



Protecting Field Crops from Grasshoppers

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GRASSHOPPERS are the large, jumping insects that are so common during our summers. They feed on a wide variety of weeds. Although they are called "grass" 'hoppers, they feed also on broad-leaved plants. They are no problem as long as they stay in the weeds. They do feed on field crops, but are of concern only when numerous enough to threaten the yield of the crop. This happens in a few fields in Michigan every year. The 'hoppers become especially abundant during some years, and their damage can be extensive during these outbreak years. Outbreaks occurred during 1965, 1970, 1971, and were especially widespread during 1978. Outbreaks are well publicized, but the grasshoppers are always present. We should stay alert for them even during non-outbreak years.

BIOLOGY

Grasshoppers are small- to medium-sized insects with chewing mouth parts, long, slender feelers (antennae), and two pairs of wings. The front wings are leathery, while the hind wings are large, thin, and fold fan-like under the forewing when the insect is not flying. Their hind legs are large and enable them to jump long distances.



Fig. 1 — Adult of the redlegged grasshopper, the most common grasshopper pest.

Many different kinds of grasshoppers can be found in Michigan's field crops. The most common and damaging is the **redlegged grasshopper** (Figure 1). The adult of this species is about 1 inch long, dull grey to brown and (as its name implies) has pink to red lower joints of its hind legs. Redlegs will feed on a very wide range of plants and can be a pest in everything from home gardens to corn fields. The **differential grasshopper** (Figure 2) is less common



Fig. 2 — The differential grasshopper is large and most frequently a pest in corn.

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and more selective in its food than the redlegs. The differential is large (about 1½ inches long) and is greyish to greenish-yellow. This species feeds on many plants but is commonly a pest of corn in Michigan.

The life cycles of the different species of grasshoppers are similar. The female grasshoppers lay eggs in clusters (called "pods") in the upper surface of the soil during the mid-to-late-summer. The eggs, of course, are laid where the grasshoppers are most abundant, such as in unplowed weedy areas. The embryos in the eggs develop to a certain stage and then development ceases. The egg then passes the fall and winter in a dormant (or diapausing) state.

Egg development starts again when the soils warm up in the spring. The young grasshoppers (called nymphs) begin to hatch from the eggs in late May. They strongly resemble the adults, but are smaller. The wings of the nymphs are small pads, and nymphs cannot fly; but they can jump and are very active. They feed by chewing and usually feed from the margins of the leaves. They are heavy eaters during the day and largely inactive at night.

The nymph must shed (molt) its hard outer skin as it grows. The nymphs molt five times during their development. Their feeding increases greatly with increasing size. The larger nymphs are especially voracious and active. They will move from their weedy home fields into adjacent fields of crops when their numbers are large. The movement begins in late June and commonly reaches only the margins and headlands of the crop. They can infest entire fields, however, during the outbreak years or where they are locally abundant during non-outbreak years.

The final molt produces the winged adult, which can fly as well as jump. Its flights, however, are usually short and low. Michigan species will move from one field to another but do not travel the great distances covered by some western migratory species. The adults mate, and the females lay several pods of eggs during the summer. The adults begin to die off in early fall, but a few of them will persist until the heavy frosts.

CONTROL

Weather

Weather is extremely important in determining the numbers of grasshoppers. Grasshoppers, like other insects, cannot control their body temperature, and the speed of development is determined by the surrounding temperature. The newly hatched nymphs are especially sensitive to cold weather early in the season. They are also dependent on moisture for good growth of their food. Excessive

moisture, however, favors the development of the fungal diseases of the 'hoppers, while drought can make some soil too hard for egg laying. A warm summer and fall that is somewhat dry favors grasshopper development and egg laying; and a moist, late spring favors survival of the small nymphs. The combination of the right weather (for the grasshoppers) can result in an outbreak.

Natural Enemies

Natural enemies attack and assist in keeping grasshopper numbers down. Grasshoppers are especially subject to fungal diseases during wet weather. Other diseases and insect and even nematode parasites infest the 'hoppers. Predacious animals including insects, spiders, toads, mice, birds, skunks, and even larger animals such as foxes will also eat them. Of special interest is the fact that larvae of the blister beetles eat grasshopper eggs, while the blister beetle adults feed on plants, including some farm crops. We tend to minimize the effectiveness of these natural enemies during the outbreak years. The combination of inclement weather and natural enemies keeps the 'hoppers down to non-damaging numbers during most years, however, and we need to use auxiliary controls only during those few years when natural controls fail.

Checking Fields

Grasshopper problems start in large, weedy areas. You should locate such areas on your farm and keep them in mind as possible trouble spots. Ditch banks, rights-of-way, roadsides, fence rows, farm lanes, grain stubble, and old pastures or other unplowed weedy fields should be suspect. Simply look occasionally for grasshoppers in such areas and adjacent crops, starting in mid- to late-June. Grasshoppers will move from a field that is mowed or dries out. Check adjacent fields for grasshoppers when the fields that they are in change.

A good rule-of-thumb is that 8 grasshoppers per square yard in weeds, pasture, and drill crops, or about 1 per row-foot in row crops, are the minimum numbers considered to be threatening. The grasshoppers are very noticeable at these numbers when you walk through the field. Grasshoppers tend to stay together in groups. Make counts in several estimated, yard-square or 10 row-feet areas when the 'hoppers are noticeable. Consider a control when the average number of counts exceeds the minimum numbers given above. Let your county Extension agent know if grasshoppers are threatening so that he can inform others of the problem.

Grasshoppers are primarily leaf feeders and cause damage to ears, flowers, or pods only when they are numerous. Field crops can lose some foliage

without losing yield. The need to use an insecticide for grasshoppers depends on the expected loss of foliage. The minimal number of grasshoppers needed to justify a spray must be adjusted to the size of the plants and the time of the year. About double the minimal number of grasshoppers is needed to justify a spray when the plants are large or when the grasshoppers appear late in the season.

Application

One of the insecticides listed in Table 1 should be applied as soon as possible after deciding that a spray is needed. Grasshoppers are frequently pres-

ent in only parts of a field, commonly in margins and headlands. Only infested areas and a 20- 40-foot border around them need to be treated. Baits or granules as well as sprays may be applied if equipment is available and the insecticide is labeled for grasshopper control. **READ THE LABEL** before buying the insecticide to be sure that the product is registered for grasshopper control in the crop and for application at the time you will use it. A minimal amount of water can be used with sprays, as the grasshoppers are very active and complete coverage of the plants is not needed.

Table 1. — Insecticides Recommended for Grasshoppers in Field Crops

<i>Crop</i>	<i>Insecticide</i>	<i>Pounds of active insecticide per acre</i>	<i>Limits (Apply no closer to harvest than number of days given)</i>
Alfalfa, clover, hay and pasture grasses	azinphosmethyl (Guthion)	0.50	16 days
	carbaryl (Sevin)	1.50	0 days
	diazinon	0.50	7 days
	dimethoate (Cygon, De-Fend)	0.50	10 days
	malathion	1.25	0 days
Corn	diazinon	0.50	7 days
	malathion	1.00	5 days
	ULV malathion	8 liquid oz.	5 days
	carbaryl (Sevin)	1.50	0 days
Grass hays and pasture grasses	naled (Dibrom)	0.75	4 days; do not apply to crop over 12 in. high
Small grains	malathion	1.00	7 days
	ULV malathion	8 liquid oz.	7 days
	parathion	0.50	15 days; barley, oats and wheat only
	toxaphene	1.50	0 days
Sugarbeets	carbaryl (Sevin)	1.50	14 days
Dry beans, soy beans	carbaryl (Sevin)	1.50	0 days

LEARN TO IDENTIFY GRASSHOPPERS.
CHECK FIELDS REGULARLY FOR
GRASSHOPPERS. APPLY AN INSEC-
TICIDE ONLY WHEN NEEDED.

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