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MANAGEMENT OF INSECT PESTS IN SOYABEAN - WHITE PAPER BY IVORYCHEM

INSECTS	RECOMMENDED PRODUCT
Bean leaf beetle	PLUNGE 85 WP
Mexican bean beetle	Methomyl
Japanese beetle	Thiodicarb
Redheaded flea beetle	
Grasshoppers	
Green cloverworm.	
Stink bugs	Methyl parathion

INSECTS

Bean Leaf Beetle
The bean leaf beetle is a chrysomelid leaf beetle that varies in color from golden brown to green, generally has 4 black spots on the wing covers, and always has a black triangle on the scutellum (area centrally behind the thorax). The larvae develop below ground on the root system.

See photo: Bean leaf beetle

Mexican Bean Beetle

The Mexican bean beetle is a coccinelid beetle (i.e. the lady bug family). The adult is a gold color and rather oval shaped beetle having 16 black spots on the wing covers. The larvae have conspicuous spines and when fully grown measure approximately 1/2 inch in length.

See photo: Mexican bean beetle

Green Cloverworm

The green cloverworm can be found at subeconomic levels in most soybean fields. Occasionally, however, conditions produce a population explosion of this pest, which in turn results in heavy defoliation of soybean plants. It does not pay to control green cloverworm populations until there

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are eight or more worms per linear foot of row.

Two-spotted spider mite.

Spider mites, *Tetranychus urticae*, can cause economic losses in soybeans under extended hot, dry conditions, as have been observed in recent years. In most years, however, this pest is of little concern in Pennsylvania.

Spider mites are minute, about 1/60 inch or less in length, and are closely related to spiders and ticks. They are greenish white to green, and in some cases reddish. This mite can be identified from other mites by two dark spots on its abdomen. Mites typically live in colonies and produce a thin web on lower leaf surfaces.

Mites go through four stages of development: egg, larva, nymph, and adult. Eggs are small and oval (micro-scopic) and generally are laid on the underside of leaves. The larvae have six legs, while the nymphal and adult stages have eight legs. Both the larval and nymphal stages have little impact on yield. Adult females are responsible for most injury to soybeans.

Field Symptoms

Insect defoliation assessment is based on the collective foliar damage by the entire pest complex at any one time. If a significant problem exists, generally one species is causing the most of the injury. Thus, it is important that the problem pest be identified and determined whether the casual agent is increasing or decreasing in activity. The following symptoms are characteristic of the individual pests.

Bean leaf beetles chew fairly small but clean cut holes in the foliage. Individual holes are seldom not more than 1/4 inch in diameter, unless feeding is extensive. Redheaded flea beetle is very similar to bean leaf beetle injury.

Mexican bean beetles - both adults and larvae - cause a very skeletonized form of injury compared to that of the other defoliating insects.

Japanese beetle adults chew larger holes than the other beetles. In general, Japanese beetle damage is very concentrated in comparison to other insect feeding that is randomly dispersed.

Grasshopper injury is difficult to distinguish from bean leaf beetle or Japanese beetle injury. However, grasshopper injury tends to be more pronounced along the perimeters of fields near grassy alleyways, fencerows, and ditch banks.

Green cloverworm’s damage to soybeans is caused by the larval stage. The larvae are pale green with two narrow white strips along each side of the body. They are bare, slender, about 1.25 inches long when fully grown, and easily distinguishable from other insect larvae by the number of prolegs on the abdomen (short, fleshy legs along the middle of the body). Cutworms and armyworms have four pairs, loopers have two pairs, and green cloverworm larvae have three pairs of prolegs. Typically, green cloverworm populations are held in check by fungal and viral diseases.

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Adult moths overwinter in buildings, under trash, and in other protected sites. There are two generations per year in Pennsylvania. The first generation develops on alfalfa, clover, and other legumes during May and June. The larvae of the second generation are active from late June to early August and occasionally are serious pests of soybeans.

Spider mites have piercing-sucking mouth parts and feed by sucking sap from the plant. Mite injury somewhat resembles herbicide injury or some foliar diseases. Typical damage symptoms are small yellow speckles on the leaves. As injury becomes more severe, the leaves become yellow and develop brown lesions, and the plants die. Rain is the surest way to stop the spread of mite damage. Several miticides can be used, however, if dry, hot conditions are expected to persist.

Life Cycles

The bean leaf beetle has 2 generations per year and overwinters in the adult stage. Overwintering adults become active during the first warm weather of spring and move to soybeans as the crop emerges. By mid-June adult activity declines as immature egg, larvae, and pupae stages of the 1st generation develops below ground. First generation adults appear in July and defoliation activity resumes. A second generation develops and adults begin to emerge in September. As weather cools and soybeans are no longer available, the 2nd generation adults seek protected overwintering sites.

The Mexican bean beetle has 2 generations per year and overwinters in the adult stage. All stages develop on the foliage and both the larvae and adults may cause significant skeletonized defoliation. Adults of the 1st generation peak around early July and the 2nd generation appears in late August or early September.

The Japanese beetle passes through 1 generation per year and overwinters in the larval stage. Larvae pupate in the late spring and adults generally appear in June or early July. Eggs are laid in the soil which hatch into grubs that develop and remain as the overwintering stage.

The green cloverworm overwinters in the south. One or more generations may occur depending on the time of migration and the climate. Peak larval activity may range from July to late August.

Spider mite populations build up under hot, dry conditions because generation time is reduced substantially and fungal diseases cannot infect the pest. At 66°F, a generation is completed in about 20 days. In contrast, at 90°F, the pest completes a generation in about 7 days, and each adult female produces several hundred offspring. At this rate, if one female contributed 50 new females per generation, she alone would be responsible for 6.25 million female mites feeding in the field by the end of one month of 90°F temperatures. From this example, it is easy to see why spider mite outbreaks can occur rapidly during extended hot, dry periods.

Grasshoppers overwinter in the egg stage in the soil. Eggs hatch in the spring and nymphs feed on grassy areas gradually moving into soybeans. As nymphs become adults, populations become more evenly dispersed. In the fall, eggs are deposited in the soil which become the overwintering stage.

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Sampling and Assessment
During initial emergence of soybean plants, damage assessment is based on the potential for stand loss. To estimate stand loss, check 20 row feet of soybeans in at least 5 locations of the field and determine the percentage of plants cut or destroyed (significant defoliation is tolerable).

If 20% of plants are cut and stand has gaps of one foot or more, or if at least one seedling per foot of row is destroyed, then rescue treatment is warranted.

After trifoliate leaves have formed, damage assessment is based on estimates of defoliation. To estimate defoliation, the following procedure is recommended:

1. Pick a trifoliate leaf from the top, middleand low third of 10 randomly selected plants. (It is suggested that one carry a plastic bag for collection of foliage so that damage assessment may be made at one time.)
2. From each trifoliate discard the most and least damaged leaflets. At this point one should have 30 leaflets upon which the defoliation estimate will be based.
3. Compare the selected leaflets to the illustration provided in Figure 5 and record the average level of defoliation.

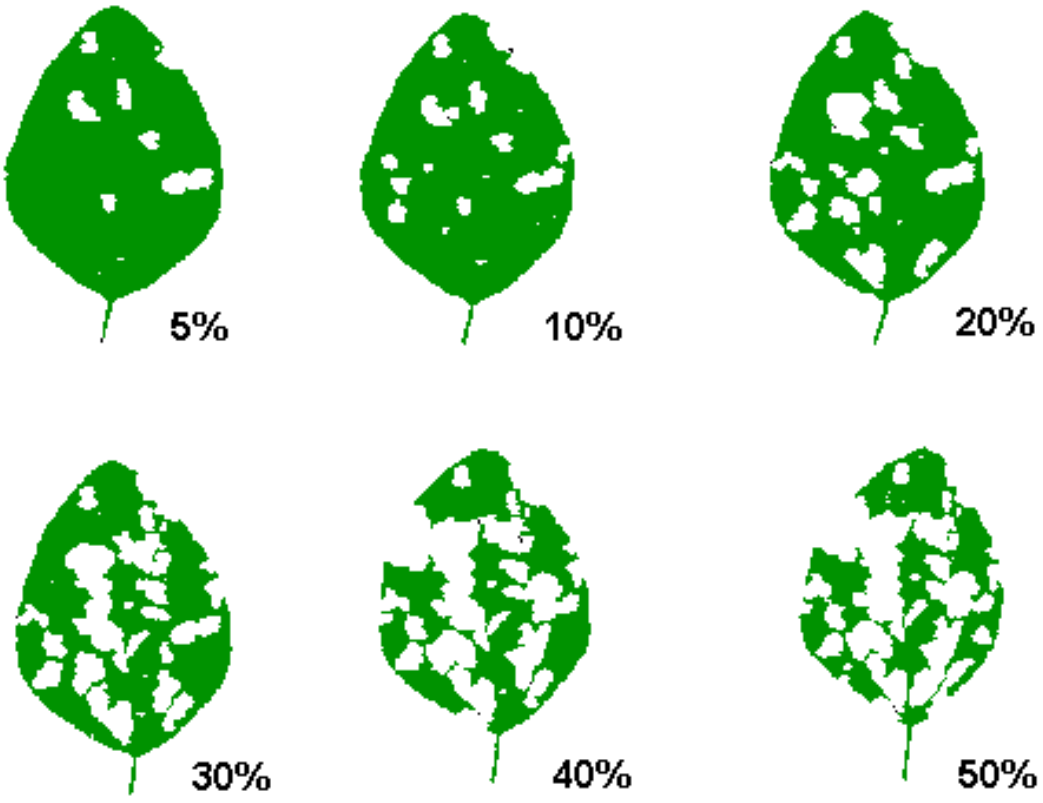

Figure 4. Representative insect defoliation levels of soybean leaflets.

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The action thresholds for determining the need for a rescue treatment varies with the stage of soybean development. Recommended action thresholds include the following:

Soybean Development	**Action Threshold**
Pre-bloom (i.e. vegetative stages)	**30%**
Bloom to Pod-fill	**15%**
Pod-fill to maturity (unless pod feeding observed)	**25%**

If defoliation exceeds the action threshold at a given stage of soybean development, then a rescue treatment may be warranted if the pest causing the injury is present and vulnerable to treatment.

Sampling foliage and assessment of defoliation should always be accompanied by observations of the defoliating pest complex present. Preferably, the field observer should take a minimum of 30 sweeps with a standard insect sweep net. Soybeans are generally swept parallel to the rows (not across the rows). In the process, the dominant pests present and their predominant stage of development should be noted. Maintenance of sweep catch records will enable comparison from time to time to determine whether pest activity is increasing or decreasing.

CONTROL

Chemical – At booting stage, seed treatment and foliar spraying with PLUNGE 85 WP (refer to PLUNGE 85 WP marketing literature*) was found to reduce pest populations. Repeat applications as necessary up to a total of 3 times per crop but not more often than once every 7 days.

Cultural – Crop rotation is advised to prevent resistance and reduce pest population explosion.

* Visit our website at www.ivorychem.com.

Alternatively, download the PLUNGE 85 WP marketing literature at
http://www.ivorychem.com/products/PLUNGE85WP.pdf

Source: OPMS Circular # FC-22 SOYBEAN DEFOLIATION
Prepared by: Harold R. Willson, Dept. of Entomology
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