

TENNESSEE SOYBEAN PRODUCTION HANDBOOK

CHAPTER 7:

Soybean Insect Management

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Integrated Pest Management (IPM) is a concept which includes controlling crop pathogens, weeds and insects. A production system includes a combination of IPM methods, including soil sampling, soil preparation, nutrient management, cultivar selection, planting dates, row spacing, seeding rates, water management, scouting and the use of pesticides that will keep all pests below an economic injury level.

MONITORING/DETECTION/SAMPLING

Monitoring (scouting) is a fundamental part of any IPM program because treatment decisions are based on past and current pest numbers. Sampling methods will vary depending upon the pest. Good management requires systematic sampling and detection. Insect pests are very mobile and enter fields at different stages of crop growth. Therefore, sampling techniques and economic injury levels vary during the crop growing periods from bloom to pod fill to maturity.

ECONOMIC INJURY LEVEL (EIL)

Economic injury level (EIL) is the level of a pest population capable of an amount of damage, which, if prevented, would offset the cost of treatment applied. The cost of action taken equals the benefits received. Determining economic injury levels is an important part of an IPM program. An Economic Threshold (ET) is a pest population level below the economic injury level where an application of pesticide should keep the population from reaching the EIL. The economic threshold provides a margin of safety between detection and the point of action taken. A practical determination of an ET is made based on leaf area reduction and yield loss or how much yield loss is caused by a given number of insect pests. This level varies with plant growth stage. Information, suggested treatment levels (ET) and materials in this chapter refer to insect and mite control in soybeans.

Many different insects can be found on soybeans in Tennessee. Some are detrimental, while others are beneficial. The most economical and effective program begins with proper insect identification and a determination of

possible economic damage. Serious reductions in yield and grade may result if an outbreak of an insect pest occurs and is not controlled. Some soybean pests feed on leaves and stalks; others are primarily pod feeders.

INSECT IDENTIFICATION

Fall armyworm is a multicolored, striped caterpillar. They often have a prominent, light-colored inverted “Y” on a dark-colored head, but the head of this species is often lighter in color when it occurs on soybean, in pastures or on weedy grasses. Armyworms may feed on leaves, stems and pods. Economically damaging infestations are most common in late maturing fields. Serious damage is sometimes seen when larvae occur on weedy grasses within the field and move onto soybean when the grasses are consumed or removed with an herbicide application. Infestations may also be worse along field edges where grasses are present.

Beet armyworm larvae are generally green in color, and the small larvae feed in clusters of 10-30 individuals, often skeletonizing the undersides of leaves. Larger larvae are less aggregated and may feed on leaves, flowers and pods. They have a small black dot on either side of the body above the second pair of true legs. Beet armyworm larvae are often found on plants near Palmer pigweeds, a preferred host of this species. Thus, infestations may be worse in fields where this weed is common. Beet armyworm infestations can be worsened by the previous use of insecticides that disrupt populations of beneficial insects. Infestations also tend to be worse in fields with wider rows or skimpy stands and particularly during hot and dry summers.

Yellowstriped armyworm is rarely a pest, and, when treatment is needed, it is almost always on seedling plants where larvae may cause excessive defoliation. Larvae are typically dark in color with a prominent yellow stripe running the length of their body on either side. They usually have an obvious dark spot on either side of the body on the body segment behind the last pair of true legs. The thorax, where the true legs are located, of smaller larvae tends to be slightly wider than the rest of the body (giving it a barrel-chested appearance).

Larvae sometimes feed on flowers or small pods; however, treatment is rarely if ever needed once blooming has begun.¹

Bean leaf beetles are almost always present in soybean fields and sometimes causes economic injury.² Adults are about 1/4 inch (6 mm) in length and sometimes have pairs of black spots on their wings. The color of adult beetles varies, but they are usually reddish, yellowish or tannish. A key identifying characteristic of bean leaf beetles is a rear-facing black triangle on the top of the wings just behind the thorax. Eggs are laid on the soil surface and larvae are found in the soil, where they cause little injury and are rarely seen.

Adult bean leaf beetles damage soybean plants by chewing holes in leaves and may occasionally feed on pods. Holes in leaves are roughly spherical in shape. In very rare cases, heavy feeding by first generation beetles on seedling plants can lead to stand loss; however, most economic damage is caused by defoliation of larger soybeans from later generations. Bean leaf beetle is also a vector of bean pod mottle virus. Soybean plants infected with bean pod mottle virus can show a variety of symptoms from chlorotic leaf mottling, puckering and necrosis. This virus may also cause harvest problems as it may cause “green stem syndrome,” a disorder where the soybean stem stays green even after the plant has matured, making harvest more difficult. Although there is potential for economic loss from bean pod mottle virus, it is rarely a major concern in Tennessee.

Blister beetles get their name from the defensive secretion cantharidin that they secrete from the joints of their legs when disturbed, which can cause burning and blistering of the skin. Adults are soft-bodied beetles. Their appearance varies based on species, but adults are roughly 2 cm (3/4 inch) in length. The striped blister beetle has alternating dark brown and yellow stripes along the length of the body. The margined blister beetle is black with a gray border along the margins of its wing covers. The prothorax of blister beetles, the area between the head and the wings, is narrower than the head and the wings. Larvae are grub-like and found in the soil. Adults of both species, and especially the striped blister beetle, feed in clusters and skeletonize soybean leaves, making large and irregular holes between the leaf veins. Some soybean varieties are more preferred by blister beetles than others. Feeding is typically localized to a few small areas of the field, and often blister beetles will leave a soybean field as quickly as they arrived.

Japanese beetles can be a pest of gardens, trees, ornamental plants and agricultural fields. Adults have a bright metallic green head and thorax with copper-colored elytra

(hardened wings) and a row of five spots of white hairs on each side of the abdomen below the wings. They are oval shaped and vary in length from 8-11 mm (3/8 to 1/2 inch) and a width of 5-7 mm (1/4 inch). Larvae or “white grubs” are found in the soil and do not cause economic damage in soybean. Japanese beetles have one generation per year in Tennessee. Adults typically emerge from late May through July and often feed in small clusters. Japanese beetles primarily feed on the upper foliage of soybean, consuming leaf tissue between veins and leaving a lace-like skeleton.

Mexican bean beetles belong to the same family of insects as the lady beetles. Adults are copper colored with 16 black spots on its back. Larvae are yellow to brown with many spines on the back and sides. Adults and full-grown larvae are about 6 mm long (1/4 inch), and both damage soybean by feeding on the undersides of leaves, resulting in a lacy skeletonized appearance. Mexican bean beetles rarely occur at economically damaging levels, and this primarily occurs in the central and eastern parts of Tennessee.³

Corn earworm, also called bollworm or podworm, may cause occasional but serious damage to soybean by feeding on flowers and pods. Some leaf feeding may also be observed but is rarely a concern. Large caterpillars may be green, brown or yellow, with light and dark stripes running the length of the body, and they also have sparse setae (hairs) on their bodies. Larvae reach a length of 1.5 inches and have four pairs of prolegs and a pale brown or orange head.⁴

Cutworms may be pests of soybean by cutting seedling plants and potentially reducing stand density; however, economically damaging infestations in soybean are relatively rare compared with cotton or corn. The caterpillars have four pairs of prolegs, are brown to dark grey in color, and are generally hidden below ground during the day. During the night, small larvae may chew holes in leaves; however, larger larvae may cut small plants and pull plant parts partly underneath the soil. Symptoms of injury are cut stems or wilted plants. Leaf petioles may also be cut. Cutworm damage is more frequent in reduced tillage systems and following a legume cover crop. Cutworms may become established on existing vegetation and move to emerging soybeans once this vegetation has been killed.⁵ Destroying all green vegetation at least 21 days prior to planting reduces the likelihood of cutworm damage.

Dectes stem borers are long-horned beetles native to the United States east of the Rocky Mountains. Larvae tunnel within the stem of soybean and wild host plants. The adult beetle is gray and approximately 3/8 inch in length. Eggs

¹ For information on sampling, treatment thresholds and control information, see UT Crops. “Fall Armyworm, Beet Armyworm, and Yellowstriped Armyworm.”

² For information on sampling, treatment thresholds and control information, see UT Crops. “Bean Leaf Beetle.”

³ For information on sampling, treatment thresholds and control information, see UT Crops. “Blister Beetle, Japanese Beetle, and Mexican Bean Beetle.”

⁴ For information on sampling, treatment thresholds and control information, see UT Crops. “Corn Earworm.”

⁵ For information on sampling, treatment thresholds and control information, see UT Crops. “Cutworms.”

are yellowish, shiny, elongated and darken to an amber color prior to hatching. The legless larva is creamy white or yellowish with brown mouthparts. It is less than 1/16-inch long when it hatches from the egg but reaches a length of 1/2 to 5/8 inch when full grown. The pupa is yellowish-white, turning to dark brown before the adult emerges. Besides soybean, giant ragweed, sunflower and cocklebur are known hosts. The *Dectes* stem borer has only one generation annually. Mature larvae overwinter within the stem at the base of infested plants, near or just below the soil level. Pupation occurs in the spring, lasting 10-15 days in Tennessee, with emergence of adults beginning in late June and continuing to August.⁶ An adult female can live 4-8 weeks and lay as many as 50 eggs. The female beetle chews a small hole in the leaf petiole (or, less commonly, in stems), where she lays a single egg. Females prefer to lay eggs in relatively bigger plants, often during bloom (R1 to R3 growth stages). In no-till production areas, it is not uncommon for some soybean fields to have 80% or more infested plants.

As it grows, a larva moves from an infested leaf petiole into the main stem, where it tunnels within the pith of the main stem until the plant matures. More than one larva may infest a soybean plant, but only one individual survives to maturity. In preparation for overwintering, older larvae girdle the stem from the inside at 2-5 inches above the soil. Tunneling in leaf petioles or in the main stem has little direct effect on yield; however, the girdling behavior can result in lodging, which can cause yield loss, primarily by reducing harvest efficiency. The timing and amount of girdling is unpredictable and often doesn't result in significant lodging, even in heavily infested fields.

Grasshoppers are a generalist group of plant feeders. Short-horned grasshoppers (family Acrididae) are most commonly observed in soybean. They have short, thread-like antennae with enlarged hind legs that aid in jumping. Grasshoppers have chewing mouthparts, and the adults have two pairs of wings that are folded over their "backs" when not flying. Adults of some species can exceed 2 inches in length. The color patterns of grasshoppers vary considerably because a) there are multiple species observed in soybean, b) colors change as they molt from one life stage to another, and c) their colors may change to match their environment.

Grasshoppers are an occasional pest of soybean, but some fields in Tennessee require an insecticide application in most years.⁷ Grasshoppers feed primarily on foliage and are part of the defoliating pest complex in soybean, but feeding on flowers, pods and other plant parts is sometimes observed. Leaf feeding is characterized by irregular holes that extend in from the leaf margins or between the leaf veins. Plants are most susceptible to damage when they are small, from the time of emergence to V2; therefore, most serious infestations are seen on seedling

soybean plants. Both immatures (nymphs) and adults may feed on the main stems of seedlings and reduce plant stands to the point where replanting is needed; however, serious damage is usually caused by large numbers of nymphs. Grasshopper infestations are often worse following a dry year.

Green cloverworms are commonly found in soybean. The caterpillar (larva) is green, slender and reaches a length of about 1 inch. It has three pairs of abdominal prolegs; this distinguishes it from other caterpillars found in soybean. It feeds only on leaves, and the feeding damage is similar to that of loopers. Smaller green cloverworm larvae crawl in a looping, inchworm fashion similar to loopers; however, green cloverworm larvae often wriggle spastically when disturbed or prodded, helping to distinguish them from loopers. They may be found at any time during the season, but they are damaging only at high populations or in combination with other defoliators.⁸

Kudzu bug on kudzu or soybean have been reported from most soybean producing areas of Tennessee, and this invasive insect has spread rapidly through the state. Adult kudzu bugs are about the same size as adult lady beetles. They are approximately 1/4-inch long, almost square in shape with a brown to olive-green hue. The immature stages are more rounded, smaller and "hairy." Eggs of kudzu bugs are light-colored, barrel-shaped and placed on leaves or other plant parts in two rows. Kudzu bugs are generally found on the stems where they feed on plant juices (phloem). They do not feed on seeds. It takes many kudzu bugs to cause economic damage to soybean, but infestation levels may reach hundreds of bugs per plant.⁹

Saltmarsh caterpillars and other woolly worms are commonly found in soybean. Larvae feed only on leaves and occasionally cause enough defoliation to justify treatment. The feeding damage is similar to that of other defoliating caterpillars. Eggs are laid in a mass, usually on leaves, and the small, light-colored and somewhat hairy larvae may be found clustered together after hatching. Larger larvae of the saltmarsh caterpillars are hairy and vary considerably in color, although they tend to be white, yellowish or cream-colored when an outbreak occurs. The larvae have four pairs of prolegs and grow to a length exceeding 2 inches.¹⁰

Soybean aphid is a relatively new, invasive pest in Tennessee. Economically damaging infestations are rare and more likely in the eastern half of the state. Soybean aphids are pale yellow, small and soft-bodied insects typically found on the undersides of leaves or on stems where they feed on sap (phloem) with piercing-sucking mouthparts. Most aphids will lack wings. They are the only aphid found in soybean that will occur in large numbers. Feeding by immatures and adults may result in the accumulation of honeydew on the plant. Previous infestations in Tennessee

⁶ For information on sampling, treatment thresholds and control information, see UT Crops. "Dectes Stem Borer."

⁷ For information on sampling, treatment thresholds and control information, see UT Crops. "Grasshoppers."

⁸ For information on sampling, treatment thresholds and control information, see UT Crops. "Green Cloverworm."

⁹ For information on sampling, treatment thresholds and control information, see UT Crops. "Kudzu Bug."

¹⁰ For information on sampling, treatment thresholds and control information, see UT Crops. "Saltmarsh Caterpillar."

have mostly occurred later in the season when temperatures have been relatively mild. Soybean mosaic virus and other viral diseases are sometimes transmitted by aphids during feeding.¹¹

Slugs and snails are not insects but mollusks and, more specifically, gastropods. Instead of legs, they have a muscular foot that secretes mucus, creating a “slime trail” as they crawl across the soil or plant. They both have two pairs of retractable tentacles on their head.

Snails have a shell, and they rarely cause economic damage. In Tennessee, most of the snails found in row crops do not feed on plants, even though they are often found on plants during the day.

Slugs do not have a shell and often cause economic damage. The marsh slug, *Deroceras laeve*, is a common species found in Tennessee. Slugs feed mostly at night but sometimes can be seen in the early morning hours on cloudy, wet days. Slugs take shelter in the soil or under plant residue during the day. Economically damaging infestations almost exclusively occur in low- or no-till production systems, especially where a lot of plant residue is present. Thus, infestations are often worse in fields following corn, sorghum or wheat cover crop. Infestations are also usually higher in wet areas of the field. Slug damage to seedling plants can be substantial when the seed furrow is not entirely closed during planting, which typically occurs when planting conditions are wet. An open seed furrow gives slugs access to feed on emerging seedlings during the day or night. When infestations are severe, stem feeding may result in “cut plants.”¹² Replanting may be necessary when severe infestations are present.

Soybean loopers are a common defoliating caterpillar found in soybeans. They do not feed on pods. Both soybean looper and cabbage looper may be present; however, in Tennessee, economically damaging infestations are uncommon until mid-August and September, and these infestations are often composed mostly of the soybean looper. Larvae of both species are light green and have two pairs of prolegs (excluding the pair on the last abdominal segment). The caterpillars move with an inchworm or looping fashion when crawling. The body is thickest at the rear and tapers to the head, reaching a length of about 1.3 inches. Populations are often held in check by beneficial insects and diseases.¹³

Spider mites are an occasional pest of soybeans. They are not insects, being more closely related to spiders. The twospotted spider mite is the most common mite found infesting soybeans. At full size, spider mites are only 0.3-0.4 mm long and difficult to see with the naked eye. They are pale yellow to orange in color, and, under magnification, a dark spot can be seen on either side of the body.

Sometimes, a dark red body color is observed (previously called the carmine mite). The adult and nymphal stages have eight legs, but the larval stage that emerges from the egg has six legs. Both immature and adult spider mites cause injury to soybeans by sucking juices from plants. As their name suggests, a fine silken webbing is produced by the mites and may be observed on infested leaves. They may feed on all plant structures but are most commonly observed on the undersides of leaves. Infestations are often most severe during hot and dry weather. Mites reduce the plant’s ability to produce photosynthate and, under severe infestations, cause premature defoliation.¹⁴

Stink bugs are common pests in Tennessee. There are several species of stink bugs that may occur in soybean, and both the adults and nymphs cause injury by feeding on developing seed with their piercing-sucking mouthparts. Adults are shield-shaped, either mostly green or brown in color, and 0.5 to 0.67 inches long. Immatures vary considerably in size and color, both within and among species. Stink bugs may introduce diseases into developing seeds, reduce seed size and germination, and lower milling quality. Damaged seed may appear wrinkled and smaller than normal.

The green stink bug is the most common species that feeds on soybean in Tennessee. The brown stink bug is another common component of the stink bug complex. Other plant feeding species that may be present include the red-shouldered stink bug and the dusky brown stink bug. The southern green stink bug is less common but may be observed after warm winters, particularly in the southernmost counties. The brown marmorated stink bug and the redbanded stink bug are invasive species that may also be observed in some areas of the state. Like the southern green stink bug, redbanded stink bugs are more likely to occur after a very mild winter. Finally, predatory (beneficial) stink bugs such as the spined soldier bug may also be found in soybean and are sometimes mistaken for brown or dusky brown stink bugs.¹⁵

Threecornered alfalfa hoppers are a green, wedge-shaped insect about 1/4 inch long. They are an occasional pest of soybean. The adults are very mobile and hop when disturbed. Adults and nymphs feed by inserting their piercing-sucking mouthparts and girdling the circumference of stems or leaf petioles. A callus (girdle) is created at the site of feeding. Plants may snap over while walking through the field or during a storm if threecornered alfalfa hoppers, typically the adults, have girdled the main stem of plants less than 10-12 inches tall. Lodging is often observed long after the girdle was made and when plants are no longer susceptible to damage. Leaves may be seen turning brown where petioles have been girdled. Feeding by threecornered alfalfa hopper does not cause yield loss

¹¹ For information on sampling, treatment thresholds and control information, see UT Crops. “Soybean Aphid.”

¹² For information on sampling, treatment thresholds and control information, see UT Crops. “Slugs (and Snails) in Corn, Soybean and Cotton.”

¹³ For information on sampling, treatment thresholds and control information, see UT Crops. “Soybean Looper.”

¹⁴ For information on sampling, treatment thresholds and control information, see UT Crops. “Spider Mites.”

¹⁵ For information on sampling, treatment thresholds and control information, see UT Crops. “Stink Bugs.”

unless lodging occurs, especially when this lodging occurs during the mid- or late reproductive stages (R4 and beyond).¹⁶

Thrips may be observed feeding on seedling soybean. Common examples include tobacco thrips and soybean thrips. Thrips are small, slender insects. Adults are about 1.5 to 2.0 mm long and can usually be distinguished from the immatures by the presence of two pairs of wings that are held folded behind the back. Each wing is characterized by a fringe of hairs on the posterior margin, but this is not visible except under magnification. Some adults may be wingless. Depending upon the species, adult color varies from yellowish to black. Eggs are very small and are inserted into the host plant. Immature thrips found in soybeans are pale yellow to straw-colored. Both immature and adult stages have modified, piercing-sucking mouthparts and feed on plant juices from the wounds made by their “beak.”

Thrips are very common insects found in soybean but rarely justify an insecticide treatment because soybean plants are tolerant to injury.¹⁷ Economic damage to soybeans is only likely during the seedling stage when environmental conditions result in poor seedling growth and low vigor. Feeding often causes yellow or white speckling on leaves, particularly around leaf veins, and a general stunting of plants. Leaves may be somewhat crinkled or cupped when thrips populations are high, and, in rare cases, plants may be killed.

The **Velvetbean Caterpillar** is common in the coastal regions of the South. In Tennessee, it is sometimes found late in the growing season on late maturing soybeans, especially after one or more particularly mild winters. The larvae grow larger than most other caterpillars found in soybean and can cause substantial defoliation when present in large numbers. Color varies considerably, but when found in Tennessee the larvae are typically green in color. Small larvae loop in an inchworm fashion similar to green cloverworm or loopers, but velvetbean caterpillars have four pairs of prolegs. Similar to the green cloverworm, the larvae wiggle rapidly when prodded. This behavior helps to distinguish them from corn earworm with which they are sometimes confused.¹⁸

¹⁶ For information on sampling, treatment thresholds and control information, see UT Crops. “Threecornered Alfalfa Hopper.”

¹⁷ For information on sampling, treatment thresholds and control information, see UT Crops. “Thrips.”

¹⁸ For information on sampling, treatment thresholds and control information, see UT Crops. “Other Defoliating Caterpillars.”

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