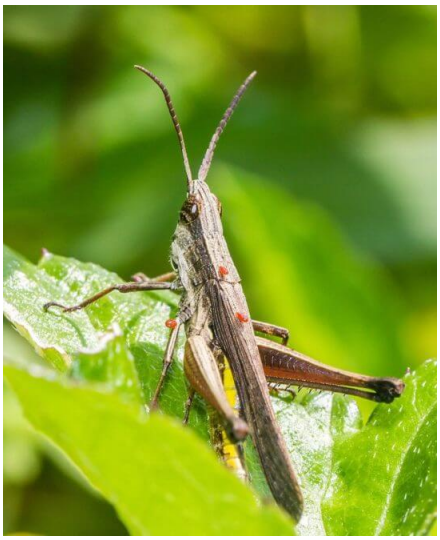
GRASSHOPPERS

Soybean Pests









Overview

Grasshoppers are relatively large insects, capable of doing considerable damage in a short amount of time. Grasshoppers are general feeders on grasses and weeds and often move to cultivated crops later in the season. Crop damage is likely to be greatest in years when dry weather accompanies high populations. Drought conditions reduce natural vegetation, forcing grasshoppers to move to cultivated crops when preferred food sources become scarce. Drought conditions also suppress naturally occurring entomopathogenic fungi (fungi that infect and kill insects) that help keep grasshopper populations in check.

Corn, soybeans, small grains and other crops may have localized problems with this pest when grasshopper populations are high. Grasshopper nymphs can consume entire soybean seedlings. On more mature plants, the nymphs eat irregular holes in the leaf issue. Adult grasshoppers consume entire leaves, except the tougher veins, and also feed on the pods.

Common species include the following:
Migratory Grasshopper (Spur-throated) (*Melanoplus sanguinipes*)



Photo Credit: Sangmi Lee, Grasshoppers of the Western U.S., USDA APHIS PPQ, Bugwood.org

- This species is widely distributed across North America and causes more damage to field crops, gardens, and rangeland than any other species of grasshopper
- Medium sized
- Positive identification includes a spine located between the first pair of legs
- Coloring of the lower hind leg varies and can include red, gray, orange and deep pink
- There may be a prominent orange stripe on the upper hind leg
- Nymphs can be tan or gray and occasionally light green

Differential Grasshopper (*Melanoplus differentialis*)



Photo Credit: David Riley, University of Georgia, Bugwood.org

- This grasshopper favors cultivated land and can be a severe pest on numerous crops including soybeans
- Its primary range is the central Great Plains east to the Mississippi River
- Adult coloring is brownish or greenish and the color darkens with age
- Nymphs (young grasshoppers) can be bright yellow
- There are inverted chevrons along the upper hind leg and the lower leg is yellowish with black spikes
- All adults have yellow tarsi (feet) and antennae, or in some cases reddish-yellow antennae

Two-striped Grasshopper (*Melanoplus bivittatus*)



- This species feeds on a mixed diet of many kinds of plants and can be a major pest on small grains, alfalfa, and corn
- It is widely distributed across all soybean growing regions
- Adults are light brown with shades of green on the head
- The top of the head is dark brown
- Two yellow stripes run the length of the body from the eyes to the edges of the wings and the tip of the abdomen
- The long back legs are tan with chevrons on the sides and alternating patches of black and tan along the inner edges
- Nymphs change color and pattern as they molt through multiple instars

Red-Legged Grasshopper (*Melanoplus femurrubrum*)



Photo Credit: Russ Ottens, University of Georgia, Bugwood.org

- Can be a crop pest in soybeans, alfalfa, clover, corn, and small grains
- It is widely distributed across all soybean growing regions
- It has a reddish-brown back and a greenish-yellow belly
- The rear feet are red
- The wings typically extend beyond the abdomen

Clear-winged Grasshopper (*Camnula pellucida*)



Photo Credit: Sangmi Lee, Grasshoppers of the Western U.S., USDA APHIS PPQ, Bugwood.com

- Generally found in northern states bordering Canada
- This medium sized grasshopper is yellow to brown
- The front wing is mottled and the hind wings are transparent
- Nymphs are cream, tan, or black
- The front wings of resting grasshoppers have light stripes that converge near the middle of the wing

Scouting

Outbreaks of grasshoppers are more likely after two or more years of dry weather. Long, warm autumns, followed by warm, dry springs contribute to the building of grasshopper populations. A long, warm autumn favors egg-laying by grasshoppers.

Summer lifecycle of common cropland grasshoppers

Grasshopper species	Nymph stage	Adult stage

Two-striped	May through early July	Early June through end of season
Migratory	Mid-May through mid-August	Late July through end of season
Clear-winged	Mid-May through mid-August	Late June through end of season
Red-legged	Late May through late August	Late June through mid-August
Differential	Mid-June through mid-August	Mid-August through end of season

Scouting should start after plants emerge. Concentrate sampling on field margins, fence rows, dirt roads and ditches. Soybean fields adjacent to undisturbed weedy sites, alfalfa, and small grain fields are susceptible to grasshopper infestation, so fields with this characteristic should be monitored carefully. Insect counts can be used when scouting early in the season. Later in the season, as plants develop, estimating percent defoliation is the recommended method.

For early season scouting, count the number of adults and nymphs in a one square foot area. Repeat this for a total of 20 samples. To determine the number of grasshoppers/square yard (which thresholds are defined as), multiply your average number of grasshoppers/square foot by nine.

Later in the season, visually inspect plants for defoliation. To estimate defoliation, examine a minimum of 10 plants.

To estimate percent defoliation:

From each plant, select a leaf from the top, middle and bottom thirds of the plant.

- Use Figure 1 to estimate percent defoliation for each leaf and determine the average percent defoliation across the three leaves from each plant.
- This average percent defoliation for the field's canopy can be compared to treatment thresholds.

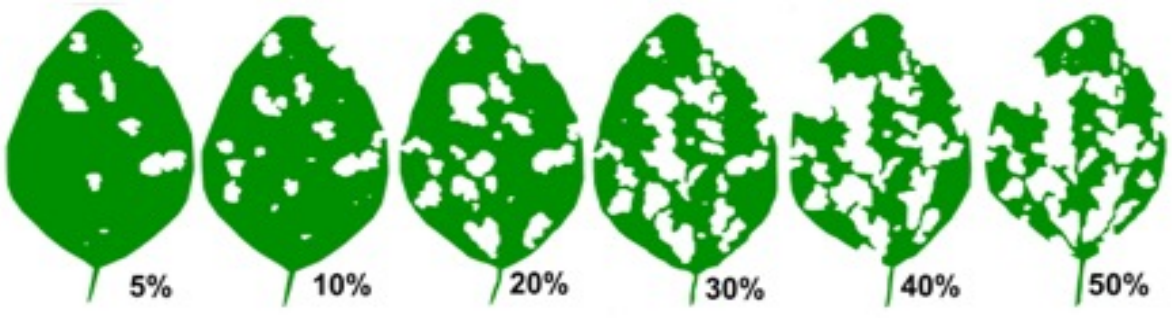


Figure 1. Levels of soybean defoliation. Injury is often overestimated. Cropwatch – University

of Nebraska – Lincoln

Injury symptoms
Leaf injury from grasshopper nymphs look similar to the small holes caused by Japanese beetle feeding but are more jagged in shape. Older nymphs and adult grasshoppers will eat the entire leaf, leaving only the major leaf veins.

Management

Insecticide management
Decisions should be based on the attainment of certain thresholds.

For insect number estimation, a consensus threshold of 30-45 nymphs or 8-14 adults per square yard within the field justifies treatment control. If the grasshopper population is found on field margins but not within the field, it may be justifiable to treat only the margins. If more than 60 nymphs per square yard were observed on adjacent non-crop areas, the areas and the portion of the field immediately bordering the areas may be treated. If both crop and non-crop borders are treated, be sure the product chosen is labelled for both sites.

For defoliation-based threshold, the following recommendations from the University of Minnesota can be used:

- For vegetative plants (before flowering), treat if grasshoppers are present and defoliation reaches 30 percent.
- For reproductive plants (flowering to pod fill stage), treat if grasshoppers are present and defoliation reaches 20 percent.
- Treat if grasshoppers or other pod feeding insects are present and pod injury reaches 10 percent. Treat aggressively if populations are large and pod clipping is occurring.

Chemical and biological control products
Adult grasshoppers are difficult to control with insecticides due to their size, mobility, and decreased susceptibility to the insecticides. The best time to control grasshoppers with insecticides is during the 3rd and 4th instars when they are 1/2 to 3/4 inch long. These stages will occur in early to mid-summer, depending on the species and soybean growing region. By this time, most eggs will have hatched and the nymphs will be more susceptible to insecticides. Also, they will still be concentrated in their hatching areas where they can be controlled more effectively than when dispersed later in the summer.

The biological control agent, *Nosema locustae*, can be placed on various baits and is marketed for grasshopper control under several trade names. Grasshoppers must eat the Nosema-treated bait as second or third instar hoppers. This requires both early season

scouting and treatment of grasshopper populations in border areas of the field. Flaky wheat bran treated with *Nosema locustae* is particularly recommended when control is needed near water or near threatened and/or endangered wildlife. Check with local Extension units for recommended insectides and for *Nosema* products available in your area. Always read and follow directions on the product label.

Cultural Management
Tillage of small grain stubble or fallow before the egg laying period may be an effective deterrent to oviposition (egg laying in the soil). Tillage after eggs are laid is ineffective since it does not cause egg mortality.

Eliminate tall grass and weeds around crops, trees and gardens you want to protect. This reduces food sources so grasshoppers are not attracted to these areas, exposes grasshoppers to greater predation from birds and mammals, and also makes these areas less attractive for egg-laying.

Similarly, summer weed control in fallow fields eliminates food sources so there will be nothing for small nymphs to feed on when eggs hatch, and fields will not be attractive to egg-laying adults.

Beneficial Insects and Fungi
Many beneficial insects feed on grasshoppers. Natural enemies are the reason why we generally see only localized outbreaks of grasshoppers. Some beneficials include the larvae of blister beetles and ground beetles (which feed on the eggs), bee flies (parasites of eggs), robber flies, Scelionid wasps, flesh flies (Sarcophaga), certain species of parasitic nematodes, the red locust mite, and tangle-veined flies. The parasitic flies deposit eggs on the nymph or adult, and the emerging larvae eat their way into the body of the grasshopper. Generally, parasitized grasshoppers die earlier and do not reproduce.

An insect killing fungus, *Entomophthora grylli*, often causes locally high mortality in grasshopper populations. Infected grasshoppers can be seen in a characteristic pose at the top of a plant, in which the grasshopper grasps the plant in a “death embrace” with front and middle legs while the hind legs are extended. It dies in this position. Fungal spores develop in and on the body of the infected grasshopper. These spores become airborne and infect other grasshoppers. Under warm, humid conditions, great numbers of grasshoppers are destroyed by this fungus. Contrarily, when conditions are hot and dry, the fungus is inactive and grasshopper populations can increase unchecked.

Predation of nymphs and adults by larger animals such as toads, snakes, birds, skunks, shrews and moles also have an impact on grasshopper populations during the summer months.

Resources

Grasshopper Identification Guide for Cropland Grasshoppers
University of Nebraska Extension
https://marketplace.unl.edu/extension/grasshopper-identification-guides.html

Grasshopper Integrated Pest Management User Handbook
USDA APHIS
https://naldc.nal.usda.gov/organic_roots/

Grasshoppers on Soybean-Northern Plains IPM Guide
Northern Plains IPM Guide
https://wiki.bugwood.org/NPIPM:Grasshoppers_(soybean)

Grasshoppers
Iowa State University
https://www.ent.iastate.edu/soybeaninsects/grasshoppers

Grasshoppers
University of Illinois
http://extension.cropsciences.illinois.edu/fieldcrops/insects/grasshoppers/

Grasshoppers of Nebraska
University of Nebraska
http://entomology.unl.edu/grasshoppers/

Minnesota Grasshopper Management
University of Minnesota
https://soybeanresearchinfo.com/wp-content/uploads/2019/03/grasshoppers_MN2012.pdf

Orthoptera of the Northern Great Plains
North Dakota State University
https://www.ndsu.edu/pubweb/~gefauske/hopper/orthoptera_home.htm

SOYBEAN RESEARCH
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