egg mass per plant during the initial survey. If cumulative counts (taken 1 week apart) exceed 1 egg mass per plant, apply a treatment.

For best results, treatment should be applied soon after egg hatch to kill the young larvae before they bore into the plant. The larvae begin tunneling into the stalks about 10 days after hatching. Because egglaying for the second generation extends over a 3- to 4-week period, timing of insecticide application should be precise. Occasionally, two treatments may be necessary for satisfactory control.

CORN LEAF APHIDS

Corn leaf aphids are small, soft-bodied, greenish-blue plant lice about the size of a pinhead. They do not overwinter in Illinois, and it is impossible to predict what the situation will be in 1982. Winged corn leaf aphids, blown

into Illinois on southwesterly winds during mid- to late June, become established within the whorl leaves of the corn plant. These aphids give birth to living young. In the absence of predators, parasites, diseases, and hard beating rains, aphid populations may increase very rapidly.

Corn leaf aphids have sucking mouthparts and cause damage by sucking moisture from the corn plant. Soil moisture stress and heavy infestations on the upper leaves and tassel may result in barren plants or reduced ear size. The critical period for damage is during tassel emergence through pollination. If aphids are allowed to cover the tassel and upper two or three leaves, yield losses are likely to occur.

Fields should be scouted for aphids beginning about one week before tassel emergence. Pull and unroll the whorl leaves of plants selected at random to check for aphids. Treatment is suggested if 50 percent of the plants have 100 or more corn leaf aphids per plant during tassel emergence and if *plants are under drouth stress.* Aphid populations usually decline after pollination is complete. However, treatment may be warranted following pollination if aphid populations continue to cover the tassel and one or two of the upper leaves.

REDUCED TILLAGE AND NO-TILL INSECT PESTS

Concern about insect problems should not keep growers from adopting conservation tillage practices. The soil-insect complex in corn, which is similar in many ways for conventional and reduced-tillage systems, can be readily controlled by applying soil insecticides at planting time. With a few exceptions, outbreaks of insects feeding on foliage can be controlled with properly timed treatments of insecticides. **Close monitoring of fields to detect insect outbreaks is very important, regardless of the tillage system.**

Weather conditions and the type of crop rotations determine to a great extent whether a soil insect problem will occur and what kind it will be. In some instances, tillage may also influence the kind and abundance of an insect pest. Some tillage operations favor specific pests. Others tend to reduce pest problems. The general expectation is that insect infestations will be more pronounced where no-tillage is used in corn than where conventional or reduced-tillage systems are used.

No-Till Pests

Insect problems occur more frequently in no-till corn than in any other conservation tillage system and are often more serious. Crop residue left by the use of no-till practices provides a stable environment for pest survival and development. Pest problems occurring under these conditions include European corn borer, cutworms, armyworm, common stalk borer, wireworms, seedcorn maggots, billbugs, slugs, and mice. Soil insecticides may be needed on no-till corn following corn (in rootworm area), grass sod, legumes, or following any crop in which grasses and broadleaf weeds are prevalent.

Soil Insect Control

Select a soil insecticide that will control the anticipated soil insect pest. Consult Table 4 for suggestions. If a soil insecticide is not applied at planting, a diazinon planter-box seed protectant will give protection against seedcorn maggots and seedcorn beetles.

Surface residues from no-till and reduced-tillage systems may present some problems with the placement and incorporation of granular soil insecticides applied at planting. To be most effective, the soil insecticide should be incorporated into the upper ½ inch of soil, and not just broadcast on the surface. Granules remaining on the soil surface are degraded by sunlight, resulting in erratic or poor control.

NOTE: Before using Mocap, Dyfonate, or Thimet on no-till corn, be sure that soil moisture is low enough to ensure closing of the seed furrow to prevent the insecticide granules from contacting the seed. Crop injury may occur with these products.

Aboveground Insect Pests

Aboveground insects will be more of a problem in no-till corn than under reduced or conventional tillage. Corn planted in grass sod or fall-seeded rye is vulnerable to attack by *armyworms.* The moths lay eggs on the grasses during April or early May. After vegetation is killed by a herbicide, the larvae move to the young corn seedlings and feed on them. Control is justified when 25 percent of the plants are being damaged. Rescue treatments are effective, but a spray volume of 15 to 20 gallons per acre will improve coverage and control.

Instances of damage to corn by the *common stalk borer* have been greater in no-till corn than with other tillage systems. Moths of this insect deposit their eggs on weeds in late August and September. When a herbicide is applied in the spring to no-till corn in fields previously infested with host weeds, the newly hatched stalk borer larvae move from the dead vegetation and attack newly emerging corn plants. Control of common stalk borer with insecticides is generally poor because the worms do not have access to the chemical.

Noninsect pests in no-till corn include *slugs* and *mice.* There are no effective control measures for slugs. Mouse damage may be a severe problem, particularly in corn following sod. To reduce or prevent mouse damage to corn, use a hopper-box seed treatment of methiocarb (Mesurol 50% bird repellent) at the rate of 1 pound per 100 pounds of seed corn. This product has a state label.

FORAGE INSECTS

In 1982, we expect *alfalfa weevils* to cause moderate to severe damage to the first cutting of alfalfa in most areas

of Illinois. In the southern counties, where a lot of egg laying takes place in the fall, alfalfa-weevil larval damage occurs early in the spring. Damage to the first cutting in northern Illinois is more likely to occur if hay harvest is delayed. Otherwise, the injury to alfalfa in the northern counties will occur on the stubble and new growth of the second cutting.

Numbers of alfalfa weevils are regulated to a large extent by winter weather. During a cold, open winter the mortality rate is high in overwintering weevil populations; during mild winters the mortality rate is low.

A parasitic wasp and a fungal disease organism that attacks alfalfa weevil larvae sometimes regulate weevil numbers in the spring. The fungal disease, which was first found in Illinois in 1979, was not a significant factor in 1981, so weevil larvae were not held in check. The effect that natural enemies and diseases have on alfalfa weevil populations is still unknown. Although the wasp and the fungus will be present in alfalfa fields in 1982, we cannot yet predict their effect on weevil numbers.

Alfalfa growers in southern and central Illinois should inspect their fields closely in April, May, and June. Early larval damage appears as pinholes in the growing terminals. As the larvae grow, they skeletonize the leaves, and damaged fields appear tattered. Growers in northern Illinois should look carefully for larval damage in late May and June. All growers should examine the stubble after the first cutting, because larval and adult feeding can slow or halt new growth. Follow the suggestions in Circular 1136, "Alfalfa Weevil Pest Management Program," to determine the need and proper timing of a treatment. If this circular is unavailable, a rule of thumb is to treat when 25 percent of the tips are being skeletonized. This threshold may be as high as 40 percent in northern Illinois, where damage occurs later in the season.

Potato leafhoppers may cause moderate to severe damage to the second and third cuttings of alfalfa in all areas of Illinois in 1982. Populations of leafhoppers were large in 1981, and many acres of alfalfa were injured severely. Damaged alfalfa was stunted and turned yellow or brown. Many people confused the damage with diseases or nutrient deficiency.

Damage first appears as a yellow, wedge-shaped area at the tip of the leaf and is more evident during dry weather. However, population levels are difficult to predict because the leafhoppers do not survive the winter in Illinois. They migrate from southern states into Illinois during May and June.

Potato-leafhopper damage may begin on the new growth as soon as the first hay crop is removed. (Stunting and yellowing are signs of leafhopper injury.) A swarm of leafhoppers at the time of the first cutting indicates that there may be a problem in the new growth. If you use a sweep net to monitor fields, apply treatments when there are one or more leafhoppers per sweep.

BEAN LEAF BEETLES

Bean leaf beetles overwinter as adults under debris in fencerows, wooded areas, and other protected sites. The survival of the overwintering beetles depends on the winter weather. A mild winter increases the chances for a large population in the spring. In addition, if soybeans are planted early in 1982, the beetles will establish themselves early. The availability of soybeans during the early part of the season is essential for the survival of bean leaf beetles. The survival of large numbers early in the season generally means an even larger population in August. On the other hand, a severe winter and later planted soybeans will reduce the number of bean leaf beetles in the spring.

The beetles may cause considerable leaf-feeding injury to double-cropped soybeans and late maturing soybean varieties. Insecticide treatments are recommended during the critical pod-set and pod-fill stages, when defoliation exceeds 15 to 20 percent. The greatest concern, however, is caused by the beetles' pod-feeding damage, which leaves scars on many pods. These scars predispose the pods to fungal infections. We are still uncertain how much pod-feeding affects yields.

CHEMICAL INJURY TO SOYBEANS

There have been instances of phytotoxicity to soybeans when organic phosphate soil insecticides were used. The problems have occurred where growers started planting soybeans without first emptying the insecticide boxes. Organic phosphate soil insecticides applied in soybean fields treated with metribuzin (Sencor or Lexone) may result in injury to a soybean crop, according to information on the labels.

CALIBRATION FOR GRANULAR SOIL INSECTICIDES

Calibrate the applicators for granular soil insecticides before the planting season begins. In some instances, poor control is caused by applying rates that are too low. Proper calibration will help avoid this problem. Most soil insecticide bags have a list of suggested settings for the particular model of applicator. The settings are based on planting speed. The *beginning settings* are helpful, but be sure to check your actual application rate under your own operating conditions.

Follow these steps for calibrating the applicator:

1. Calibration of granular applicators for soil insecticides is usually based on determining how many ounces of product are needed per 1,000 feet of row. Consult the insecticide label or Table 2 for labeled rates for rootworm control. These rates are expressed in ounces per 1,000 feet of row and pounds of product per acre.

2. Consult the label or manufacturer's recommendation for an approximate application setting. Adjust the setting on each hopper.

3. Select an area for a test run, preferably in the field, so that speed and traction conditions are constant. Measure off 1,000 feet.

4. Fill the hoppers and attach a plastic bag or container to each delivery tube to catch the granules from each hopper.

5. Drive the premeasured distance (1,000 feet) at the same speed to be used during the planting operation.

6. Weigh the material collected from each hopper. Use a scale that weighs in ounces (e.g., a postal scale or a diet scale).

7. Compare the quantity (ounces) per bag against those given in Table 2. To obtain one pound of active ingredient per acre the following amounts of material should be collected:

Formulation, percent	Oz. collected per 1,000 ft.
10	12
15	8
20	6

8. Recalibrate if the difference in quantity applied during the calibration process is more than 10 percent over or under the rate suggested on the label.

MANAGING INSECT PESTS IN STORED GRAIN

This section describes a program for preventing insect problems in stored grain. For more details on insecticide formulations and dilution of them, see Table 10.

Store only clean, dry grain. Its moisture content should be 13 percent or less; it should be cooled to 40°F as soon as possible; and foreign material should be kept to a minimum. If grain is to be stored one month or more between May and October, follow the procedures listed below.

Wheat

1. Thoroughly clean in, around, and under the bin and clean grain-handling equipment before harvest. Collect the first few bushels coming through the combine and feed to livestock.

2. Spray the walls, ceiling, and floor of the bin to runoff with 1.5 percent malathion; use 3 ounces of the 50 to 57 percent EC per gallon of water.

3. Treat the wheat with malathion. Mix 1 pint of malathion 50 to 57 percent EC in 2 to 5 gallons of water and spray the mixture as uniformly as possible over each 1,000 bushels. Treat the wheat as it is being augered or elevated into the bin. An alternative is to apply 10 pounds of 6 percent malathion dust (wheat flour) per 1,000 bushels. Do not treat the grain until after it is heat dried.

4. Hang one dichlorvos resin strip per 1,000 cubic feet of overspace in enclosed bins and replace the strips every 6 weeks. In open bins use the dichlorvos resin strips under a raised tarp. An alternative to the dichlorvos strip is *Bacillus thuringiensis* (Dipel, Topside, SOK-BT). Apply it as a wettable powder (1 pound per 10 gallons of water) or liquid concentrate (4 pints per 10 gallons of water) at 0.6 pints per bushel to the top 4 inches of wheat as it is augered into the bin. A dust formulation of *Bacillus thuringiensis* is available and should be applied at ½ ounce per bushel on the top 4 inches of wheat as it is binned. Level the surface of the wheat after treatment.

5. Spray the surface of the grain with malathion. Add 3 ounces of malathion 50 to 57 percent EC to 1 gallon of water. Apply at a rate of 2 gallons of finished spray per 1,000 square feet. An alternative is to apply 6 percent malathion dust at 5 pounds per 1,000 square feet. The surface treatment will help prevent infestation by insects entering bins through the top vent.

6. Cool the grain to 40°F as soon as possible. Insect reproduction ceases below 60°F, and feeding stops below 50°F.

7. Reinspect the grain at regular monthly intervals. Insert metal rods or a temperature probe down through the center of the grain to check for "hot spots."

Corn

Follow the same steps as for wheat if the corn is harvested before October 1 or carried over beyond May 15 of the following year. Otherwise, no treatment is needed other than cleanup and bin spraying.

Soybeans

Clean the bin and grain-handling equipment before harvest, and spray the walls, ceiling, and floor of the bin as suggested for wheat. If soybeans are harvested before October 1 or carried over beyond May 15 of the following year, use the same treatment as suggested in step 4 under wheat. No insecticide is labeled for direct application to stored soybeans.

Infested Carry-Over Grain

Apply a fumigant to corn or wheat that becomes infested between May and October, following the procedure described below. After fumigating, follow steps 4 through 7 under wheat.

NOTE: Bins with a capacity of more than 3,000 bushels should probably be treated by a licensed, professional fumigator. See your county Extension adviser in agriculture for a list of licensed fumigators.

1. On a calm, warm day when the grain temperature is above 65°F (preferably above 70°F), seal cracks and holes in the bin, paying particular attention to the base area around the doors and ventilating fan.

2. Level the surface of the grain, break up any caked or crusted areas, and remove webbing. The surface level of the grain should be at least 8 inches below the lip of the bin.

3. Apply a liquid fumigant at 3 to 5 gallons per 1,000 bushels. Use the higher rate on wooden bins and in flat storages. Place the containers on the surface, spacing them

evenly. Loosen the caps slightly, then remove them, and invert the containers on the surface. *Get out of the bin within 30 seconds to one minute.* It is better to apply the liquid fumigant uniformly over the surface as a course spray if you can do so from outside the bin. Have someone standing outside the bin as a safeguard. Some common liquid fumigants are carbon bisulfide + carbon tetrachloride (80:20 mixture), and ethylene dichloride + carbon tetrachloride (75:25 mixture). Other liquid fumigants may contain additional materials such as ethylene dibromide and sulfur dioxide and are also effective. The aluminum phosphide (Phostoxin, Detia) tablet or pellet can be used, but a special application device is needed to place the tablets in the grain mass. When handling the tablets, do not allow water to come in contact with them. Wear neoprene rubber gloves to prevent perspiration from coming in contact with the tablets.

4. Put a tarp over wooden bins if you can do so safely. Close for 72 hours and then air out. The empty containers should be removed from the bin after airing and disposed of properly.

5. Place signs at all entrances warning that the bin is being fumigated and list the fumigant used and the name, address, and telephone number of a responsible person to contact in case of emergency.

6. As an alternative to fumigation, it may be possible to use a malathion protectant treatment. If the grain can be moved to a clean and sprayed bin, apply a spray of malathion to the grain as it is augered or elevated to the new bin. The spray is commonly applied from a 3-gallon tank sprayer. Mix 1 pint of 50 to 57 percent malathion in 2 to 5 gallons of water and spray the mixture on each 1,000 bushels. Although the malathion will not immediately kill insects that are inside the kernels, it will eventually provide effective control.

NOTE: Anhydrous ammonia is not suggested for fumigation of stored grains. It is generally ineffective against insects in stored grain at dosages below the point at which grain is blackened from exposure.

Uninfested Carry-Over Grain

Beginning about May 15 in the southern half of Illinois and June 1 in the northern half of the state, follow these suggestions. Grain not treated with an overall malathion protectant spray will need to be fumigated in the summer. Normally, in the southern half of Illinois, two fumigations per season will be needed. Apply the first treatment in mid-July and the second about September 1. In the northern half of the state, one fumigation per season is usually sufficient. Apply this treatment in mid-August. Follow steps 4 through 7 under wheat. Follow the same procedure for each succeeding year of storage.

Table 4. Field Corn

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Corn rootworm larvae	June-August	*Amaze (isofenphos)	1[b]	Band	For John Deere 7000 series planters, place Dyfonate, Mocap, and Thimet behind the firming wheels. Do not place Dyfonate, Mocap, or Thimet in direct contact with the seed. (See text on soil insecticides at planting time.) Basal treatments during cultivation with Amaze, Counter, Dyfonate, Furadan, Lorsban, Mocap, or Thimet are effective in late May or early June.
		Counter (terbufos)	1[b]	Band	
		**Dyfonate (fonofos)	1[b]	Band	
		**Dyfonate (fonofos)	3	Broadcast-PPI[c]	
		**Furadan (carbofuran)	1[b]	Band	
		Lorsban (chlorpyrifos)	1[b]	Band	
		**Mocap (ethoprop)	1[b]	Band	
		Thimet (phorate)	1[b]	Band	
Seedcorn maggot	At germination	**Amaze (isofenphos)	1[b]	Band	At planting.
		Counter (terbufos)	1[b]	Furrow	
		**Dyfonate (fonofos)	1[b]	Band	
		Lorsban (chlorpyrifos)	1[b]	Furrow	
		diazinon	1½ oz. a.i. per bu.	On seed	
		Lorsban (chlorpyrifos)	1 oz. a.i. per 100 lb. of seed	On seed	Slurry formulation used to treat seed before planting.
Seedcorn beetles	At germination	**Amaze (isofenphos)	1[b]	Band	At planting.
		**Dyfonate (fonofos)	1[b]	Band	
		Thimet (phorate)	1[b]	Band	
		diazinon	1½ oz. a.i. per bu.	On seed	
Wireworms	May-June	**Amaze (isofenphos)	1[b]	Band	Amaze is labeled for control of low to moderate infestations. Thimet and Dyfonate applied in a 7-inch band are labeled for suppression of wireworms.
		Counter (terbufos)	1[b]	Band, furrow	
(*Wireworms continued on the next page.*)		**Dyfonate (fonofos)	1[b]	Band	
		**Dyfonate (fonofos)	4	Broadcast-PPI[c]	

Table 4. Field Corn (continued)

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Wireworms (continued)		**Furadan (carbofuran)	2[b]	Band, furrow	
		Lorsban (chlorpyrifos)	2[b]	Band, furrow	
		Lorsban (chlorpyrifos)	2	Broadcast-PPI[c]	
		**Mocap (ethoprop)	1[b]	Band	
		Thimet (phorate)	1[b]	Band	
Cutworms	May-June	Lorsban granules (chlorpyrifos)	1[b]	Band	At planting.
		Lorsban spray (chlorpyrifos)	1-2	Broadcast-PPI[c]	
		**Dyfonate (fonofos)	1[b]	Band	Suppresses cutworms.
		**Dyfonate (fonofos)	4	Broadcast-PPI[c]	
		**Mocap (ethoprop)	1[b]	Band	At planting. Controls light to moderate infestations.
		Lorsban spray (chlorpyrifos)	1-1½	Broadcast	Apply as a postemergence rescue treatment when 3 percent or more of the plants are cut in the 2-leaf stage and there are 2 or more cutworms per 100 plants. At the 4-leaf stage, control is justified if 3 percent or more of the plants are cut and there are 4 or more worms per 100 plants.
		Sevin spray (carbaryl)	2[b]	Plant base	
		Sevin bait (carbaryl)	1-2	Broadcast	
		Dylox, Proxol spray (trichlorfon)	1[b]	Plant base	
		*Penncap-M (micro-encapsulated methyl parathion)	1	Broadcast	Apply Penncap-M only by ground.
White grubs	May-October	**Amaze (isofenphos)	1[b]	Band	Amaze is labeled for control of low to moderate infestations, and Counter is labeled for reduction of white grubs at planting.
		Counter (terbufos)	2[b]	Band	
Garden symphylan	May-July	Counter (terbufos)	1-2[b]	Band	At planting.
		**Dyfonate (fonofos)	2	Broadcast-PPI[c]	
		Lorsban (chlorpyrifos)	1-1½[b]	Band	
Billbug	May-June	Lorsban granules (chlorpyrifos)	2[b]	Band, furrow	Apply Lorsban spray or toxaphene spray as a postemergence rescue treatment when damage appears.
		Lorsban spray (chlorpyrifos)	1-1½	Broadcast	
		toxaphene	2[b]	At plant base	
Flea beetles	May-June	Sevin, Savit (carbaryl)	1[b]	Over row as spray	When leaves on seedling plants are severely damaged and some plants are being killed.
		diazinon	½[b]		
Sod webworm	May-June	toxaphene	2[b]	At base of plant	At time of initial attack.
Common stalk borer	May-June	Furadan (carbofuran)	2-3[b]	Furrow	Application of Furadan at planting time may provide early season suppression of common stalk borers. Postemergence sprays of carbaryl (Sevin), methomyl (Nudrin, Lannate), or chlorpyrifos (Lorsban) may give some control if applied when damage first appears.
Hop vine borer	May-June	None labeled	..	...	Postemergence sprays of carbaryl (Sevin), methomyl (Nudrin, Lannate), or chlorpyrifos (Lorsban) may give some control if applied when damage first appears.
Thrips	May-June	malathion	1[b]	On foliage as spray	When severe wilting and yellowing of leaves are noticed.
		Metasystox-R (oxydemeton-methyl)	½[b]		
Armyworms	May-August	Sevin (carbaryl)	1½	Over row as spray	At first migration, or when worms are eating leaves above ear level.
		Dylox, Proxol (trichlorfon)	1		
		*Lannate, *Nudrin (methomyl)[d]	½		
		malathion	1		
		Lorsban (chlorpyrifos)	1		

Table 4. Field Corn (continued)

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Chinch bug	June-August	Sevin (carbaryl)†	2[b]	Spray at base of plant	At start of migration from small grains. Use only ground equipment and apply 25 to 40 gallons per acre.
European corn borer, first generation	June-July	diazinon granules Furadan granules (carbofuran) Dyfonate granules (fonofos) *Penncap-M (microencapsulated methyl parathion)	1 1 1 1	On upper ⅓ of plant and into whorl	When 50% or more of the plants have fresh whorl feeding, live borers present, and extended leaf height is 24 inches or greater.
		Thuricide granules (*Bacillus thuringiensis*)	see label		For suppression. A second application may be needed.
European corn borer, second generation	Late July, mid-August	diazinon granules Furadan granules (carbofuran) Dyfonate granules (fonofos) *Penncap-M (microencapsulated methyl parathion)	1 1 1 1	On foliage	Apply at first hatch when there are one or more egg masses per plant, or when cumulative counts, made one week apart, exceed one egg mass per plant.
		Thuricide granules (*Bacillus thuringiensis*)	see label		For suppression. A second application may be needed.
Woollybear caterpillars	July	None labeled	..	...	Silk clipping caused by caterpillars does not generally warrant control.
Grasshoppers	June-September	Sevin (carbaryl) diazinon Cygon (dimethoate) malathion Lorsban (chlorpyrifos) *Penncap-M (microencapsulated methyl parathion)	1-1½ ½ ½ 1 ½ ½	Over row as spray	As needed.
Spider mites	July-August	Di-Syston 15G (disulfoton) Meta-Systox-R (oxydemetonmethyl) Thimet 15G (phorate) Trithion (carbophenothion) ethion diazinon	1 ½ 1 1 1 ½	On foliage	Begin control if the majority of plants are infested with mites severe enough to cause some yellowing or browning of the lower leaves before dent stage.
Japanese beetle	July-August	Sevin, Savit (carbaryl)	1	Over plant	During the silking period to protect pollination if less than 75% of plants are silked and three or more beetles are present per ear.
Corn leaf aphid	July-August	malathion diazinon	1 1	On foliage	Apply during late whorl to early tassel when 50% of plants have light to moderate infestations and plants are under drouth stress.
Corn rootworm beetles	July-August	Sevin, Savit (carbaryl) malathion diazinon Imidan (phosmet) *Penncap-M (microencapsulated methyl parathion)	1 1 ½ ½ ½	Overall spray or directed toward ear zone	Before 75% of plants have silked, if there are 5 or more beetles per plant and if silk clipping is observed. Only to protect pollination. Imidan is labeled for suppression of corn rootworm beetles.

Table 4. Field Corn (continued)

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Southwestern corn borer	August	Furadan granules (carbofuran)	1	On foliage	Direct granules over row. Apply when 25% of the plants have egg masses or larvae on leaves. Early-planted corn usually escapes damage.
		diazinon granules	1-2		
		Dyfonate granules (fonofos)	1		
		*Penncap-M (microencapsulated methyl parathion)	1		
Corn earworm	August	Sevin (carbaryl)	2	Directed toward ears	Insecticide applications are rarely effective for the control of earworms in commercial field corn after worms enter ear tips.
		*Lannate, *Nudrin (methomyl)[d]	½		
Fall armyworm	July-September	Sevin, Savit sprays (carbaryl)	2	On foliage	Granules are more effective if worms are deep in whorl. If worms are small and out on leaves, sprays are effective. Treat when 35% of plants have whorl damage and if worms are present. Treatments to control worms in ear tips are not generally effective.
		diazinon granules	1		
		Dylox. Proxol spray (trichlorfon)	1		
		*Lannate, *Nudrin (methomyl)[d]	½		

* Use restricted to certified applicators only.
** Liquid formulations of Dyfonate, Furadan, Mocap, and Amaze are restricted. Amaze 20G is also restricted.
† State labeled insecticide. Applicator must have Illinois label in possession when applying.
[a] See Table 14 for insecticide restrictions.
[b] Based on 40-inch row spacing. Increase rates for narrow rows.
[c] PPI Pre-plant incorporated.
[d] To be applied only by experienced operators or those wearing protective clothing.

Table 5. Soybeans

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Seedcorn maggot	Germination	diazinon	¾ oz. a.i. per bu.	On seed	At planting time.
Bean leaf beetle	May-June, August	Sevin, Savit (carbaryl)	1	On foliage	When defoliation reaches 30% before bloom or 15% during blooming and pod fill and if beetles are present in the field. If 10% of pods are damaged and leaves are green.
		Orthene (acephate)	½-1		
		*Penncap-M (microencapsulated methyl parathion)[b]	1		
		*Lannate, *Nudrin (methomyl)[c]	½		
		*Pydrin (fenvalerate)	0.1		
Cutworms	May-June	Sevin bait, Sevin XLR (carbaryl)	1½	Broadcast	During plant emergence if stand has gaps of one foot or more.
		diazinon	2-4	Broadcast PPI	
Thistle caterpillar	June	Sevin (carbaryl)	2	On foliage	When defoliation reaches 30% before bloom and 15% between bloom and pod fill.
Mexican bean beetle	May-July	*Penncap-M (microencapsulated methyl parathion)[b]	½-¾	On foliage	See bean leaf beetle (above) for defoliation threshold.
		Orthene (acephate)	½-1		
		*Nudrin, *Lannate (methomyl)[c]	½		
		Sevin (carbaryl)	1		
		malathion	1½		
		Cygon (dimethoate)	½		
		*Pydrin (fenvalerate)	0.1		

Table 5. Soybeans (continued)

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Grasshoppers	June-September	Cygon (dimethoate)	½	On foliage	When migration into fields begins and defoliation or pod feeding reaches economic levels. See bean leaf beetle (above).
		Sevin, Savit (carbaryl)	1		
		Orthene (acephate)	½		
Japanese beetle	June-July	Sevin (carbaryl)	1	On foliage	When defoliation reaches 15% during bloom and pod fill.
Green cloverworm	July-August	Sevin (carbaryl)	1	On foliage	When defoliation occurs during blooming, pod set, and pod fill. Usually requires 12 or more half-grown worms per foot of row and 15% defoliation to justify treatment.
		*Lannate, *Nudrin (methomyl)[c]	½		
		Orthene (acephate)	½-1		
		malathion	1½		
		Dipel, Thuricide, Bactur, SOK (*Bacillus thuringiensis*)	(See label)		
		*Penncap-M (microencapsulated methyl parathion)[b]	½-¾		
		*Pydrin (fenvalerate)	0.1		
Webworms	June-August	Sevin, Savit (carbaryl)	1	On foliage	Requires 15% or more defoliation between bloom and pod fill to justify treatment.
Spider mite	June-August	Trithion (carbophenothion)	½-¾	On foliage	As needed on field margins or entire field.
		Cygon (dimethoate)	½		
Stink bugs	July-August	Orthene (acephate)	¾-1	On foliage	When adult bugs or large nymphs reach 1 per foot of row during pod-fill.
		*Penncap-M (microencapsulated methyl parathion)[b]	½-¾		
		Sevin (carbaryl)	1		
		*Pydrin (fenvalerate)	0.1-0.2		
Thrips	June-August	Sevin, Savit (carbaryl)	1	On foliage	If seedlings are being seriously damaged and some plants are being killed.
		*Lannate, *Nudrin (methomyl)[c]	¼		
Blister beetles	July-August	Sevin (carbaryl)	1	On foliage	See bean leaf beetle (above) for defoliation threshold.
Saltmarsh caterpillar	August	Sevin (carbaryl)	2	On foliage	See bean leaf beetle (above) for defoliation threshold.
		*Lannate, *Nudrin (methomyl)[c]	½		
Loopers	August	Orthene (acephate)	½-1	On foliage	See bean leaf beetle (above) for defoliation threshold.
		Thuricide, Dipel, Bactur, SOK (*Bacillus thuringiensis*)	(See label)		
		*Lannate, *Nudrin (methomyl)[c]	½-1		
		*Pydrin (fenvalerate)	0.1-0.2		
Woollybear caterpillar	August	None labeled	..	...	Infestations are rarely economic.
Whitefly	August-September	None labeled	..	...	High infestations are occasionally present on double-crop soybeans, but are rarely economic.
Corn earworm	August-September	Orthene (acephate)	1	On foliage	Damage occurs when larvae feed on pods. Apply control if populations exceed 1 per foot of row.
		Sevin (carbaryl)	1		
		*Lannate, *Nudrin (methomyl)[c]	½		
		*Penncap-M (microencapsulated methyl parathion)[b]	1		
		*Pydrin (fenvalerate)	0.1-0.2		

* Use restricted to certified applicators only.
[a] See Table 14 for insecticide restrictions.
[b] This product is highly toxic to bees.
[c] To be applied only by experienced operators or those wearing protective clothing.

Table 6. Alfalfa and Clover

Insect	Time of attack	Insecticide[a, b]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Clover leaf weevil	March-April	malathion	1	On foliage	When larvae are numerous and leaf feeding is noticeable, usually in early to mid-April. Usually requires 5 or more healthy larvae per crown to justify treatment.
Alfalfa weevil (spring treatment for larvae)	March-June	*Furadan (carbofuran)[c, d] *Supracide (methidathion)[c] malathion plus methoxychlor Imidan (phosmet) *Penncap-M (microencapsulated methyl parathion)[e] *Lannate, *Nudrin (methomyl)[c]	¼ ½ 2 qt. per acre 1 ½ 0.9	On foliage	Refer to circular 1136. Or when 25% of tips are being skeletonized and if there are 3 or more larvae per stem, treat immediately. Do not apply sprays during bloom. Instead, cut and remove the hay. Two treatments may be necessary on first cutting. Watch regrowth of second crop for signs of damage, and apply a treatment if feeding damage is apparent. **Do not spray alfalfa with Penncap-M during bloom to avoid injury to bees.**
Alfalfa weevil adults	June	*Furadan (carbofuran)[c, d] *methyl parathion	½-1 ½	On foliage	As a stubble spray. Technically, Supracide and Penncap-M could be used, since the labels do not distinguish between alfalfa weevil larvae and adults.
Spittlebug	Late April, May	malathion plus methoxychlor malathion	2 qt. per acre 1	On foliage	When spittle masses are found and nymphs average more than 1 per stem.
Cutworms	May-June	Sevin (carbaryl) Dylox, Proxol (trichlorfon) *Lannate, *Nudrin (methomyl)[c]	1½ 1 ½	On foliage	As needed on regrowth of second cutting.
Aphids	April-August	Cygon, De-Fend (dimethoate) diazinon malathion *Furadan (carbofuran)[c, d] *Penncap-M (microencapsulated methyl parathion)[e] *Supracide (methidathion)[c] *Lannate, *Nudrin (methomyl)[c]	½ ½ 1 ¼-½ ½ ½-1 ½	On foliage	When aphids are abundant and lady beetle larvae and adults, parasites, and diseases are low.
Leafhoppers	June-August	Sevin, Savit (carbaryl) diazinon *Penncap-M (microencapsulated methyl parathion)[e] Cygon, De-Fend (dimethoate) Dylox, Proxol (trichlorfon) *Supracide (methidathion)[c] Imidan (phosmet) *Furadan (carbofuran)[c, d]	1 ½ ½ ½ ½-1 ½-1 1 1	On foliage	When second-growth alfalfa is 4 to 5 inches tall, apply a treatment where there are one or more leafhoppers per sweep.
Grasshoppers	June-September	Cygon, De-Fend (dimethoate) Sevin, Savit (carbaryl) *Furadan (carbofuran)[c, d] diazinon	½ 1 ¼ ½	On foliage	When grasshoppers are small and before damage is severe. Avoid treatments when plants are blooming. Cut the hay and remove the crop.

Table 6. Alfalfa and Clover (continued)

Insect	Time of attack	Insecticide[a, b]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Webworms	July-August	Sevin, Savit (carbaryl) Dylox, Proxol (trichlorfon) malathion plus methoxychlor	1 1 2 qt. per acre	On foliage	If damage appears.
Fall armyworm	August-September	Sevin (carbaryl) Dylox (trichlorfon) *Lannate, *Nudrin (methomyl)[c]	1 1 ½	On foliage	Usually in late summer or early fall on new seedings or established stands.

* Use restricted to certified applicators only.
[a] See Table 14 for insecticide restrictions.
[b] Before applying insecticides, be certain to clean all herbicides out of equipment. During pollination, apply very late in day or, if possible, avoid application during bloom.
[c] To be applied only by experienced operators or those wearing protective clothing.
[d] Only for pure stands of alfalfa. When using no more than ¼ pound per acre, allow 7 days between application and harvest. If you use ¼ to ½ pound per acre, allow 14 days to elapse between application and harvest.
[e] This product is highly toxic to bees exposed to direct treatment or residues on crops.

Table 7. Grain Sorghum

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Cutworms	May-June	Sevin (carbaryl)	2	Over row	When seedling plants are being cut.
Yellow sugarcane aphid	May-June	Metasystox-R (oxydemeton-methyl)	¼-½	Over row	Treatment should be applied at first sign of damage to seedling sorghum; 5 to 10 aphids per leaf.
Greenbug	June-July	Cygon, De-Fend (dimethoate) malathion diazinon Metasystox-R (oxydemetonmethyl)	¼-½ 1 ½ ¼-½	Over row	When greenbug damage is sufficient to cause death of more than 2 normal-sized leaves before the hard-dough stage. Caution: Some sorghum varieties are sensitive to organophosphate insecticides.
Grasshoppers	June-August	Cygon (dimethoate)	½	Over row	As needed.
Fall armyworm	July-August	Sevin (carbaryl) *Lannate, *Nudrin (methomyl)[b]	1½ ¼-½	Over row	When there is an average of 2 worms per head. Leaf feeding or whorl damage is seldom economic.
Webworms	After heads form	Sevin, Savit (carbaryl) *Lannate, *Nudrin (methomyl)[b]	1-2 ½	Over row	When 5 or more larvae per head are found.
Corn earworm	After heads form	Sevin, Savit (carbaryl) *Lannate, *Nudrin (methomyl)[b]	1-2 ¼-½	Over row	When there is an average of 2 worms per head.
Sorghum midge	August-September	Cygon (dimethoate) diazinon Sevin (carbaryl) *Lannate, *Nudrin (methomyl)[b] Lorsban (chlorpyrifos)	¼ ¼-½ 1½ ¼-½ ¼	Over row	Apply during bloom when 50% of heads have begun to bloom and there are 1 or more midge adults (flies) per head.
Corn leaf aphid	July-September	Cygon (dimethoate) malathion	¼ 1	Over row	Corn leaf aphids rarely cause economic damage unless populations are heavy and drouth conditions exist.
Chinch bug	June-August	Sevin (carbaryl)	2	At plant base	

* Liquid formulations are restricted to certified applicators only.
[a] See Table 14 for insecticide restrictions.
[b] To be applied only by experienced operators or those wearing protective clothing.

Table 8. Small Grains (Barley, Oats, Rye, Wheat)

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Armyworm	May-June	toxaphene[b]	1½	On foliage	When there are 6 or more armyworms per linear foot of row and before extensive head cutting occurs. Do not use trichlorfon on rye.
		Dylox, Proxol (trichlorfon)	½-1		
		*Lannate, *Nudrin (methomyl)[c]	½		
		Sevin (carbaryl)	1		
Greenbug, English grain aphid	May-June	Cygon (dimethoate)	¼	On foliage	Aphids damage plants indirectly by transmitting disease. Once yellowing is noticeable, it is usually too late to treat. Use dimethoate on wheat only. Do not apply Penncap-M to rye.
		malathion	1		
		*Penncap-M (microencapsulated methyl parathion)[d]	¼		
Fall armyworm	October-November	toxaphene[b]	2	On foliage	During fall when damage to new growth is apparent. Do not use trichlorfon on corn.
		Dylox, Proxol (trichlorfon)	½-1		
		Sevin (carbaryl)	1		
Variegated cutworm	May-June	Dylox, Proxol (trichlorfon)	½-1		As needed. Do not use trichlorfon on corn.
Wheat stem maggot	May-June	None	..	...	No chemical control. Damage shows as white heads when field is still green.
Grasshoppers	Fall	malathion	1	On foliage	During fall when damage is apparent, treat field borders and noncrop areas to stop migration.
		toxaphene[b]	2		
		Cygon (dimethoate)	½		
		*Penncap-M (microencapsulated methyl parathion)[d]	½		
		Sevin (carbaryl)	1		

* Use restricted to certified applicators only.
[a] See Table 14 for insecticide restrictions.
[b] For use on dairy farms only when alternate material is not available and when insect emergency exists. Do not apply as foliage sprays or dusts to, or adjacent to, dairy pasture, hay, or forage crops.
[c] To be applied only by an experienced operator or one wearing protective clothing.
[d] This product is highly toxic to bees.

Table 9. Grass Pasture

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Grasshoppers	June-July	*Penncap-M (microencapsulated methyl parathion)[b]	½	On foliage	As needed.
		diazinon	½		
		malathion	1		
		Sevin (carbaryl)	1		
Armyworms	June-July	Dylox, Proxol (trichlorfon)	1	On foliage	As needed. Sevin and Dylox may be applied without removal of grazing livestock.
		malathion	1		
		Sevin (carbaryl)	1		

* Use restricted to certified applicators only.
[a] See Table 14 for insecticide restrictions.
[b] This product is highly toxic to bees.

Table 10. Stored Grain (Corn, Wheat, Oats)[a, b]

Insect	Time of attack	Insecticide and dilution	Dosage	Placement	Suggestions (See Table 14)
Angoumois grain moth (earcorn)	May-October (southern ⅓ of Illinois only)	malathion 57% E.C. 3 oz. per gal. water	Apply to runoff	Spray surface and sides about May 1 and August 1	Plant tight husk varieties. Store as shelled corn to avoid all but surface damage by angoumois moth.
Indian meal moth[c]	May-October	dichlorvos 20% (DDVP, Vapona) plastic resin strip[d]	1 strip per 1,000 cubic feet of space above grain mass	Attach to ceiling or side wall	Clean and spray bin with 1.5% malathion to runoff before storage. Store only clean, dry grain. Install strips on May 15 or at storage. Replace strips every 6 weeks between May and October. As an alternative to the strips, apply *Bacillus thuringiensis* (B.t.) at the auger as the grain is binned.[f] **Note: Level the grain after treatment.** For emergency treatment use B.t. raked in and the dichlorvos resin strip.
		Bacillus thuringiensis[e] dust 4,000 units per mg.	½ oz. per bu. (See Table 11.)	Apply to top 4 inches of grain	
		Bacillus thuringiensis[e] WP 16,000 units per mg. 1 lb. in 10 gal. water	0.6 pt. per bu. (See Table 11.)	Apply to top 4 inches of grain	
		Bacillus thuringiensis[e] LC 4,000 units per mg. 4 pt. in 10 gal. water	0.6 pt. per bu. (See Table 11.)	Apply to top 4 inches of grain	
GENERAL Internal and external feeders Rice and granary weevils Flat grain beetle Saw-toothed grain beetle Rusty grain beetle Foreign grain beetle Cadelle beetle Flour beetles	May-October	malathion 57% E.C. 1 pt. per 3-5 gal. water[g]	2-5 gal. per 1,000 bu.	Spray uniformly as grain is binned. After binning apply 2 gallons per 1,000 square feet over the surface.	Clean and spray bin with 1.5% malathion to runoff before storage. Store only clean, dry grain. Protect surface with dichlorvos resin strips or B.t. as recommended for meal moths.
		malathion 6% wheat flour dust	10 lb. per 1,000 bu.	Apply over wheat in combine hopper or uniformly as wheat is binned. After binning, apply 5 pounds per 1,000 square feet over the surface.	
		liquid fumigant[b, i]	3-5 gal. per 1,000 bu.	On surface; repeat if necessary	Clean and spray bin with 1.5% malathion to runoff before storage. Store only clean, dry grain. Apply in late July and September in the southern half of Illinois; apply in mid-August in the northern half of Illinois. Protect surface with dichlorvos resin strips or B.t. as recommended for meal moths.
		*methyl bromide + *ethylene dibromide[i, j]	As directed	On surface	
		*aluminum phosphide[k]	180 tablets or 300 pellets per 1,000 bu.	Uniformly throughout	Fumigants are best used for emergency control of existing infestations.

Table 10. Stored Grain (Corn, Wheat, Oats)[a, b] (continued)

*Use restricted to certified applicators only.
[a] Corn need not be treated if harvested after October 1 unless it is to be carried over after May 15 the following year. Wheat and oats should be treated if they are to be held for one month or more in storage after harvest. Soybeans stored at safe moisture levels are attacked only by Indian meal moth.
[b] Grain carried over after May 15 of the following year should receive a surface spray of 1.5% malathion at 2 gal. per 1,000 sq. ft. or a dust treatment of 6 percent malathion dust at 5 pounds per 1,000 sq. ft. for general feeders and either a B.t. or dichlorvos resin strip application for Indian meal moth control.
[c] Remove webbing before treatment.
[d] Effective only in enclosed bins. Kills adult moths but not the eggs or larvae. A week or two is required to control effectively an existing infestation. Fumigate the grain if immediate control is desired. Also cleared for use in bins of stored soybeans.
[e] Kills larvae only. A week or two is required to control an existing infestation. Fumigate the grain if immediate control is desired. Cleared for use on soybeans. Called Dipel, Topside, and SOK-BT.
[f] We do not recommend the raked-in method of application for B.t. on grain just going into storage.
[g] Use only the grade of malathion labeled for use on stored grain. Apply after drying, because malathion vaporizes and is lost rapidly when grain is heat dried.
[h] Two common liquid fumigants are *carbon bisulfide + *carbon tetrachloride and *ethylene dichloride + *carbon tetrachloride.
[i] Use with extreme caution. Apply only under calm conditions and when grain temperature is 70°F or above. Grain should be 8 inches below the lip of the bin and should be leveled before fumigating. Cover the surface with a plastic tarp for 24 hours, then air out.
[j] Called the 73 mixture.
[k] Called *Phostoxin or *Detia. Slow vaporization with a 3-day exposure period. Can be used at grain temperature of 60°F or above. Grain should be 8 inches below the lip of the bin and should be leveled before fumigating. Cover the surface with a plastic tarp for 3 days, then air out.

Table 11. Amount of *Bacillus thuringiensis* (B.t.) to Apply

Bin diameter (feet)	Bushels in top 4 inches of grain	Amount of B.t. wettable powder (lb.) and water (gal.) needed	Amount of B.t. liquid concentrate (oz.) and water (gal.) needed	Amount of B.t. dust (oz.) needed
8	13	0.1/1	6½/1	6½
12	30	0.25/2½	14½/2½	15
16	53	0.4/4	26/4	27
20	84	0.6/6	39/6	42
24	120	0.9/9	58/9	60
28	163	1.25/12½	80/12½	82
32	214	1.6/16	103/16	107

Table 12. Non-Crop Areas

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Grasshoppers	June-July	Sevin (carbaryl)	1	On foliage	When grasshopper nymphs average 15 to 20 per square yard along roadsides and fencerows. Do not spray areas adjacent to water. Apply treatments while hoppers are small and before they migrate into row crops.
		Cygon (dimethoate)[b, †]	½		
		diazinon	½		
		malathion	1		

[a] See Table 14 for insecticide restrictions.
[b] To be applied only by an experienced operator or one wearing protective clothing.
† State labeled insecticide. Applicator must have Illinois label in possession at time of application.

Table 13. Sunflowers

Insect	Time of attack	Insecticide[a]	Pounds of active ingredient per acre	Placement	Timing of application, comments
Cutworms	May-June	toxaphene Sevin (carbaryl)	1½-2 1½	Over row	When 10% of the seedlings are damaged.
Sunflower beetle	May-June	toxaphene Sevin (carbaryl)	1½-2 1-2	Over row	When defoliation reaches 25%. Do not apply toxaphene after yellow ray petals have formed.
Thistle caterpillar	June	toxaphene	1½-2	Over row	When defoliation reaches 25%.
Grasshoppers	June-August	toxaphene Sevin (carbaryl)	2 1	Over row	When defoliation reaches 25%.
Sunflower moth larvae	July	Thiodan, Tiovel (endosulfan) *Supracide (methidathion)[b]	1 ½	Over row	Apply first treatment when a field has reached 20 to 25% bloom and moths are present.
Stem weevil	June	Sevin (carbaryl) *Supracide (methidathion)	1-2 ½	Over row	When there are 2 or more beetles per plant.
Armyworm	May-August	Sevin (carbaryl)	1½-2	Over row	When defoliation reaches 25%.
Fall armyworm	July-August	Sevin (carbaryl)	1½-2	Over row	When defoliation reaches 25%.

* Use restricted to certified applicators only.
[a] See Table 14 for insecticide restrictions.
[b] To be applied only by experienced operators or those wearing protective clothing.

Spraying blossoming sunflowers can be extremely hazardous to bees. Coordinate with local beekeepers before applying sprays.

Table 14. Limitations in Days Between Application of the Insecticide and Harvest of Crop and Restrictions on Use of Insecticides for Field Crop Insect Control

(Blanks denote that the product may not be labeled or suggested for that specific use in Illinois)

	Worker re-entry time (hours)[a]	Field corn		Sorghum	Forage crops		
		Grain	Ensilage and stover		Alfalfa	Clover	Pasture
*Amaze (isofenfos)[b]	...	75,A	75,A	...	...	...	...
Counter (terbufos)	...	B	B	...	...	...	...
Cygon, De-Fend (dimethoate)	...	14	14	28	10,C	...	...
Diazinon	...	B	10	7	7	7	0
**Di-Syston (disulfoton)[a, b]	...	40	40	...	...	...	...
**Dyfonate (fonofos)[b]	...	45	45	...	...	...	...
Dylox, Proxol (trichlorfon)	...	D	D	...	0	0	0
Ethion	24	50,E	50,E	...	...	...	...
**Furadan (carbofuran)[b]	...	B,F	F,G	...	7,H	...	...
*Guthion (azinphos-methyl)[a, b]	24	...	...	...	16,C	16,C	...
Imidan (phosmet)	...	14	14	...	7,C	...	...
**Lannate (methomyl)[a, b]	...	B	3	14	7	...	...
Lorsban (chlorpyrifos)	...	50,I	50,I	14,J	...	...	...
Malathion	...	5	5	7	0	0	0
Metasystox-R (oxydemeton-methyl)	48	7,K	7,K	45,L	...	...	...
Methoxychlor	...	...	...	...	7	7	...
*Methyl parathion[a, b]	48	...	...	...	15	15	...
**Mocap (ethoprop)[b]	...	B	B	...	...	...	...
**Nudrin (methomyl)[a, b]	...	B	3	14	7	...	...
*Penncap-M (microencapsulated methyl parathion)[a, b]	...	12	12	...	15	...	15

Table 14. Limitations (continued)

	Worker re-entry time (hours)[a]	Field corn		Sorghum	Forage crops		
		Grain	Ensilage and stover		Alfalfa	Clover	Pasture
Sevin, Savit (carbaryl)	...	B	B	21	0	0	0
*Supracide (methidathion)[b]	...	...	...	...	10,M	...	...
Thimet (phorate)	...	30,N	30,N	...	...	...	...
Thuricide (*Bacillus thuringiensis*)	...	B	B	...	...	...	...
Toxaphene	...	B	P	...	...	...	...
Trithion (carbophenothion)	48	21	21	...	...	...	...

		Barley	Oats	Rye	Wheat	Soybeans	Sunflowers
Cygon (dimethoate)	...	...	...	...	60	21	...
Dipel, Thuricide, Bactur, SOK (*Bacillus thuringiensis*)	...	...	...	...	...	0	...
Diazinon	...	...	...	...	...	Q	...
Dylox (trichlorfon)	...	21	21	...	21	...	...
*Guthion (azinphos-methyl)[a, b]	24	...	...	...	...	45,R	...
**Lannate (methomyl)[a, b]	...	10	10	10	10	14	...
Malathion	...	7	7	7	7	3	...
**Nudrin (methomyl)[a, b]	...	10	10	10	10	14	...
Orthene (acephate)	...	...	...	...	...	14,R	...
*Penncap-M (microencapsulated methyl parathion)[a, b]	...	15	15	...	15	20,S	...
*Pydrin (fenvalerate)	...	...	...	...	...	21,T	...
Sevin (carbaryl)	...	...	...	...	21,U	0	60,R
*Supracide (methidathion)[b]	...	...	...	...	...	...	50,R
Thiodan, Tiovel (endosulfan)	...	...	...	...	...	...	0,V
Toxaphene	...	P	P	P	P	...	W
Trithion (carbophenothion)[a, b]	48	...	...	...	...	7,R	...

A. Do not use for forage, fodder, or ensilage or harvest fresh corn (including sweet corn) or corn grain within 75 days of last application. Make only one application per season either at planting or cultivation. Soybeans may be planted one year after application. Other crops not listed on the label may be planted 10 months after application.

B. No specific restriction when used as recommended.

C. Apply only once per cutting, and do not apply during bloom.

D. Three applications may be made per season. Can be applied up to harvest.

E. Do not make more than 1 application after ear formation. Do not feed treated forage to livestock.

F. Do not plant crops other than alfalfa, corn, peanuts, peppers, potatoes, rice, sorghum, strawberries, sugar beets, sugarcane, and tobacco within 18 months of last application. Soybeans and oats may be planted the following season. Sweet corn, tomatoes, cabbage, peas, succulent beans, and dry beans may be planted the following season if the previous season's application did not exceed 8.7 pounds per acre of Furadan 15 Granules, 13 pounds per acre of Furadan 10 Granules, or 2 pints 10 fluid ounces per acre of Furadan 4 Flowable. Any other crop may be planted, if it is not harvested or grazed.

G. Do not make a foliar application if Furadan 10 granules were applied at more than 10 pounds per acre at planting. Do not make more than two foliar applications per season.

H. Make no more than two applications per season. Do not apply more than once per cutting. Do not use more than 1 pint per acre in the second application. Apply only to fields planted to pure stands of alfalfa.

I. Do not apply more than 3 pints of Lorsban 4E by postemergence application per season. Do not allow livestock to graze in treated areas or feed treated corn silage, fodder, or grain to meat or dairy animals within 50 days after treatment. Do not make more than one application of the granular formulation per season.

J. Do not make more than 3 applications. The treated crop is not to be used for forage, fodder, hay, or silage within 14 days after the last treatment. Do not treat sweet varieties of sorghum.

K. Do not apply more than once per season.

L. Do not apply more than 3 times per season. Do not use on sweet sorghum.

M. Make no more than one foliage and one stubble application per cutting.

N. Besides treatment at planting, one more application can be made at cultivation or over the corn later in the season.

P. Do not feed treated forage to dairy animals or animals being finished for slaughter. Do not graze meat animals on granular-treated stover within 28 days of slaughter.

Q. Diazinon is labeled only as a preplant broadcast treatment.

R. Do not graze or feed treated crop to livestock.

S. Do not make more than 2 applications per season.

T. Do not feed or graze livestock on treated plants. Do not make more than 4 spray applications per season. Pydrin is highly toxic to fish and bees.

U. Do not make more than 2 applications after grain heads emerge from boot. Do not apply within 21 days of grain harvest. There is no time limitation on green wheat used as pasture or forage.

V. Do not feed treated forage to livestock. Do not exceed 3 applications.

W. Do not apply after the yellow petals have formed on the flower heads. Do not feed forage to livestock. Do not apply more than 2 times per season.

* Use restricted to certified applicators only.

** Liquid formulations are restricted.

[a] Workers should be warned in advance of treatments. Workers may not enter fields treated with the insecticides without wearing protective clothing for the intervals indicated. They may not enter a field treated with other insecticides without protective clothing until the spray has dried or the dust has settled. Protective clothing includes a hat, long-sleeved shirt, long-legged pants, and shoes and socks.

[b] Sprays to be applied only by experienced operators wearing proper protective clothing.

Table 15. Relative Toxicities of Commonly Used Agricultural Insecticides

Trade name	Chemical name	Toxicity to mammals[a]		Toxicity to		
		Acute oral	Acute dermal	Birds	Fish	Bees
*Amaze	isofenphos	high	high	high	high	...
Counter	terbufos	high	high	high	very high	...
Cygon, De-Fend	dimethoate	moderate	moderate	moderate	very low	high
Diazinon	diazinon	moderate	moderate	high	high	high
Dipel, Bactur, Topside, Thuricide, SOK	*Bacillus thuringiensis*	very low	very low	very low	very low	very low
**Di-Syston	disulfoton	high	high	moderate	...	moderate
**Dyfonate	fonofos	high	moderate	moderate	...	...
Dylox, Proxol	trichlorfon	low	low	low	very low	low
Ethion	ethion	high	high	low	...	very low
**Furadan	carbofuran	high	moderate	moderate	moderate	high
*Guthion	azinphosmethyl	high	moderate	moderate	very high	high
Imidan	phosmet	moderate	low	low	...	high
**Lannate, **Nudrin	methomyl	high	moderate	low	...	high
Lorsban	chlorpyrifos	moderate	moderate	moderate	very high	high
Malathion	malathion	low	low	low	moderate	high
Metasystox-R	oxydemetonmethyl	moderate	moderate	moderate	...	moderate
Methoxychlor	methoxychlor	low	low	very low	very high	low
*Methyl parathion	methyl parathion	high	high	moderate	very low	high
**Mocap	ethoprop	moderate	high	moderate	...	moderate
Orthene	acephate	moderate	moderate	moderate	low	high
*Penncap-M	microencapsulated methyl parathion	moderate	low	moderate	very low	high
*Pydrin	fenvalerate	moderate	low	low	very high	very high
Sevin	carbaryl	low	low	very low	very low	high
*Supracide	methidathion	high	moderate	moderate	high	high
Thimet	phorate	high	high	moderate	very high	moderate
Thiodan	endosulfan	high	high	low	...	moderate
Toxaphene	toxaphene	moderate	moderate	low	very high	low
Trithion	carbophenothion	high	high	...	...	moderate

*Use restricted to certified applicators only.
** Liquid formulations are restricted. Amaze 20G is also restricted.
[a] Relative toxicities based on acute oral and acute dermal LD_{50} values of technical insecticide.

Always read the label before applying insecticides.

The suggestions given in this circular are revised annually by entomologists of the College of Agriculture and the Illinois Natural History Survey.

Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. WILLIAM R. OSCHWALD, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign. The Illinois Cooperative Extension Service provides equal opportunities in programs and employment.

18M—10-81—52379—nr