

# Field Bean Soybean and Sugar Beet Production

COOPERATIVE EXTENSION SERVICE

## *insect and nematode control in Michigan*

MICHIGAN STATE UNIVERSITY

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INSECT AND NEMATODE CONTROL on field beans, soybeans, and sugar beets is made up of a number of different methods. Note especially that cultural practices (including weed control) and crop rotations can be as beneficial as insecticides or nematocides in protecting plants from insect and nematode damage (or even moreso in some cases). The ideal field bean, soybean, or sugar beet growing operation on any farm considers a unified program of both cultural and chemical use for insect or nematode problems. This bulletin points out the important methods of reducing or eliminating insect or nematode damage to the crops.

### CAUTIONS

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

Apply chemicals no closer to harvest than the days given in this bulletin. These are minimal days before harvest. Earlier treating, if applicable, is much better. Meat and milk can be seized if they contain more insecticide or nematocide residue than allowed by the Federal Food and Drug Administration.

Read the package label for additional instructions on safe use of pesticide chemicals on field beans, soybeans, and sugar beets.

All insect control suggestions issued by the Entomology Department of Michigan State University are based on tolerances established by the Federal Food

and Drug Administration and the United States Department of Agriculture. If changes occur in these, we will attempt to inform you through our regular channels of communication.

Nematocides are normally applied as bought to soils, although some are diluted with water. Special calibration of application equipment is needed. In the case of insecticides, determining the amount of water to apply per acre is always a problem. However, the following may be used as a guide:

When field bean, soybean, and sugar beet plants are small (up to 4 to 12 inches high) 15 to 50 gallons of water may be enough. Larger plants normally require more water (50 to 125 gallons) for satisfactory control. Water requirements will also vary according to the type of equipment used. Amount of water or oil is stated specifically in the recommendations for aircraft application.

Generally, weed sprayers are not entirely suitable for control of field bean, soybean, and sugar beet insects, except flea beetles and other easy-to-reach pests such as leafhoppers and soil insects. For general farm insect control, it is well to buy a sprayer to meet variable problems.

Warnings about the use of the chemicals on field beans, soybeans, and sugar beets appear in the columns: "Control Instructions" and "Insecticides Per Acre." Read these before using any insecticide or nematocide.

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

<sup>1</sup>The authors thank John Knierim, assistant Professor of Entomology, for his help in preparing this bulletin.

## Identification Key for the Important Insects Affecting Field Beans, Soybeans and Sugar Beets

Place of Damage	Description of the Insects and Their Damage to the Plants	Name of Insect
SEED	Seed fails to sprout or sprouted seedlings are weak and sickly. Often dirty-colored (yellowish-white), legless, tough-skinned maggots are found boring in the seed. These have a pointed head and are ¼ inch long when mature. Most damaging in damp soils with high organic matter.	Seed corn maggot (but other species of maggots may occur).
SEED AND ROOTS	Seed fails to germinate: germ of the seed eaten or the seed hollowed leaving sometimes only the coat. Smooth-skinned, dark-brown to yellowish, hard-bodied, wire-like worms (up to 1½ inches long) feeding on the seed or found in soil surrounding the seed.	Wireworms.
ROOTS BUT SELDOM SEED	Small roots eaten; skin of larger roots stripped; larger root tips missing. On sugar beets, deep pits are eaten into the tubers and roots; small plants may be cut off 2 to 3 inches below the soil surface causing them to wilt. Large (up to 1½ inches long) white-curved grubs with brown heads and legs, may be found in the soil.	White grubs (June beetles).
	Leaves of plants turn from dark to yellowish green. The plants may wilt, especially during the hot part of day. To be sure about the identity of this insect the following must be found in the soil: (1) a whitish mold-like substance on the roots and in the surrounding soil; (2) small yellowish-white lice covered with the mold.	Sugar beet root-louse. (Found on sugar beets only.) Note: This insect is damaging in droughty soils, not generally in soils with adequate moisture.
PLANTS AT SOIL LEVEL	Dead and wilted plants occur in stretches of row or over the field in scattered spots, especially in the morning. Plants may be cut through at or near ground level. Thick-set, greasy appearing, curved-bodied, thick-skinned, yellowish, greenish or blackish worms may be found near or up to a foot away from damaged plants. These insects are usually found buried at least an inch in the soil during the day. They feed mostly at night and occur on the surface of the soil at this time.	Cutworms.
SEEDLINGS	Small holes (shot holes) eaten through leaves; in severe cases the leaves may be entirely destroyed. Small brown, black or striped jumping beetles associated with the damage.	Flea beetles.
SUGAR BEET PETIOLE ONLY	Crescent-shaped scars occur on the grooved side of the petiole. Associated with the damage are greenish to brassy brown plant bugs, nearly ¼ inch long. Very commonly a yellowish V-shaped area, occurs where the front wings attach to the body shortly behind the head. NOTE: Tarnished plant bug has been mistaken for petiole borer injury but the latter damage is to the fleshy side of the petiole not to the grooved side as is the case with the tarnished plant bug.	Tarnished plant bug (also called Lygus bug).
FOLIAGE	Small (up to 1/12 inch long) nearly black in color, long-legged, wingless or winged insects feeding in clusters on the underside of the leaves, along the stems, or in the buds. Near the tip end of the insect's body are two slender tubes, projecting backwards. (Other similar kinds of insects may infest field beans, soybeans, and sugar beets, but may be a different size and color.)	Bean aphid.
	Leaves with circular or ragged-edged holes: In some cases the leaves are entirely eaten, blossoms may be devoured. Various sized worms (up to 1¼ inches long) on the underside of the leaves. These are slender, light green in color, with faint white lines running lengthwise of the body, especially when the worms are reaching maturity. The small worms are yellowish-green, usually without the white lines plainly visible.  All sizes of the worms wiggle and drop quickly to the ground when disturbed.	Green cloverworm.

## Identification Key—Continued

Place of Damage	Description of the Insects and Their Damage to the Plants	Name of Insect
	Early in the season leaves have irregular holes, quite similar to the green cloverworm. In addition (later in the season), the leaves are feathered and turn brownish. A copper-brown, ¼ inch long lady-beetle type insect, with 8 small black spots on each upper wing, eats holes in the leaves. A yellow-shiny grub (larva) eats the skin off the underside of the leaves, causing the feathery sieve-like damage; if pods are on the plant they may be eaten.	Mexican bean beetle. Note the difference between the damage done by the adult and grub of the Mexican bean beetle; Also the difference in appearance of grub and adult.
	Small (up to about ½ inch long), wedge-shaped, green to greenish-yellow, winged or wingless sucking-type insects on the underside of the leaves. When disturbed, they may run sideways. Bean foliage especially may be dwarfed, curled and crinkled; the tips of leaves turn brown and form rosettes. This problem affects pod formation and yield.	Leafhoppers.
	Very small (up to 1/25 inch long) grayish-black (winged) or reddish-yellow (wingless) sucking type insects on the underside of the leaves of small plants. The foliage has a silver-bleached color. Small plants are often wilted, especially during drought periods having hot days.	Bean thrips.
	Exceptionally small (up to 1/60 inch long), reddish or greenish 8-legged creatures on the underside of the leaves. These are associated with an almost invisible webbing in which they hide. The leaves become blotched with red or yellow, many eventually dying. Plants may be very dry and thick-leaved since drought conditions bring on mite problems during July and August.	Mites. (especially two spotted mite.)

## DRIFT

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

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

Where problems of pesticide drift exist, use phosphate or carbamate insecticides on field beans, sugar beets and soybeans, and only those registered for forage and pasture crops. Always read the label for instructions. *If the name of a crop does not occur on the label, you can assume it is not registered for use on that crop.*

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

Abbreviations used in this bulletin are:

WP. means wettable powder.

SP. means soluble powder.

EC. means emulsifiable or spray concentrate.

SC. means suspension concentrate.

D. means dust.

## FIELD BEANS

The Mexican bean beetle, in recent years, has become the most important pest of field beans in Michigan. For the most part, it is more damaging to colored than to navy beans.

Before laying eggs, the adult Mexican bean beetles leave fence rows, woodlots, and other overwintering places to feed on young beans during the 2- to 8-leaf stage. Foliar treatments at this time, often give as good or better results on the adults than two or more treatments for the yellow-spiny grubs later in the season. In-soil, systemic phosphate insecticides give good control of both adults and grubs.

Aphids (plant lice) and leafhoppers are present in some numbers every year on field beans in Michigan.

Outbreaks of these insects, however, do not occur yearly. Hence, control of them is accomplished in one of two ways: Preventive measures requiring either a 7- to 10-day foliar spraying program, or the use of an in-soil systemic phosphate insecticide. An emergency control program is applied only in those seasons when damaging leafhopper or aphid populations exist. Outbreaks of these two insects will not necessarily come in the same season, because favorable weather conditions are different for them. An in-soil systemic treatment is preferred when the overall problem of Mexican bean beetles, leafhoppers, and aphids is considered.

**Green cloverworm** outbreaks have not occurred regularly. The 1964 severe infestation was the first in over 25 years in Michigan. A few of these worms, however, occur every year but their damage is small. Hence, yearly control of the insect has not been practiced.

The feeding areas of the green cloverworm and the adult Mexican bean beetle are very similar. Because of this, only identification of the insect concerned with the damage will tell the problem.

The most important consideration for control of green cloverworm is determining how many worms are present in a field. Because the worms hide successfully underneath the leaves of field beans, shaking the plants vigorously to knock the larvae to the ground is a must to making a satisfactory count. Generally, from six to twelve worms per running foot of row are needed before treating would pay.

**Seed-corn maggots** often reduce bean stands. Control is easy and thorough by seed treatment. Other methods of reducing the damage caused by this insect are given in the control tables.

**Nematodes** have not been an important problem to date on field beans in Michigan. Fumigating with nematocides is not suggested for this crop. But satisfactory rotations are important to field bean growing, and to holding nematodes to a low population level. In all rotations, weed control is very important (see the nematode section under sugar beets in the tables).

## SOYBEANS

Generally, insects are not too damaging to soybeans except for **white grubs**. On occasions, these insects damage soybeans severely, usually when the crop is planted in sod. Sod land should be inspected for white grubs the year before the crop is planted. Do this in the fall before freezing or the insects will have moved too deep in the soil to be seen easily.

Consider only the white-curved grubs as indicating a need for treating. Adults found in the soil in the fall overwinter there, leaving the ground without damaging the crop.

**Green cloverworm.**— In 1964, the insect affected some soybean fields. For detailed information concerning this insect, read the instructions given under field beans.

Nematodes have not been an important problem to date on soybeans. Soybean cyst nematode severely damages this crop but is not known north of Illinois. Fumigating with nematocides is not suggested for the crop. But satisfactory rotations are important to soybean growing and important to holding nematodes in check. In all rotations, weed control is very important (see the nematode section under sugar beets).

## SUGAR BEETS

Insect problems on sugar beets in Michigan are not always important, yet the beets are never entirely free of damage.

**Flea beetles** and **aphids** occur early in the growth of the crop. Flea beetles, especially, hinder early growth and often need controlling as soon as the crop is thinned.

**Aphids** occur occasionally in sufficient numbers that control measures are required. Leaf crinkling, wilting, and other signs of insufficient leaf performance, indicates the need for aphid control.

**The root louse** occurs primarily in hot, dry weather, especially during drouth conditions. Sufficient moisture to keep the beets growing well holds these insects in check.

**Wireworm** and **white grub** problems are about the same on sugar beets as they are on other in-soil growing crops. These insects will be most prevalent following sod. Because of this, inspection of sod soils intended for sugar beet planting should be made the year before the crop is grown, especially in the fall of the year before freezing weather. This gives an indication of the overall wireworm and white grub problem. Apply control measures in the spring just before planting the sugar beets.

**Nematodes** infesting sugar beets occur in Michigan. Usually they damage the crop when it is planted year after year on the same land or where too close rotation programs are followed. In either case, root knot and sugar beet nematode populations can build

up, damaging the beets. The most successful and least expensive way of handling nematodes on sugar beets is to follow a good rotation program. At least three years (if nematodes are not present) or four years (if they are present) should be allowed between crops on the same land. For sugar beet nematode control, alfalfa, clovers, corn, beans, peas, potatoes, soybeans and small grains are satisfactory in sugar beet rotations. The principal requirement with these crops is a good stand free of weeds. Corn and small grains are suitable in rotations with sugar beets for root knot nematodes; but this nematode is not as important in Michigan as the sugar beet nematode.

If fumigation of sugar beet land is desired, we will supply information for this operation. Write the

Entomology Department, Michigan State University, East Lansing.

#### SPECIAL NOTE ON SEED TREATMENT

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

**SLURRY METHOD**—To suggested wettable powders add enough water to make a sloppy paste or slurry. Treat by stirring or swirling seed in the slurry until thoroughly coated. Dry the seed before planting. Slurries are preferred to dusts, since they adhere to the seed better and are less irritating to use.

### Field Beans

Program	MATERIALS	WARNINGS
Treatment — Pests When to Control	Amount of actual chemical to be applied per acre. (Formulation dosage rate given in parentheses)	Apply no treatment closer to harvest than number of days given.
<b>SOIL PREPARATION:</b> Bean Maggot (usually seed corn maggot) Before planting.	Flies are attracted to rotting organic matter and freshly plowed soil. Plow manure and sod under thoroughly.	Soil preparation is an aid to bean maggot control. Use it along with seed treating.
<b>SEED TREATMENT:</b> Bean Maggot (usually seed corn maggot) For best control of bean maggot, use both soil and seed treatment.	Dieldrin, 1 ounce 50% WP plus Thiram or captan, 1½ ounces of 75% WP to 100 pounds of seed. Use slurry or dust method (see appendix). This treatment can be mixed with the seed in the planter box, but uniform mixing of seed and chemical must be maintained. If possible, buy insecticide-fungicide treated seed instead of treating seed on the farm.	Use dieldrin, Thiram or captan only as a seed treatment. <i>Do not feed treated beans to livestock or use yourself.</i> <i>When handling dieldrin-treated seed, do not expose the hands to it or breathe the fumes.</i>
<b>SOIL TREATMENT AT SEEDING:</b> Aphids, Cloverworms (small) Leafhoppers, Mexican bean beetle  This treatment is systemic in nature. Drought tends to make it less effective.	Phorate (Thimet) or Di-syston. Of either material, use 10 pounds of 10% granular formulation to an acre. (This is 1 pound of actual chemical per acre).  At planting time apply as a side-dressing: <i>That is 2 inches away and 2 inches below the seed</i> — not in contact with the seed. If a combination of fertilizer and phorate or fertilizer and Di-syston can be bought, application by this method is satisfactory.	Use phorate or Di-syston only as directed on field beans. Other methods of application may not be satisfactory. Avoid prolonged skin contact or breathing of these chemicals.  Do not feed phorate or Di-syston treated bean foliage until 60 days after planting.
<b>SEEDLINGS:</b> Bean maggot infested fields  Reseed.	Bean seeds are damaged early in the spring when soil is wet. Reseeding immediately after damage usually gives a good stand. In wet years, it is advisable to treat seed with dieldrin before replanting. (See seed treating above).	Use dieldrin only as a seed treatment.
<b>Cutworms</b>  Cutworms live close to the surface of the ground. Hence, control for them can be applied when the crop comes up and as needed.	Trichlorfon (Dylox), 1½ pounds SP. (This is 3 pounds 50% soluble powder).  or  Carbaryl (Sevin), 1½ pounds WP or SC. (This is 3 pounds 50% WP or SC).	14 days. Do not feed treated vines to beef or dairy animals. Do not drift onto forage crops unless feeding is delayed 14 days after contamination of alfalfa (see label for other limitations).  0 days (No time limit).
		<b>NOTE:</b> Carbaryl can be drifted onto alfalfa, clovers and pastures without contaminating these crops for livestock feed.

## Field Beans—Continued

Program	MATERIALS	WARNINGS
Treatment — Pests When to Control	Amount of actual chemical to be applied per acre. (Formulation dosage rate given in parentheses)	Apply no treatment closer to harvest than number of days given.
<b>FOLIAGE TREATMENT:</b>		
<b>Mexican bean beetle adults</b> Apply when plants are small, usually 2-8 leaf stage.	Carbaryl (Sevin), 1 pound WP or SC. (This is 2 pounds 50% WP or SC). or Malathion, 1 1/4 pounds EC or WP. (This is 2 pints of 5 pounds per gallon EC or 5 pounds 25% WP).	0 days (No time limit on forage). Forage can be fed to all classes of livestock.  1 day (No time limit on forage). Forage can be fed to all classes of livestock.
<b>Mexican bean beetle grubs</b> Apply to underside of leaves, repeat as needed, but according to limita- tions placed on the insecticides.	Guthion, 1/2 pound EC or WP. (This is 1 quart of 2 pounds per gallon spray con- centrate (EC) or 2 pounds of 25% WP).	30 days. Apply no more than 4 times per season. Do not feed treated forage to any type of livestock.
<b>Aphids (mosaic)</b> When they first appear and as needed. On susceptible varieties, be- gin treating when plants come up; continue at 7-day intervals.	For Mexican bean beetle, leafhoppers, green cloverworm and thrips.  Note: Malathion is satisfactory for bean aphid.	NOTE: Carbaryl and malathion can drift onto alfalfa, clovers and pastures without contaminating these crops for livestock feed.
<b>Leafhoppers</b> When 5 or more appear on underside of the leaves per hill.	Carbophenothion (Trithion), 1/2 pound EC or WP. (This is 1 pint of 4 pounds per gallon EC or 2 pounds 25% WP).	7 days. Treat no more than twice per sea- son. Do not feed treated forage to live- stock until 21 days after application. Do not drift it onto forage crops unless 28 days are allowed between contamination and use.  NOTE: Apply Carbophenothion when the temperature is 65°F. or above.
<b>Green Cloverworm</b> These insects occur only occasionally, beginning the last half of July. Treat when 6 to 12 worms are on plants per foot of row.	For Mexican bean beetle, aphids and thrips.	
<b>Thrips</b> These insects occur during cool dry weather in the early part of the grow- ing season. Rains sufficient for good plant growth usually control thrips on field beans, or satisfactorily reduce their damage.	Demeton (Systox), 1/2 pound EC. (This is 1 quart of 2 pounds per gallon EC). For aphids only.  Instructions for aircraft application: Use only carbaryl or malathion as given for Mexican bean beetle, leafhoppers and green cloverworm. Apply malathion in 2 gallons of water per above dosage or carbaryl in 4 gallons of water. Do not use fuel oil. Airplanes should fly 5 to 10 feet above the crop.	21 days. Do not feed or graze forage upon which demeton has drifted for 21 days after contamination.  Insecticides applied by air can drift a mile or more. Hence, only malathion or carbaryl which do not create residue prob- lems on nearby forage crops should be applied by air.  NOTE: Sevin is very toxic to honey and other bees. Avoid using it where honey bees will be killed.

## Soybeans

Program	MATERIALS	WARNINGS
Treatment — Pests When to Control	Amount of actual chemical to be applied per acre. (Formulation dosage rate given in parentheses)	Apply no treatment closer to harvest than number of days given.
<b>SOIL PREPARATION:</b> Bean Maggot (usually seed corn maggot) Before planting.	Flies are attracted to rotting organic matter and freshly plowed soil. Plow manure and sod under thoroughly.	Soil preparation is an aid to bean maggot control. Use it along with seed treating.
<b>SOIL TREATMENT:</b>  White grubs and wireworms Before planting. These insects dam- age soybeans usually following sod.	Suggestions for cash grain farms: Aldrin, 3 pounds G. (This is 15 pounds 20% granular formulation). or Heptachlor, 3 pounds G. (This is 120 pounds 2 1/4% granular formulation). Apply only one material evenly to the sur- face of the soil and spring tooth or disk immediately 4 inches deep. Seed treat- ments will not satisfactorily control heavy white grub and wireworm populations in soybeans. Use preplant treatment only (treatment applied after seeding is not generally suc- cessful).	Use aldrin and heptachlor only as directed for white grubs and wireworms. Do not use them on dairy farms. Unless there is real need for wireworm and white grub control, soil treatment for these in- sects should not be a regular practice for soybeans.  WARNING: Do not use this aldrin or heptachlor treatment for soybeans where potatoes, carrots or sugar beets are to be grown in the next 3 to 5 years. Use in- stead the insecticides suggested for dairy farms.

## Soybeans—Continued

Program	MATERIALS	WARNINGS
Treatment — Pests When to Control	Amount of actual chemical to be applied per acre. (Formulation dosage rate given in parentheses)	Apply no treatment closer to harvest than number of days given.
	<p>Suggested program for dairy farms: Diazinon, 4 pounds G. (This is 40 pounds of 10% granular formulation per acre). or Parathion, 4 pounds G, EC or WP. (This is 16 pounds 25% WP, or 2 gallons of 2 pounds per gallon EC, or 30 pounds 10% G).</p> <p>Apply one of the materials evenly to the soil surface and spring tooth or disk immediately into the top 4 to 6 inches of soil. Seed treatments will not satisfactorily control heavy white grub and wireworm populations in soybeans.</p> <p>Use preplant treatment only (treatments applied after seeding are not generally successful).</p>	<p>Use Diazinon or parathion only as directed for white grubs and wireworms.</p> <p>Special warning: When applying parathion and other similar phosphate-type insecticides, take extreme care to prevent skin, lung and mouth uptake of the chemicals. See the label for instructions on how to use safely any material. Keep all animals and people out of parathion-treated areas for 48 hours. Do not contaminate streams or ponds.</p> <p>Diazinon or parathion soil treatment is suggested for wireworm and white grub control on dairy farms.</p>
<p><b>SEED TREATMENT:</b> Bean Maggot (usually seed corn maggot), Root-rots, damping-off. For best control of bean maggot, use both soil and seed treatment.</p>	<p>Dieldrin, 1 ounce 50% WP plus Thiram or captan, 1 1/4 ounces — to 100 pounds of seed. Use slurry or dust method for applying treatment (see appendix).</p>	<p>Use dieldrin only as a seed treatment. Do not feed dieldrin treated beans to livestock or yourself.</p> <p>When handling dieldrin treated seed, do not expose the hands to it or breathe the fumes.</p>
<p><b>FOLIAGE TREATMENT:</b> Mexican bean beetle adults Apply treatment when plants are small, usually 2- to 8-leaf stage.</p> <p>Mexican bean beetle grubs Apply to underside of leaves; repeat as needed.</p>	<p>Carbaryl (Sevin), 1 pound WP or SC. (This is 2 pounds 50% WP or SC). or Malathion, 1 1/4 pounds EC. (This is 2 pints of 5 pounds per gallon EC).</p> <p>For Mexican bean beetle, leafhoppers, and green cloverworm.</p>	<p>0 days (Carbaryl). Forage can be fed to all classes of livestock.</p> <p>1 day (Malathion).</p> <p>NOTE: Carbaryl and malathion treated beans, hay, alfalfa, clover and pasture can be fed to dairy animals without restriction in days before harvest.</p>
<p>Green cloverworm Apply to underside of leaves; repeat as needed. Start treatment when no more than 6 to 12 worms occur per foot of row. Shake plants vigorously to determine count per foot.</p>	<p>Carbophenothion (Trithion), 1/2 pound EC or 3/4 pound of WP. (This is 1 pint of 4 pounds per gallon EC or 3 pounds 25% WP).</p> <p>For Mexican bean beetle and mites only.</p>	<p>7 days. Do not feed treated forage to livestock.</p>
<p>Leafhoppers When 5 or more occur on underside of leaves per plant. Leafhoppers are most critical during cutting of first crop hay.</p>	<p><b>Instructions for aircraft applications:</b> Use only carbaryl or malathion as given for Mexican bean beetle, leafhoppers, and green cloverworm. Apply malathion in 2 gallons of water per above dosage rate and carbaryl in 4 gallons. Do not use fuel oil instead of water.</p>	<p>Alfalfa, clovers and pasture drifted with carbophenothion cannot be fed to livestock for 28 days.</p> <p>Insecticides applied by aircraft can drift a mile or more. Hence, only those materials that do not create residue problems on adjacent crops should be applied by air.</p>
<p>Mites When plants first show bronzing or yellowing of leaves. Repeat as needed.</p>	<p>For best results with malathion or carbaryl, temperature should be 65°F. or above at the time either is applied.</p>	

## Sugar Beets

Program	MATERIALS	WARNINGS
Treatment — Pests When to Control	Amount of actual chemical to be applied per acre, (formulation dosage rate given in parentheses)	Apply no treatment closer to harvest than number of days given.
<b>SOIL PREPARATION:</b>		
<b>Wireworms and White Grubs</b> Before planting.	Parathion, 4 pounds C, EC or WP. (This is 16 pounds 25% WP; or 2 gallons of 2 pounds per gallon EC; or 40 pounds 10% G).  or  Diazinon, 4 pounds G. (This is 40 pounds of 10% granular formulation per acre).  Apply one of the materials evenly to the soil surface and spring tooth or disk im- mediately into the top 4 to 6 inches of soil. Seed treatments will not satisfactorily control heavy white grub and wireworm population in sugar beets.  Use preplant treatment only (treatments applied after seeding are not generally suc- cessful).	Use Diazinon or parathion only as directed for wireworms and white grubs.  Special warning: When applying para- thion and other similar phosphate-type insecticides, take extreme care to prevent skin, lung and mouth uptake of the chemi- cals. See the label for instructions on how to use safely any material. Keep all ani- mals and people out of parathion-treated areas for 48 hours. Do not contaminate streams or ponds.
<b>SEED TREATMENT:</b>		
<b>Root Maggots, Root Aphids</b> Complete control of root aphids can- not be expected from treating the seed.	For treating the seed for maggots, use: Phorate (Thimet), 1½ pounds 44% D to 25 pounds of seed (6 pounds to 100 pounds of seed). Apply with a commercial seed treater.	Treat seed with fungicides before treating with insecticides.
<b>SOIL TREATMENT AT PLANTING:</b>		
<b>Root Aphid and foliage control of Aphids, Flea Beetles, Leafhoppers and Mites.</b>	Use 9.2 ounces of 10% phorate granules to 1,000 feet of row (regardless of the spacing of the rows). Apply in the fertilizer band (either 2 inches to the side and 2 inches below the seed, OR 3 inches directly below the seed).  NOTE: 30-inch-spaced rows take 10 pounds of 10% phorate granules per acre* — that is, 1 actual pound of chemi- cal per acre. 32-inch-spaced rows take 9.5 pounds of the same material; 34-inch- spaced row, 9 pounds, etc.  *30-inch-spaced rows take 17,424 linear feet (or running feet) per acre; 32-inch-spaced rows, 16,335 linear feet.	Do not let this use of phorate come in direct contact with the seed.  Do not use the chemical closer to harvest than 60 days.  Do not graze livestock on the growing crops or feed tops or beet pulp.
<b>SOIL SURFACE TREATMENT:</b>		
<b>Cutworms</b> Usually at time or shortly after sugar beets come up.	Carbaryl (Sevin), 1½ pounds WP or SC. (This is 3 pounds 50% WP or SC).  or Trichlorfon (Dylox), 1½ pounds SP. (This is 3 pounds 50% soluble powder).  or Parathion, ½ pound WP or EC. (This is 2 pounds 25% WP, or 3½ pounds 15% WP, or ½ pint 8 pounds per gallon EC).	14 days. Tops can be fed to livestock.  14 days. If tops are to be fed to livestock, do not treat within 25 days of harvest.  15 days. Do not feed tops within 15 days of treating. Keep workers out of fields for 48 hours after treating.
<b>FOLIAGE TREATMENT:</b>		
<b>Aphids (plant lice), Flea beetles</b> <b>Tarnished plant bug, Blister beetles</b> These various kinds of insects can ap- pear at different times on the sugar beet crop. Hence, more than one foliar treatment may be needed.	Endosulfan (Thiodan), ½ pound EC or WP. (This is 1 quart 2 pounds per gallon EC or 1 pound 50% WP).  or Parathion, ½ pound WP or EC. (This is 2 pounds 25% WP, or 3½ pounds 15% WP, or ½ pint 2 pounds per gallon EC).  or Malathion, 1¼ pounds EC. (This is 2 pints 5 pounds per gallon EC). For aphids only.	Do not feed treated tops to livestock.  15 days. Do not feed tops within 15 days of treating. Keep workers out of fields for 48 hours after applying parathion.  0 days. (If the tops are used for feed or food, 7 days).

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. N. P. Palton, Director, Cooperative Extension Service, Michigan State University, East Lansing, Mich. 1P-15M-12.65—CU