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Managing SOYBEAN INSECTS in Texas



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Suhas S. Vyavhare
Postdoctoral Research Associate

Michael O. Way
Professor of Entomology

Allen Knutson
Professor and Extension Entomologist

Stephen Biles
Extension Agent–Integrated Pest Management

Rebecca A. Pearson
Research Assistant

The Texas A&M University System

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This is a revision of a previous edition published in 1999. Texas soybean insect pest management has changed considerably in the past 16 years. New varieties have been released, new production systems adopted, new and emerging pests have become problematic, and new pest management tools developed. The objectives of this revised edition are to: 1) describe the major soybean insect pests of Texas, including their associated damage in relation to soybean growth stages, 2) describe the various sampling methods for these pests, and 3) list the management tools for each pest in terms of treatment thresholds.

Use the control recommendations in this publication as a guide. Every soybean field differs in terms of soil, microclimate, surrounding cropping patterns, and farmer input. The old adage "one size fits all" clearly does not apply to soybean pest management. The information given here will help stakeholders better manage soybean insect pest problems for maximum profits with minimal inputs, and preserve and improve the soybean agroecosystem.

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Apurba Barman, Texas A&M University: Conchuela stink bug

Bastiaan Drees, Texas A&M University: Green lacewing adult

Herb Pilcher, USDA Agricultural Research Service, Bugwood.org: Redshouldered stink bug

Pat Porter, Texas A&M University: Flower fly, ichneumonid wasp, lady beetle pupae and adult, tachinid fly

Mike Quinn, TexasEnto.net: Ventral view of redbanded stink bug and redshouldered stink bug

Dominic Reisig, North Carolina State University: Thrips injury

Steven Roberson, North Carolina State University: Green stink bug, lesser cornstalk borer larvae stem injury, lesser cornstalk borer larva on stem, spined soldier bug

Winfield Sterling, Texas A&M University: Braconid wasp, brown lacewing, damsel bug, green lacewing larva, ground beetle, minute pirate bug, spined soldier bug nymph

Cesar Valencia, Texas A&M University: Assassin bug

Suhas Vyavhare, Texas A&M University: Collection of field data, ground cloth sampling, insect identification with hand lens, southern green stink bug nymph, soybean delayed maturity, soybean growth stages and development, sweep net sampling

M. O. Way, Texas A&M University: Fall armyworm; redbanded stink bug adult and nymph; southern green stink bug adult

S-219 Regional Project: Banded cucumber beetle, bean leaf beetle, big-eyed bug, black cutworm, brown stink bug adult, cabbage looper, dectes stem borer adult, garden webworm, green cloverworm, green stink bug nymph, lesser cornstalk borer symptoms in the field, soybean damage from foliage-feeding caterpillars, soybean looper, soybean podworm, soybean thrips, striped blister beetle, threecornered alfalfa hopper adult, threecornered alfalfa hopper injury, threecornered alfalfa hopper nymph and petiole girdle, velvetbean caterpillar

Contents

Managing soybean insect pests in Texas depends largely on geography, climate, and common agronomic practices.

Most soybeans in Texas are grown in the Northern High Plains, Blacklands, Northeast Texas, Upper Gulf Coast, and the Lower Rio Grande Valley—an area that extends north to south from Oklahoma to the Mexican border and west to east from the Northern High Plains to the Louisiana border.

Research data show that, over the last decade, there have been substantial fluctuations in both the area planted and yields produced (Fig. 1).

Market prices and climate often influence both acreage and yield. Based on a 2012 census, less than 20 percent of Texas soybean acreage is irrigated, with most soybeans produced in areas with adequate rainfall (generally in the eastern half of the state where annual precipitation can exceed 40 inches). Recently, soybean production has increased in the Lower Rio Grande Valley where two irrigated crops are produced each year. Soybeans in the Northern High Plains are also irrigated and frequently planted following an early spring failure of the cotton crop. The average yield of irrigated soybeans in Texas is almost twice that of rain-fed soybeans.

But, soybeans do not tolerate excessively wet conditions such as standing water. Heavy, persistent rains that result in prolonged saturated soil can kill soybeans or cause severe stunting. A good management option is to plant soybeans on beds rather than drill-planting, particularly on the Upper Gulf Coast where rainfall is relatively abundant. Also, precision-leveled fields can improve drainage and reduce irrigation costs.

Soybean farmers should manage their crop to achieve maximum yield at minimum cost. This requires a high level of decision-making, similar to more high-value crops such as rice and cotton. Management decisions involve variety selection, planting method and date, and pest control programs. Weed, disease, and insect control programs

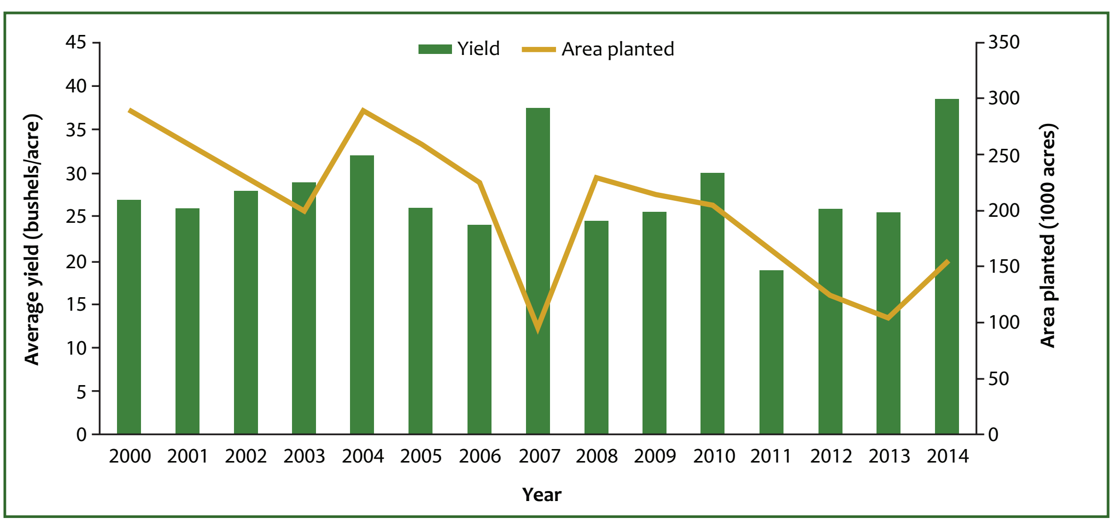

Figure 1. Soybean acreage and average yield in Texas 2000–2014. Source: National Agricultural Statistics Service.

Figure 2. Collection of field data.

must be effective and timely, which means the soybean farmer or crop consultant must do the necessary agronomic "homework" and scout fields regularly and thoroughly from planting to harvest.

Soybeans are grown in diverse regions of Texas and the complex of insects across the state that attack soybeans is also diverse. For each region, a unique group of insect pests damages soybeans, making the crop vulnerable to attack throughout the crop season. This is why frequent and careful scouting for insect pests and beneficial insects is critical to successful soybean production (Fig. 2).

High spring and summer temperatures and humidity, abundant rainfall, and a long growing season (characteristic of the eastern half of the state) are conducive to rapid buildup of pest populations. A soybean farmer who does not check fields frequently runs the risk of being unaware of damaging pest populations during critical growth stages. This lack of attention and management can result in significant yield and quality loss and less than optimum insect control.

Unfortunately, some farmers apply insecticides on a "calendar basis," causing an overuse of pesticides and detrimental effects on the environment and beneficial species. Also, applying insecticides without scouting can needlessly increase production costs and foster resistance development.

Pest Management Principles

Integrated pest management (IPM) is a philosophy used in the design of insect, mite, disease, and weed control programs. It uses the most economically and ecologically sound combination of effective pest suppression techniques to create an economically viable production management system.

The first line of defense against pests is prevention through good agronomic practices or cultural methods that discourage pest population development. Implement control measures only when pest populations reach levels that cause crop losses greater than the cost of the treatment. This is the economic threshold level or treatment threshold. Scout fields regularly to determine if and when that level is reached. Precise timing and execution of each production operation is essential. In short, IPM strives to optimize rather than maximize pest control efforts.

The treatment thresholds in this publication are guidelines. Several factors affect the level of damage soybean plants can tolerate before the cost of a control tactic (such as the use of an insecticide) becomes profitable. These factors include the anticipated market value of the crop, anticipated yield, and the cost of the treatment.

In general, when the market value of soybeans is high and the cost of control is low, treatment thresholds decrease (fewer pests or less pest damage can be tolerated). Treatment thresholds may also change with the growing season, presence of different pests, type of damage, plant growth stage, and general plant vigor.

Sampling Soybeans to Estimate Insect Densities and Plant Damage

In order to know when pest infestations exceed the economic or treatment threshold, estimate the densities of insect pests and damage in a field. Sampling thoroughly at least once a week is the key to effective pest management (Fig. 3).

Do not bias results by sampling only near the field margins. Often, pest populations will be greater close to the edge of a field. It takes more effort to sample deeper into the field, but the results are more accurate and representative of the entire field.

The more samples you take, the more accurate the estimate of target pest densities will be. Do not sample only one area of a field; take samples from all portions of it. For instance, if a soybean field is rectangular, the minimum sampling effort should involve all four sides of the field.

Obvious field differences such as soil type, surrounding vegetation patterns, and topography can impact insect populations. The more variable the field, the more samples you will need to take to account for these differences. Also, sample more areas if the results show that pest densities or damage are close to treatment thresholds or if the field is very large.

Figure 3. Insect identification using a hand lens.

There are various ways to sample and, based on the production practices in a given field, each method has its strengths and weaknesses. Regardless of the sampling method, scout soybeans frequently and thoroughly from planting to near maturity because pest densities can rapidly increase to damaging levels. A Texas soybean farmer once quipped, “The best thing you can put on your field is your shadow!”

Visual Inspection Sampling Method

You can learn a lot by simply observing insects and damage in soybean fields. Many farmers routinely inspect fields visually without using a sampling tool. For instance, after seedlings emerge, main stem girdling by threecornered alfalfa hopper can cause young plants to fall over, reducing plant stand. This type of damage is easy to spot and should alert the scout (farmer or crop consultant) to perform a more detailed assessment throughout the field.

The larvae of the lesser cornstalk borer feeds below or at the surface of the soil and can kill seedling plants. Groups of dead plants within the same or adjacent rows warrants further inspection for lesser cornstalk borers.

Increased leaf damage over a relatively short time can indicate expanding densities of velvetbean caterpillars, green cloverworms, and soybean loopers or cabbage loopers. In the late summer, these caterpillars infest soybeans grown in the eastern half of the state. If scouts inspect a field at least once a week, they will notice an increase in leaf damage and conduct more intensive sampling.

Sweep Net Sampling Method

Sweep net sampling is quick, covers a relatively large area, and is easy to use on soybeans planted on beds or drill-planted (Fig. 4).

For sweep net sampling:

- Use a 15-inch diameter sweep net attached to a 2-foot wooden handle.
- Pass the sweep net through the soybean foliage so that the top of the sweep net is even with the top of the soybean plants.
- Draw the net through the foliage in 180-degree sweeps while walking through the field.
- With each step, swing the net from side to side across the row. A sample should consist of at least 10 consecutive sweeps.
- Shake the contents of the sweep net down to the bottom of the net.
- Count the captured insects as you slowly open the net or place them in plastic bags for later identification and counting.
- Repeat the sampling procedure in at least 10 random sites.

Advantages:

- Sweep nets are easy to use, relatively inexpensive, and easy to carry into and out of the field.
- Fewer specimens are lost compared to using a ground cloth.

Figure 4. Sweep net sampling.

Disadvantages:

- This method does not sample the bottom portions of the soybeans (below the bottom of the net).
- Seedling and small soybean plants cannot withstand the sweeping action of the net. Use other sampling methods for young plants.
- Sweep nets are difficult to use when plants are wet.
- Insects such as stink bugs, threecornered alfalfa hoppers, grasshoppers, and adult beetles can fly or move away from the sweep net before they are counted. (Insects are cold-blooded and become more active as temperatures increase during hot summer days.)

Ground Cloth Sampling Method

A ground cloth is an off-white fabric (usually cotton), 3 feet long on each side, with a ½- to ¾-inch dowel attached to each side. The dowels serve as handles to position the ground cloth on the soil.

Figure 5. Ground cloth sampling.

For ground cloth sampling:

- Place the ground cloth flat on the soil between two rows (Fig. 5).
- Vigorously shake the plants in 3 feet of row on both sides of the cloth.
- Count the insects that fall onto the cloth.
- Include any insects that fall at the base of plants. This gives the number of insects per 6 feet of row (3 feet of row on each side of the cloth).
- Take samples from multiple locations in the field. Unlike sweep net samples, these samples will consist of insects collected from the bottom to the top of the soybean plants.
- When sampling and kneeling on the ground, avoid fire ant mounds and possible stinging attacks if you disturb the mounds.

Advantages:

- Ground cloths are easy to use, inexpensive, and easy to carry into and out of the field.

Disadvantages:

- Ground cloths cannot be used in drill-planted soybeans unless the drill rows are widely spaced.
- Ground cloths cannot be used in wet fields.
- Each sample represents a relatively small sample area.
- Dislodged insects can fly or move away before being counted.

Maturity Groups, Determinate and Indeterminate Soybeans, and Growth Stages

Soybean characteristics and growth patterns relative to the planting date can have significant impacts on pest populations. Frequent scouting for pests that attack during vulnerable soybean growth stages is critical in order to detect and control these pests when densities exceed treatment thresholds.

For instance, on the Upper Gulf Coast east of Houston, velvetbean caterpillars, green cloverworms, and soybean loopers often occur in August and September on soybean varieties planted in May and June that require a long time to mature.

However, varieties planted in April that have a shorter maturation period are not attractive to these caterpillar pests in August and September and often avoid this damage. But, stink bugs are most abundant early in the season and can be very damaging to these earlier maturing soybeans.

Soybeans develop vegetatively first, then reproductively. Flowering occurs during the reproductive growth stage. Day length, variety, and planting date all influence this sequential growth pattern. The soybean is a short-day plant; flowering is triggered when day length is less than a critical value. This means that soybeans adapted to the northern US require a longer minimum day length to initiate flowering compared to soybeans adapted to the southern US. Northern soybeans begin flowering later in the summer than do southern soybeans.

Soybeans are classified by maturity group (MG 00 through X). Smaller numbers or Roman numerals indicate varieties adapted to more northern latitudes and larger numbers or Roman numerals indicate varieties adapted to more southern latitudes. For instance, for the eastern half of the state, most Texas soybean farmers plant MG IV–VII varieties. When planted at the proper times, MG VI and VII varieties mature later than MG IV and V varieties.

Soybeans are also classified as determinate or indeterminate (Fig. 6). Determinate soybeans have a more defined period of vegetative and reproductive growth. Once flowering begins, little additional vegetative growth occurs. After initial flowering, indeterminate soybeans continue to produce flowers and foliage. Pods on indeterminate soybeans are more evenly distributed on the stem than those on determinate soybeans, which tend to clump at the top of the plant. Most early MG soybeans are indeterminate and most late MG soybeans are determinate.

When soybeans emerge from the soil, it is easy to see the cotyledons (paired, kidney-shaped food storage organs). This is the VE stage (Fig. 7). V stands for "vegetative."

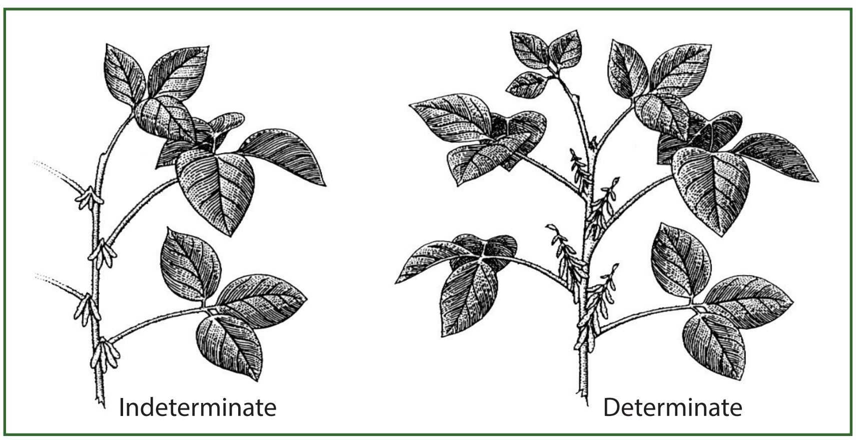

Figure 6. Soybean growth habit. Source: James A. Kalisch and John Kalish, *Handbook of Soybean Insect Pests* (1994), Entomological Society of America, reprinted with permission.

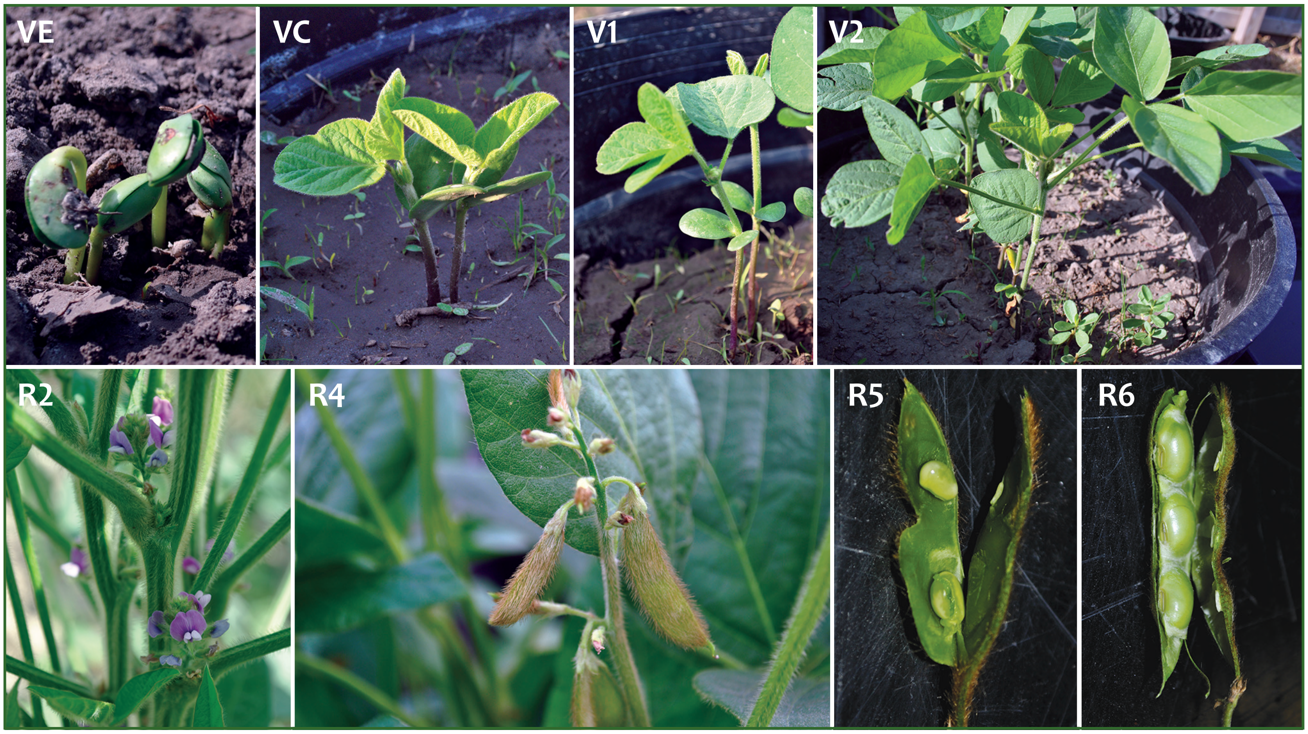

Figure 7. Soybean growth stages and development.

Then, in the VC stage, the first leaves to develop are unifoliate (a single, entire leaf), located on opposite sides of the young stem. Leaves in the V1 stage are trifoliate (consists of three leaflets). As the plant grows, additional trifoliate leaves grow at each node. The leaves alternate (adjacent nodes produce leaves originating from opposite sides of the stem) up the stem of the plant. Successive growth stages are identified by increasing numbers of trifoliate leaves (for example, V2- and V3-stage plants have two and three unrolled trifoliate leaves, respectively).

Once the plant begins flowering, plant growth stages are designated R1–8 (Table 1). R stands for "reproductive." A growth stage begins when 50 percent or more of the plants are in or beyond that stage.

The time interval from planting to R1 and among the R stages can have a major influence on insect damage. The longer the plant is vulnerable to a particular pest, the greater the chance for damage. For instance, R3–6 growth stages are very susceptible to stink bug injury. Since this developmental period can last up to 7 weeks, regular and frequent scouting is essential.

Table 1. Soybean growth stages and accepted codes.

Fehr and Caviness (1977)[1]	Plant development
VE	Emergence
VC	Cotyledon + unfolding unifoliate leaves
V1	First node trifoliate leaves + photosynthesis
V2	Second node
V3	Third node
V4	Fourth node
V5	Fifth node
V6	Sixth node
V(n)	Nth node
R1	Beginning bloom
R2	Full bloom
R3	Beginning pod development
R4	Full pod
R5	Beginning seed
R6	Full seed
R7	Beginning maturity
R8	Full maturity leading to harvest

[1]Fehr, W. R. and C. E. Caviness. 1977. *Stages of Soybean Development*. SR80, Iowa State University. The most modern refinement of this system is described in Ritchie, S. W., J. J. Hanway, H. E. Thompson, and G. O. Benson. 1989. *How a Soybean Plant Develops*. SR53, Iowa State University.

Early-Season Pests (Emergence to V8)

Lesser Cornstalk Borer, *Elasmopalpus lignosellus*

Figure 8. Lesser cornstalk borer larva on soybean stem.

Lesser cornstalk borer larvae (Fig. 8) are bluish with distinct abdominal segments. Full-grown larvae are about ½ to ¾ inch long. Damage occurs when larvae bore near ground level into the main stems of young soybeans, resulting in wilting, lodging (plants fall over), and plant death (Fig. 9). Affected plants are often grouped in the same or adjacent rows because individual larvae can attack more than one plant (Fig. 10). Sometimes dead plants appear teepee-shaped.

Figure 9. Lesser cornstalk borer stem injury.

Larvae inhabit silken tubes in the soil, which are attached to the plant. Since larvae can survive on decaying vegetation, early field preparation can help prevent damaging infestations.

Because damage usually occurs during hot, dry weather, irrigating soybeans can help prevent injury. Soybeans grown on sandy soils can be more vulnerable to attack than those grown on finer soils. Since soybeans should have no fewer than four plants per foot of row for profitable yields, sparse, non-uniform stands of soybeans can tolerate less damage than denser, uniform stands. Insecticides applied to the seed and also applied post-emergence are available. Careful scouting during early soybean growth can detect developing populations before injury occurs.

Cutworms (various species)

Figure 10. Lesser cornstalk borer symptoms in the field.

Cutworms are the larval stages of moths that feed below or near ground level on the roots and stems of seedling soybeans (Fig. 11). Damage results in soybeans being "cut-off." Affected plants that remain standing can appear drought-stricken.

As with all caterpillars, the larger they are, the more damage they can do. Full-grown caterpillars are relatively large (1½ inches long), dark (blending well with dark soil), and often curl up into a "C" shape when disturbed.

During the heat of the day, these caterpillars remain in the soil feeding below ground level. To find the larvae, dig up seedlings along with their roots during daylight hours.

Damage can occur quickly; scout the crop from planting to well into the vegetative stages of development. Replanting may be necessary where cutworms reduce stands to less than four plants per foot of row.

Figure 11. Black cutworm.

Usually, you can find cutworms in finer soils (loamy/clay) during dry conditions that coincide with planting, emergence, and early seedling growth. The moths are dark and triangular-shaped with the wings held flat over the abdomen. Since cutworms tend to lay eggs in crop residue, planting into fields with plant residue (such as conservation tillage) can increase the chance of cutworm damage.

Certain granular and foliar insecticides are available. Apply these insecticides late in the afternoon or evening when the larvae feed above ground. In addition, to improve the coverage of liquid formulations, apply the maximum labeled final spray volumes.

Garden Webworm, *Achyra rantalis*

Garden webworms (Fig. 12) feed on the foliage of seedling soybeans. Severe damage, although uncommon, can result in stand loss. Full-grown larvae are about 1 inch long, yellow or pale green with a light-colored stripe running along the middle of the top of the body, and dark, circular plates in triangular patterns on either side of each body segment.

The larvae often produce webs that bind foliage and offer some degree of protection from natural enemies and adverse weather. No treatment thresholds exist, but scout for these pests as soon as soybeans emerge and apply an insecticide if larvae are abundant and stands are threatened.

Figure 12. Garden webworm.

Thrips (various species)

Thrips are small, slender insects about 1⁄16 inch long. Adults have fringed wings you can see with a hand lens (Fig. 13). They have rasping and sucking mouthparts they use to abrade tender plant tissue and sop up leaking plant fluids.

Figure 13. Soybean thrips.

Leaves damaged by thrips (Fig. 14) are deformed and have silvery areas. Damaged foliage often has thrips excrement, which looks like small grains of black pepper.

Many thrips species can occur in soybeans, but most are not of economic importance. In fact, some thrips are beneficial predators. Since early-season thrips have not been found to cause yield loss, insecticidal seed treatment for thrips control may not be justified.

In Calhoun County, Texas, thrips have infested some drought-stressed fields at levels that reduced yields. These populations occurred later in the growing season and caused premature defoliation of the affected plants. Drought stress may have been a factor, since all the fields with higher thrips populations suffered from a lack of soil moisture.

Figure 14. Thrips injury.

Early-to-Late Season Pests (Emergence to R7)

Threecornered Alfalfa Hopper, *Spissistilus festinus*

Threecornered alfalfa hopper adults are green, triangular-shaped, about 1⁄4 inch long, and 1⁄8 inch across the front of the head (Fig. 15). The body tapers from front to back. The nymphs are smaller and resemble the adults, but have spines along the ridge of their bodies.

Threecornered alfalfa hoppers are common and abundant on soybeans grown in the eastern half of the state. The adults overwinter

Figure 15. Threecornered alfalfa hopper adult.

Figure 16. Threecornered alfalfa hopper nymph and petiole girdle.

Figure 17. Threecornered alfalfa hopper injury.

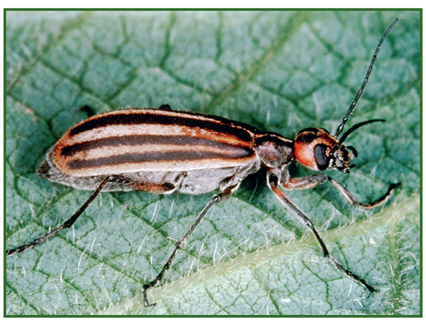

Figure 18. Striped blister beetle.

Figure 19. Bean leaf beetle.

outside the fields, move into emerging soybeans, and lay eggs in the plants. After hatching, nymphs progress through five stages before molting into winged adults.

These insects use piercing and sucking mouthparts to girdle stems and petioles (small stems attached to leaves and leaflets). Girdle lesions can encircle the stems and petioles (Fig. 16) and damage to the main stems of seedling soybeans can cause lodging, plant death, and stand loss (Fig. 17). For reproductive plants, feeding can occur on the pedicels and peduncles (small stem-like structures attached to flowers and pods), which can cause pods to separate from the plant or reduce seed weight.

Begin scouting for these insects when plants emerge from the soil. Early in the season, randomly select row-foot sections at several locations in the field to look for fresh damage.

For taller plants, sample with a ground cloth or sweep net. In fields with a history of threecornered alfalfa hopper damage, increase seeding rates to compensate for expected seedling loss. The goal is to obtain at least four undamaged plants per foot of row. Some plant death due to threecornered alfalfa hopper girdling before bloom can be tolerated because adjacent plants will fill the row space and prevent reduced yield.

Blister Beetles, *Epicauta* spp.

Blister beetle adults are about ½ to ¾ inch long and ¼ inch wide (Fig. 18). The head is wider than the thorax and the antennae are relatively long. One of the most common species of blister beetles has black or tan/yellow longitudinally-striped wing covers. Other species have entirely gray or black wing covers. The larvae are predaceous (eat other insects) but the adults have chewing mouthparts and feed on foliage. Blister beetles are a common pest of soybeans in the eastern half of the state.

Late in the season, the adults move en masse from field margins where they have built up populations on weeds. Thus, early weed control within and surrounding fields is a good management practice. Extensive leaf feeding can occur in a short time; consistent and thorough scouting helps discover emerging populations before economic damage occurs. Spot applications of insecticides can be effective because blister beetles are usually not uniformly distributed throughout the field.

Bean Leaf Beetle, *Cerotoma trifurcata*

The bean leaf beetle (Fig. 19) is common in northeast Texas where large populations can develop. The color of adult bean leaf beetles varies, but the most common form has light yellowish-green wing covers with four black, rectangular spots. A triangular black spot marks the junction of the thorax and abdomen.

The larvae feed on the roots of soybean plants, but adult beetles that chew round holes in soybean leaves cause most of the damage. Beetles may also feed on pods.

Soybean plants can withstand relatively large amounts of leaf damage, especially when plants are growing vegetatively (Fig. 20). Research in Texas shows that soybeans are most susceptible to leaf damage during R5–6 when seeds are filling in pods. At this stage, soybeans can withstand about 20 percent leaf damage before the yield is reduced.

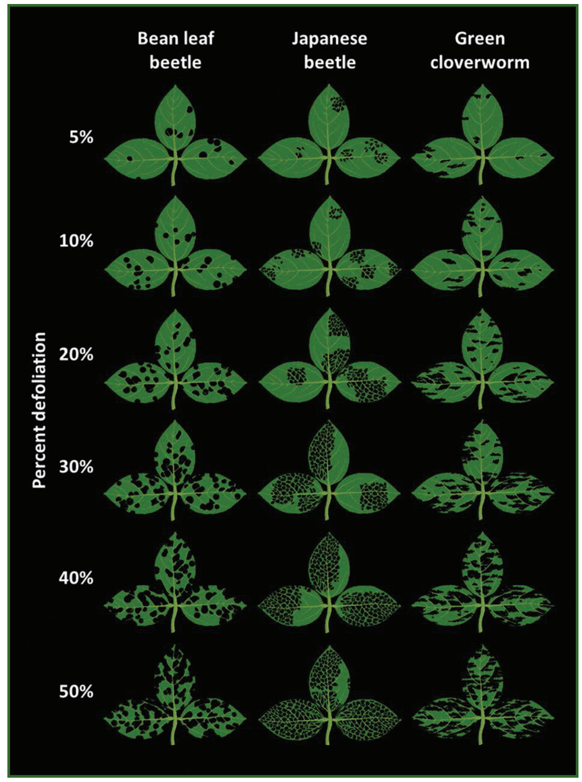

Figure 20. Defoliation Template. Source: Robert Koch, *Visual Guide for Estimation of Soybean Defoliation*, University of Minnesota Extension.

Banded Cucumber Beetle, *Diabrotica balteata*

The adult banded cucumber beetle (Fig. 21) is about ¼ inch long and ⅛ inch wide across the widest part of the abdomen. Its size and shape are similar to the bean leaf beetle, but it has a different color pattern. The wing covers are green or yellowish-green with four lighter-colored crosswise bands.

The larval and adult stages feed on roots and foliage, respectively, similar to the bean leaf beetle. The adults can be plentiful on vegetatively growing soybeans, but generally cause only minor leaf-feeding damage.

Figure 21. Banded cucumber beetle.

Mid-to-Late Season Pests (V8 to Maturity)

Dectes Stem Borer, *Dectes texanus texanus*

The dectes stem borer is a pest in the High Plains region. Adults are called long-horned beetles because their antennae are longer than their bodies. However, the larvae damage soybeans.

Dectes stem borer adults (Fig. 22) lay eggs in leaf petioles. After hatching, larvae tunnel down the petiole into the main stem where they bore up and down. Eventually, they girdle the inside of the stem base, causing lodging and yield loss late in the season.

Full-grown larvae are about ½ to ⅝ inch long, grub-like, and legless; their abdominal segments resemble an accordion.

Plowing or disking soybean stubble reduces populations of overwintering adults. No-till or stale seedbed planting can result in more borers surviving the winter and creating more damage the following year. Chemical control is not recommended, but fall tillage can reduce overwintering populations.

Good weed control in and around fields can reduce alternate weed hosts. Since adults are weak fliers, infestations are often localized. Crop rotation can help in areas where soybean production is limited.

The most effective cultural management method is to harvest as soon as possible to reduce losses caused by lodging. Scouting fields late in the season for stem borer damage helps identify problem fields that should be harvested as early as possible.

Figure 22. Dectes stem borer adult.

Foliage-Feeding Caterpillars

Larvae of soybean loopers, cabbage loopers, velvetbean caterpillars, and green cloverworms can severely defoliate soybeans, particularly in the eastern half of the state. All of these caterpillars feed on leaves, and infestations usually occur during mid-to-late season.

Generally, looper larvae are the first to appear (before velvetbean caterpillars and green cloverworms) about the time soybeans switch from vegetative to reproductive growth stages. All four species continue to build up larval populations during soybean reproductive stages.

Figure 23. Severe soybean defoliation from foliage-feeding caterpillars.

The podfill stage is especially vulnerable. Research shows that soybeans can tolerate no more than 20 percent defoliation without substantial yield loss. Use the defoliation template to estimate the percent of leaf loss (Fig. 20):

- Compare leaflets from the top, middle, and bottom of plants to the template.
- Average the percentages of leaf loss in the field.
- Be sure to sample from all areas of the field.
- Combine the leaf loss by all four species to arrive at an overall estimate.

These leaf feeders infest fields in late summer when temperatures and humidity are high. Damage can progress rapidly; frequent scouting is crucial for timely control (Fig. 23).

Occasionally, the fungus, *Noumeria rileyi,* will infect larvae late in the season, killing many of them. Infected larvae turn white and hang from the foliage. Unfortunately, these disease outbreaks usually occur when larval populations are very high following substantial crop injury.

Velvetbean Caterpillar, *Anticarsia gemmatalis*

Large numbers of velvetbean caterpillar moths migrate into Texas each year from Central and South America. The adult moth is fairly large and usually has a diagonal black line across the wings. It deposits light green eggs singly or in groups of two to three on soybean leaves, pods, and stems. Larvae progress through six instars or stages, growing larger with each molt. The older instars are much larger than the younger ones and cause the most damage.

Easily identified by their vigorous wiggling and twisting when disturbed, velvetbean caterpillars are pale yellow-green to brown and black with white or yellow stripes running lengthwise along the body (Fig. 24). They have four pairs of abdominal prolegs, plus one pair at the end of the abdomen.

Figure 24. Velvetbean caterpillar.

Velvetbean caterpillars can produce multiple generations during the growing season, with each generation being larger than the previous one. Although velvetbean caterpillars are relatively easy to control with insecticides, undetected and uncontrolled infestations can rapidly increase to cause extensive leaf loss.

In the eastern half of Texas, populations peak late in the summer and early fall, and adults fly through the soybean canopy when disturbed.

Green Cloverworm, *Hypena scabra*

Like the velvetbean caterpillar, these leaf-feeding pests are more prevalent in the eastern half of the state. Green cloverworm adults (moths) hold their wings in a triangular shape when at rest and are darker than velvetbean caterpillar moths. They lay single eggs on the underside of leaves. The eggs are translucent green and turn brownish with red specks just before hatching.

Larvae, the damaging stages, are pale green with two white stripes along the sides of the body (Fig. 25). These caterpillars have three pairs of prolegs on the abdomen and one pair of prolegs at the end of the body. (Other common caterpillar species in soybeans have two or four pairs of prolegs on the abdomen.) They progress through six to seven instars. Like velvetbean caterpillars, green cloverworm larvae also wiggle vigorously when disturbed.

Green cloverworms overwinter along the Gulf where they feed on host plants year-round. Multiple generations develop each year, with later generations responsible for the most severe soybean damage. Green cloverworms and velvetbean caterpillars are relatively easy to control with a wide array of insecticides.

Figure 25. Green cloverworm.

Figure 26. Soybean looper.

Soybean Looper, *Chrysodeixis includens* and Cabbage Looper, *Trichoplusia ni*

Both soybean loopers (Fig. 26) and cabbage loopers (Fig. 27) are most common in the eastern half of the state. Usually, the cabbage looper is less abundant in soybeans than the soybean looper. The soybean looper has developed resistance to certain insecticides and can be more difficult to control than the cabbage looper. It is important to distinguish cabbage loopers from soybean loopers so that if soybean loopers are plentiful, you can apply an effective insecticide.

The larvae of both species are similar; they have two pairs of abdominal prolegs and one pair of anal prolegs. The number and spacing of these prolegs causes the larvae to loop (hump their bodies) while walking, and they often remain in this looped position when stationary.

The best way to distinguish between the two species is to use a hand lens to inspect the inside surface of the mandibles. The cabbage looper has ridges that extend from the base to the edge of the mandibles. The ridges on the soybean looper mandible do not reach the edge (Fig. 28). Older larvae have larger mandibles that are easier to inspect for these characteristics.

Figure 27. Cabbage looper.

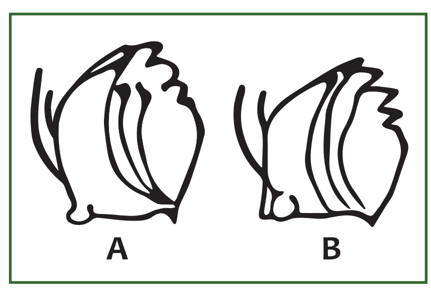

Figure 28. Mandibles of soybean looper (A) and cabbage looper (B)
Source: T. X. Liu.

The larval stages have six instars, with the older, larger larvae consuming the most leaf tissue. In the eastern half of the state, loopers can produce multiple generations in a growing season.

Generally, loopers begin infesting soybeans earlier than the other foliage-feeding caterpillars do. Soybean looper larvae are distributed throughout the soybean canopy but, unlike velvetbean caterpillars and green cloverworms, more are found in the lower canopy.

Both species lay single eggs on the underside of leaves. Soybean looper pupae are creamy white to green and enclosed in a silken cocoon attached to the underside of leaves. Cabbage looper pupae are brown and found on the soil surface.

Fall Armyworm, *Spodoptera frugiperda*

Because fall armyworm caterpillars do not usually feed on soybeans, they are not a serious soybean pest in Texas. However, large numbers of fall armyworms do feed on soybean flowers in fields with prior bermudagrass infestations. Fall armyworms develop on the bermudagrass and, after the fields are sprayed with glyphosate, the fall armyworm larvae move from the dead bermudagrass to the flowering soybeans. In this situation, poor weed control can result in insect damage.

Figure 29. Fall armyworm.

The fall armyworm has four life stages: egg, larva, pupa, and adult. It overwinters in the pupal stage in the southern regions of Texas. Up to seven generations occur each year; the typical life cycle from egg to adult is about 28 days.

Larvae are smooth-skinned and vary from light tan or green to nearly black. Usually, larvae complete six larval instars before pupation. Full-grown larvae are about 1 to 1½ inches long, with three yellow-white hairlines down their backs (Fig. 29). On each side of the body and next to the yellow lines is a wider dark stripe. Next to that is an equally wide, wavy, yellow stripe, splotched with red. To differentiate fall armyworm larvae from other armyworm species or corn earworms, look at the head. The fall armyworm head has a conspicuous white, inverted Y-shaped suture (seam or furrow) between the eyes.

Management and Treatment Thresholds for Foliage-Feeding Insects in Soybeans

All of these leaf-feeding caterpillars infest soybeans about the same time in late summer. Typically, populations build up to damaging levels quickly, so regular and frequent sampling from R1 through R6 is imperative.

In commercial fields, the progression from minor to virtually 100 percent leaf loss can occur in a week or less. **Apply an effective insecticide when larvae are in the field and before defoliation exceeds 40 percent before first bloom, before 20 percent leaf damage during blooming to podfill (R1-6), and before 35 percent leaf damage after that.** In most cases, uncontrolled populations of defoliating larvae will continue to increase to damaging levels (Table 2).

Many farmers in the southeastern US have adopted the Early Soybean Production System (ESPS), which involves planting an early MG soybean variety in April or earlier to avoid droughty conditions during pod formation and fill.

The ESPS also avoids damaging populations of defoliating caterpillars. By the time these caterpillars reach damaging levels, ESPS soybeans are close to harvest and less vulnerable to attack. Research has identified soybean varieties that are resistant or tolerant to defoliation. The Crockett variety (late MG) has a degree of resistance or non-preference, but is not widely planted due to relatively low yields and potential for lodging.

Table 2. Treatment thresholds for foliage-feeding caterpillars, bean leaf beetles, and blister beetles in soybeans, based upon estimated percent leaf damage.

Growth stage	Treatment threshold (% defoliation)
Prior to bloom (V1–about V8)	40% and larvae or beetles present
Bloom to end of podfill (R1–R6)	20% and larvae or beetles present
End of podfill to maturity (R7–R8)	Control may not be justified

Late-Season Pests (R1 to R7)

Soybean Podworm, *Helicoverpa zea*

The soybean podworm (Fig. 30) is the same insect as the cotton bollworm and corn earworm. The larva chews through the pod to feed on the developing seeds and also feeds on leaves and flowers. Large larvae are green, yellowish, or black with cream-colored bands running along the sides. Larvae have four pairs of prolegs and one pair at the end of the abdomen.

Use a ground cloth to collect podworm samples. Insecticide treatment may be justified when podworms average one medium-size larva per row foot at R1 to R5, and three medium-size larvae per row foot at R6 to R7.

Figure 30. Soybean podworm.

Stink Bugs

In the eastern half of Texas, stink bugs are major pests. They decrease soybean yield and quality by using their mouthparts to suck up the juices of developing flowers, pods, and seeds. Also, feeding on pods can reduce the germination of soybeans produced for seed, cause flat pod, and delay crop maturity. These disorders are extremely severe since seeds in affected pods do not expand and fill, damaged plants retain leaves and do not mature, and stems remain green, delaying or preventing harvest (Fig. 31). Entire fields can suffer total loss of yield.

Figure 31. Soybean delayed maturity. Rows in the foreground on the left show delayed maturity; rows in the foreground on the right show normal maturity.

Figure 32. Southern green stink bug adult.

Figure 33. Southern green stink bug nymph.

Figure 34. Green stink bug adult.

Figure 35. Green stink bug nymph.

Stink bugs can damage soybeans from first pod formation (growth stage R3) through full seed development (growth stage R6). Regular and frequent scouting is crucial because this period can last up to 7 weeks. No Texas data are available for stink bug damage to R7-stage soybeans.

Each year, multiple generations of stink bugs can develop first on legume weeds, then on soybeans when they begin to flower.

Several stink bug species attack soybeans. Research has not identified or quantified the differences in feeding behavior and damage potential among these species. When sampling for stink bugs, combine all species to arrive at a total number of stink bugs per sample.

Immature stink bugs (nymphs) look like the adults but do not have wings. If you find nymphs in the field, stink bugs are reproducing, meaning the infestation began earlier.

Stink bug eggs are barrel-shaped and laid in masses on the plant. When the eggs hatch, nymphs emerge and pass through five stages before becoming adults, growing larger with each stage. Although adults cause the most damage, large nymphs can also be destructive.

Most stink bugs feed on plants, but the spined soldier bug (also a stink bug) feeds on caterpillars, including many pest species.

Southern Green Stink Bug, *Nezara viridula*

Frequently the most common stink bug species in Texas soybean fields, southern green stink bug adults are relatively large (about ½ inch long and 5⁄16 inch wide across the thorax), green, and look much like green stink bugs (Fig. 32). To distinguish between the two species, look at the small forward-projecting spine on the underside of the insect between where the hind legs attach to the body. The end of this spine is short and rounded in the southern green stink bug, but longer and pointed in the green stink bug. Also, the southern green stink bug has reddish bands on the antennae and the green stink bug has black ones. Older southern green stink bug nymphs (Fig. 33) are green with white, black, and red spots on the top of the abdomen.

Green Stink Bug, *Chinavia hilaris*

The green stink bug is also common in soybean fields in eastern Texas. The adult green stink bug (Fig. 34) is a little larger (about ⅝ inch long and ⅜ inch wide across the thorax) than the southern green stink bug. Older nymphs are green with black markings on the thorax and abdomen (Fig. 35).

Brown Stink Bug, *Euschistus* spp.

Brown stink bugs represent a group of related species. Adults of these stink bugs are about ⅜ to 7⁄16 inch long and ⅜ inch wide across the thorax. Adults and nymphs are predominantly brown (Fig. 36).


Figure 36. Brown stink bug adult.


Figure 37. Redbanded stink bug adult.


Figure 38. Redbanded stink bug nymph.

Compared to other stink bugs, brown stink bugs are more difficult to control with some pyrethroid insecticides.

Redbanded Stink Bug, *Piezodorus guildinii*

Populations of the redbanded stink bug have increased along the Texas Gulf Coast. It is also present in northwest Louisiana, while distribution in northeast Texas is not well documented.

The adults are light green with a reddish band across the top of the junction between the thorax and abdomen (Fig. 37). They are about $\frac{3}{8}$ to $\frac{7}{16}$ inch long and $\frac{1}{4}$ inch wide across the thorax, so they are smaller than southern green stink bugs and green stink bug adults. Older nymphs are green and somewhat flattened, with a pattern of red and black markings on the top of the abdomen (Fig. 38).

Field trials show that insecticides and rates recommended for other stink bug species are also effective against redbanded stink bugs. They fly from plant to plant in soybean fields and redbanded stink bug damage, such as flat pod, is localized to the feeding sites. This means that these insects are mobile and voracious feeders, since damage in affected fields is frequently widespread.

Redshouldered Stink Bug, *Thyanta* spp.

The redshouldered stink bug is common in soybeans in northeast Texas (Fig. 39). It resembles the redbanded stink bug because of a reddish band across the top of the body between the thorax and abdomen. However, the redbanded stink bug has a long spine protruding between its hind legs; this long spine is lacking in the redshouldered stink bug (Fig. 40).

Conchuela Stink Bug, *Chlorochroa ligata*

This stink bug occurs in soybean fields in the Coastal Bend region. Although damage to soybeans has not been reported, it does occur on alfalfa, corn, cotton, peppers, sorghum, tomatoes, and various fruits. Mesquite is a common weed host plant.


Figure 39. Redshouldered stink bug adult.

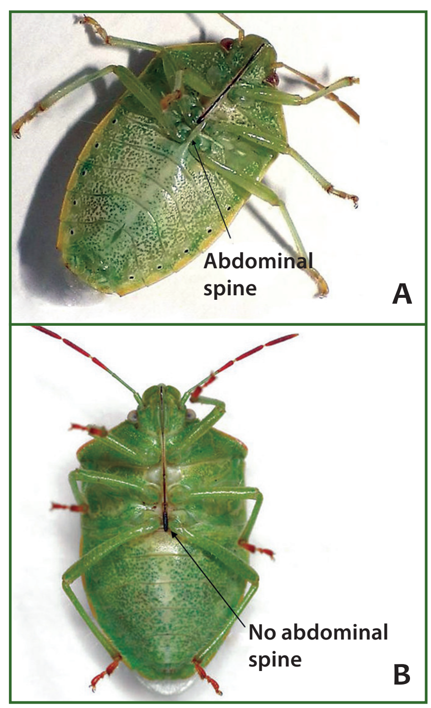

Figure 40. Ventral view of redbanded stink bug (A) and redshouldered stink bug (B).

Figure 41. Conchuela stink bug adult.

Adults are dark with a narrow, reddish-orange border that surrounds the thorax and abdomen (Fig. 41). The end of the scutellum (shield-shaped plate covering a portion of the abdomen) also has a reddish-orange spot.

Management and Treatment Thresholds for Stink Bugs

When making treatment decisions, sample stink bugs using a sweep net or ground cloth and combine all species for a total number of stink bugs per sample. Consider treatment when stink bugs average 36 or more adults and older nymphs per 100 sweeps, or one or more adults and older nymphs per row foot. The redbanded stink bug causes more damage per individual than other stink bug species. Consider treatment when redbanded stink bugs average 16 adults and older nymphs per 100 sweeps.

A variety of insecticides control stink bugs, but be aware that the period of vulnerability when pods are developing is up to 7 weeks, making insecticides with long residual activity a good option. Continued scouting is imperative because flying adult stink bugs can re-infest soybean fields after an insecticide application. Many farmers in the southeastern US have adopted the ESPS (Early Soybean Production System), which, in certain production areas, is vulnerable to stink bug attack.

Beneficial Insects

Minute Pirate Bug (Fig. 42)

Figure 42. Minute pirate bug.

Generalist predator: Feeds on aphids, small caterpillars, insect eggs, leafhopper nymphs, scale insects, spider mites, thrips, and whiteflies.

Damsel Bug (Fig. 43)

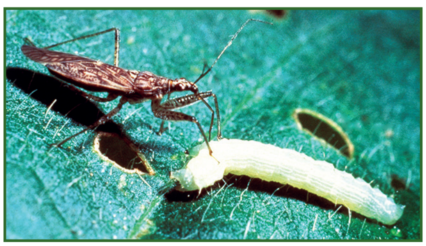

Figure 43. Damsel bug.

Generalist predator: Feeds primarily on aphids, caterpillars, insect eggs, leafhoppers, spider mites, and thrips.

Green Lacewing (Fig. 44)

Figure 44. Green lacewing adult.

Larvae are generalist predators: Feed primarily on aphids, small caterpillars, insect eggs, leafhoppers, mealybugs, psyllids, spider mites, thrips, and whiteflies, depending on species; adults are also predaceous.

Spined Soldier Bug (Figs. 45–46)

Generalist predator: Feeds on beetle larvae, true bug nymphs, and caterpillars.

Figure 45. Spined soldier bug adult.

Figure 46. Spined soldier bug nymph.


Figure 47. Brown lacewing adult.


Figure 48. Big-eyed bug.


Figure 49. Assassin bug.

Brown Lacewing (Fig. 47)

Generalist predator: Feeds primarily on aphids, small caterpillars, insect eggs, leafhoppers, mealybugs, mites, psyllids, thrips, and whiteflies.

Big-Eyed Bug (Fig. 48)

Generalist predator: Feeds primarily on small caterpillars, flea beetles, insect eggs, mites, thrips, whiteflies, and other true bugs.

Assassin Bugs (Fig. 49)

Generalist predators: Feed primarily on aphids, caterpillars, various small beetles, insect eggs, leafhoppers, and true bugs.

Lady Beetles (Figs. 50–51)

Generalist predators: Feed primarily on aphids, caterpillars, insect eggs, mealybugs, scale insects, and spider mites.

Ground Beetles (Fig. 52)

Generalist predators: Feed primarily on small insects, spiders, and various other arthropods; some species feed on seeds.


Figure 50. Lady beetle pupae.


Figure 51. Lady beetle adult.


Figure 52. Ground beetle.

Figure 53. Flower fly.

Figure 54. Ichneumonid wasp.

Figure 55. Braconid wasp.

Figure 56. Tachinid fly.

Flower Flies (Fig. 53)

Larvae are generalist predators: Feed on aphids, mealybugs, scale insects, spider mites, and thrips.

Ichneumonid Wasps (Fig. 54)

Larvae are parasitoids (develop within another insect and eventually kill it) of beetle larvae, caterpillars, and other insects.

Braconid Wasps (Fig. 55)

Larvae are parasitoids of aphids, beetle larvae, caterpillars, and other insects.

Tachinid Flies (Fig. 56)

Larvae are internal parasitoids of beetle larvae, caterpillars, grasshoppers, and other insects.

Insecticides Labeled for Control of Insect Pests of Soybeans

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Lesser Cornstalk Borer											
	Nufos 4E	chlorpyrifos	16–32	0.5–1.0	44.9/4.0	8–4	Warning	Organophosphate	24	28	At planting: If field has history of pest
	Lorsban 15 G	chlorpyrifos	8 oz/1000 row ft	n/a	15/0.15	n/a	Caution	Organophosphate	24	28	
	**Karate Z	lambda-cyhalothrin	1.92	0.03	22.8/2.08	67	Warning	Pyrethroid	24	30	Post-emergence: When stands are threatened (6 or fewer seedlings per row ft)
	Mustang Maxx	zeta-cypermethrin	3.2–4.0	0.02–0.025	9.15/0.8	40–32	Warning	Pyrethroid	12	21	
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Baythroid XL	beta-cyfluthrin	2.8	0.022	12.70/1.0	46	Warning	Pyrethroid	12	21	
	Declare	gamma-cyhalothrin	1.54	0.015	14.4/1.25	83	Caution	Pyrethroid	24	45	
	Belt SC	flubendiamide	2.0–3.0	0.0625–0.0938	39.0/4.0	64–43	Caution	Diamide	12	14	
	**Warrior II	lambda-cyhalothrin	1.92	0.03	22.8/2.08	67	Warning	Pyrethroid	24	30	
	Stallion	zeta-cypermethrin + chlorpyrifos	9.25–11.75	0.2186–0.2777	3.08 + 30.80/0.275 + 2.75	14–11	Warning	Pyrethroid + Organophosphate	24	28	
	Fastac EC	alpha-cypermethrin	3.2–3.8	0.02–0.025	10.9/0.83	40–34	Danger	Pyrethroid	12	21	
	**Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.5	0.0724	9.48 + 12.60/0.88 + 1.18	28	Warning	Pyrethroid + Neonicotinoid	24	30	
	**Besiege	lambda-cyhalothrin + chlorantraniliprole	10	0.0978	4.63 + 9.26/0.417 + 0.835	13	Warning	Pyrethroid + Diamide	24	30	
Cutworms											
	Lorsban 15 G	chlorpyrifos	8.0 oz/1000 row ft	n/a	15/0.15	n/a	Caution	Organophosphate	24	28	At planting: If field has history of pest
	Xpedient FC	bifenthrin	2.56–5.12	0.04–0.08	25.1/2	50–25	Warning	Pyrethroid	12	—	Post-emergence: When stands are threatened (6 or fewer seedlings per row ft)
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Hero	zeta-cypermethrin + bifenthrin	2.6–6.1	0.025–0.06	3.75 + 11.25/1.24	49–21	Caution	Pyrethroid	12	21	
	Besiege	lambda-cyhalothrin + chlorantraniliprole	5.0–8.0	0.0489–0.0783	4.63 + 9.26/0.417 + 0.835	26–16	Warning	Pyrethroid + Diamide	24	30	
	Nufos 4E	chlorpyrifos	16–32	0.5–1.0	44.9/4.0	8–4	Warning	Organophosphate	24	28	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Cutworms (continued)											
	Fastac EC	alpha-cypermethrin	1.3–3.8	0.008–0.025	10.9/0.83	98–34	Danger	Pyrethroid	12	21	Post-emergence: When stands are threatened (6 or fewer seedlings per row ft)
	Warrior II	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Sevin XLR Plus	carbaryl	32–48	1.0–1.5	44.1/4.0	4–3	Caution	Carbamate	12	21	
	Karate Z	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Declare	gamma-cyhalothrin	0.77–1.28	0.0075–0.0125	14.4/1.25	166–100	Caution	Pyrethroid	24	45	
	Belt SC	flubendiamide	2.0–3.0	0.0625–0.0938	39.0/4.0	64–43	Caution	Diamide	12	14	
	Asana XL	esfenvalerate	5.8–9.6	0.03–0.05	8.4/0.66	22–13	Warning	Pyrethroid	12	21	
	Ambush	permethrin	3.2–6.4	0.05–0.1	25.6/2.0	40–20	Warning	Pyrethroid	12	60	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	3.5–4.0	0.0563–0.0644	9.48 + 12.60/0.88 + 1.18	37–32	Warning	Pyrethroid + Neonicotinoid	24	30	
	Stallion	zeta-cypermethrin + chlorpyrifos	3.75–11.75	0.0886–0.2777	3.08 + 30.80/0.275 + 2.75	34–11	Warning	Pyrethroid + Organophosphate	24	28	
	Baythroid XL	beta-cyfluthrin	0.8–1.6	0.007–0.013	12.70/1.0	160–80	Warning	Pyrethroid	12	21	
	Brigadier	bifenthrin + imidacloprid	5.1–6.1	0.08–0.095	11.30 + 11.30/1.0 + 1.0	25–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Mustang Maxx	zeta-cypermethrin	1.28–4	0.008–0.025	9.15/0.8	100–32	Warning	Pyrethroid	12	21	
Garden Webworm											
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	When defoliation exceeds 40% pre-bloom and worms are present
	Mustang Maxx	zeta-cypermethrin	2.8–4.0	0.0175–0.025	9.15/0.8	46–32	Warning	Pyrethroid	12	21	
	Declare	gamma-cyhalothrin	1.28–1.54	0.0125–0.015	14.4/1.25	100–83	Caution	Pyrethroid	24	45	
	Hero	zeta-cypermethrin + bifenthrin	4–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
	Warrior II	lambda-cyhalothrin	1.60–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Karate Z	lambda-cyhalothrin	1.6–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Sevin XLR Plus	carbaryl	32–48	1.0–1.5	44.1/4.0	4–3	Caution	Carbamate	12	21	
	Belt SC	flubendiamide	2.0–3.0	0.0625–0.09375	39.0/4.0	64–43	Caution	Diamide	12	14	
	Fastac EC	alpha-cypermethrin	2.8–3.8	0.018–0.025	10.9/0.83	46–34	Danger	Pyrethroid	12	21	
	Ambush	permethrin	6.4–12.8	0.1–0.2	25.6/2.0	20–10	Warning	Pyrethroid	12	60	
	Besiege	lambda-cyhalothrin + chlorantraniliprole	8.0–10.0	0.0783–0.0978	4.63 + 9.26/0.417 + 0.835	16–13	Warning	Pyrethroid + Diamide	24	30	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Garden Webworm (continued)											
	Stallion	zeta-cypermethrin + chlorpyrifos	5.0–11.75	0.1182–0.2777	3.08 + 30.80/0.275 + 2.75	26–11	Warning	Pyrethroid + Organophosphate	24	28	When defoliation exceeds 40% pre-bloom and worms are present
	Brigadier	bifenthrin + imidacloprid	5.1–6.1	0.08–0.095	11.30 + 11.30/1.0 + 1.0	25–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.0–4.5	0.0644–0.0724	9.48 + 12.60/0.88 + 1.18	32–28	Warning	Pyrethroid + Neonicotinoid	24	30	
Threecornered Alfalfa Hopper											
	NipsIt INSIDE	clothianidin	1.28 fl oz/100 lbs seeds	n/a	47.8/5.0	n/a	Caution	Neonicotinoid	12	n/a	Seed treatment
	Cruiser 5FS	thiamethoxam	1.28 fl oz/100 lbs seeds	n/a	47.6/5.0	n/a	Caution	Neonicotinoid	12	n/a	
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	Post-emergence: When main stem girdling threatens stand (6 or fewer seedlings per row ft)
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Besiege	lambda-cyhalothrin + chlorantraniliprole	5.0–8.0	0.0489–0.0783	4.63 + 9.26/0.417 + 0.835	26–16	Warning	Pyrethroid + Diamide	24	30	
	Karate Z	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	R1 to R6: No thresholds established
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	3.5–4.0	0.0563–0.0644	9.48 + 12.60/0.88 + 1.18	37–32	Warning	Pyrethroid + Neonicotinoid	24	30	
	Asana XL	esfenvalerate	5.8–9.6	0.03–0.05	8.4/0.66	22–13	Warning	Pyrethroid	12	21	
	Warrior II	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Declare	gamma-cyhalothrin	0.77–1.28	0.0075–0.0125	14.4/1.25	166–100	Caution	Pyrethroid	24	45	
	Fastac EC	alpha-cypermethrin	2.8–3.8	0.018–0.025	10.9/0.83	46–34	Danger	Pyrethroid	12	21	
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	
	Mustang Maxx	zeta-cypermethrin	2.8–4.0	0.0175–0.025	9.15/0.8	46–32	Warning	Pyrethroid	12	21	
	Orthene 97	acephate	12–16	0.7305–0.974	97.4/0.974	1.3–1	Caution	Organophosphate	24	14	
	Dimethoate 4E	dimethoate	16	0.5	43.5/4.0	8	Warning	Organophosphate	48	21	
	Belay	clothianidin	3.0–6.0	0.05–0.1	23.0/2.13	43–21	Caution	Neonicotinoid	12	21	
	Stallion	zeta-cypermethrin + chlorpyrifos	9.25–11.75	0.2186–0.2777	3.08 + 30.80/0.275 + 2.75	14–11	Warning	Pyrethroid + Organophosphate	24	28	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Threecornered Alfalfa Hopper (continued)											
	Sevin XLR Plus	carbaryl	32	1	44.1/4.0	4	Caution	Carbamate	12	21	Post-emergence: When main stem girdling threatens stand (6 or fewer seedlings per row ft) R1 to R6: No thresholds established
	Brigadier	bifenthrin + imidacloprid	5.1–6.1	0.08–0.095	11.30 + 11.30/1.0 + 1.0	25–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Hero	zeta-cypermethrin + bifenthrin	4–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
Blister Beetles											
	Besiege	lambda-cyhalothrin + chlorantraniliprole	8.0–10.0	0.0783–0.0978	4.63 + 9.26/0.417 + 0.835	16–13	Warning	Pyrethroid + Diamide	24	30	Pre-bloom: When defoliation exceeds 40% and beetles are present R1 to R6: When defoliation exceeds 20% and beetles are present Spot treatments may suffice
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.0–4.5	0.0644–0.0724	9.48 + 12.60/0.88 + 1.18	32–28	Warning	Pyrethroid + Neonicotinoid	24	30	
	Fastac EC	alpha-cypermethrin	2.8–3.8	0.018–0.025	10.9/0.83	46–34	Danger	Pyrethroid	12	21	
	Sevin XLR Plus	carbaryl	16–32	0.5–1.0	44.1/4.0	8–4	Caution	Carbamate	12	21	
	Declare	gamma-cyhalothrin	1.28–1.54	0.0125–0.015	14.4/1.25	100–83	Caution	Pyrethroid	24	45	
	Belay	clothianidin	3.0–6.0	0.05–0.1	23.0/2.13	43–21	Caution	Neonicotinoid	12	21	
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	
	Warrior II	lambda-cyhalothrin	1.60–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Karate Z	lambda-cyhalothrin	1.60–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Stallion	zeta-cypermethrin + chlorpyrifos	5.0–11.75	0.1182–0.2777	3.08 + 30.80/0.275 + 2.75	26–11	Warning	Pyrethroid + Organophosphate	24	28	
	Mustang Maxx	zeta-cypermethrin	2.8–4.0	0.0175–0.025	9.15/0.8	46–32	Warning	Pyrethroid	12	21	
Bean Leaf Beetle											
	NipsIt INSIDE	clothianidin	1.28 fl oz/100 lbs seeds	n/a	47.8/5.0	n/a	Caution	Neonicotinoid	12	n/a	Seed treatment
	Cruiser 5FS	thiamethoxam	1.28 fl oz/100 lbs seeds	n/a	47.6/5.0	n/a	Caution	Neonicotinoid	12	n/a	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Bean Leaf Beetle (continued)											
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	Pre-bloom: When defoliation exceeds 40% and beetles are present
	Besiege	lambda-cyhalothrin + chlorantraniliprole	5.0–8.0	0.0489–0.0783	4.63 + 9.26/0.417 + 0.835	26–16	Warning	Pyrethroid + Diamide	24	30	
	Nufos 4E	chlorpyrifos	16–32	0.5–1.0	44.9/4.0	8–4	Warning	Organophosphate	24	28	R1 to R6: When defoliation exceeds 20% or 10% pods are damaged and beetles are present
	Fastac EC	alpha-cypermethrin	2.8–3.8	0.018–0.025	10.9/0.83	46–34	Danger	Pyrethroid	12	21	
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.0–4.5	0.0644–0.0724	9.48 + 12.60/0.88 + 1.18	32–28	Warning	Pyrethroid + Neonicotinoid	24	30	
	Sevin XLR Plus	carbaryl	16–32	0.5–1.0	44.1/4.0	8–4	Caution	Carbamate	12	21	
	Karate Z	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Declare	gamma-cyhalothrin	0.77–1.28	0.0075–0.0125	14.4/1.25	166–100	Caution	Pyrethroid	24	45	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Hero	zeta-cypermethrin + bifenthrin	2.6–6.1	0.025–0.06	3.75 + 11.25/1.24	49–21	Caution	Pyrethroid	12	21	
	Asana XL	esfenvalerate	5.8–9.6	0.03–0.05	8.4/0.66	22–13	Warning	Pyrethroid	12	21	
	Orthene 97	acephate	12–16	0.7305–0.974	97.4/0.974	1.3–1.0	Caution	Organophosphate	24	14	
	Belay	clothianidin	3.0–6.0	0.05–0.1	23.0/2.13	43–21	Caution	Neonicotinoid	12	21	
	Mustang Maxx	zeta-cypermethrin	2.8–4.0	0.0175–0.025	9.15/0.8	46–32	Warning	Pyrethroid	12	21	
	Ambush	permethrin	3.2–6.4	0.05–0.1	25.6/2.0	40–20	Warning	Pyrethroid	12	60	
	Warrior II	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Justice	acetamiprid + bifenthrin	2.5–3	0.035–0.04	13.0 + 10.0/1.0 + 0.8	51–43	Warning	Neonicotinoid + Pyrethroid	12	30	
	Dimethoate 4E	dimethoate	16	0.5	43.5/4.0	8	Warning	Organophosphate	48	21	
	Stallion	zeta-cypermethrin + chlorpyrifos	5.0–11.75	0.1182–0.2777	3.08 + 30.80/0.275 + 2.75	26–11	Warning	Pyrethroid + Organophosphate	24	28	
	Brigadier	bifenthrin + imidacloprid	5.1–6.1	0.08–0.095	11.30 + 11.30/1.0 + 1.0	25–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Lannate LV	methomyl	12.0–16.0	0.225–0.3	29.0/2.4	11–8	Danger	Carbamate	48	14	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Banded Cucumber Beetle											
	Sevin XLR Plus	carbaryl	16–32	0.5–1.0	44.1/4.0	8–4	Caution	Carbamate	12	21	Pre-bloom: When defoliation exceeds 40% and beetles are present
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	
	Fastac EC	alpha-cypermethrin	2.8–3.8	0.018–0.025	10.9/0.83	46–34	Danger	Pyrethroid	12	21	
	Justice	acetamiprid + bifenthrin	2.5–3	0.035–0.04	13.0 + 10.0/1.0 + 0.8	51–43	Warning	Neonicotinoid + Pyrethroid	12	30	R1 to R6: when defoliation exceeds 20% and beetles are present
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Mustang Maxx	zeta-cypermethrin	2.8–4.0	0.0175–0.025	9.15/0.8	46–32	Warning	Pyrethroid	12	21	
	Brigadier	bifenthrin + imidacloprid	5.1–6.1	0.08–0.095	11.30 + 11.30/1.0 + 1.0	25–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Stallion	zeta-cypermethrin + chlorpyrifos	5.0–11.75	0.1182–0.2777	3.08 + 30.80/0.275 + 2.75	26–11	Warning	Pyrethroid + Organophosphate	24	28	
Thrips											
	NipsIt INSIDE	clothianidin	1.28 fl oz/100 lbs seeds	n/a	47.8/5.0	n/a	Caution	Neonicotinoid	12	n/a	Seed treatment
	Cruiser 5FS	thiamethoxam	1.28 fl oz/100 lbs seeds	n/a	47.6/5.0	n/a	Caution	Neonicotinoid	12	n/a	
	Thimet 20G	phorate	9.0 oz/1000 row ft	n/a	20/0.20	n/a	Danger	Organophosphate	48	—	Post-emergence: When thrips are abundant, foliage and buds are damaged, and plants are stunted
	Mustang Maxx	zeta-cypermethrin	3.2–4.0	0.02–0.025	9.15/0.8	40–32	Warning	Pyrethroid	12	21	
	Endigo ZC***	lambda-cyhalothrin + thiamethoxam	3.5–4.0	0.0563–0.0644	9.48 + 12.60/0.88 + 1.18	37–32	Warning	Pyrethroid + Neonicotinoid	24	30	
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	Drought stressed plants are susceptible to thrips/damage
	Karate Z***	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	
	Declare	gamma-cyhalothrin	0.77–1.28	0.0075–0.0125	14.4/1.25	166–100	Caution	Pyrethroid	24	45	
	Fastac EC	alpha-cypermethrin	3.2–3.8	0.02–0.025	10.9/0.83	40–34	Danger	Pyrethroid	12	21	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Thrips (continued)											
	Besiege***	lambda-cyhalothrin + chlorantraniliprole	5.0–8.0	0.0489–0.0783	4.63 + 9.26/0.417 + 0.835	26–16	Warning	Pyrethroid + Diamide	24	30	Post-emergence: When thrips are abundant, foliage and buds are damaged, and plants are stunted Drought stressed plants are susceptible to thrips/damage
	Warrior II***	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Orthene 97	acephate	4–8	0.244–0.487	97.4/0.974	4–2	Caution	Organophosphate	24	14	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Stallion	zeta-cypermethrin + chlorpyrifos	9.25–11.75	0.2186–0.2777	3.08 + 30.80/0.275 + 2.75	14–11	Warning	Pyrethroid + Organophosphate	24	28	
	Lannate LV	methomyl	12.0–16.0	0.225–0.30	29.0/2.4	11–8	Danger	Carbamate	48	14	
	Sevin XLR Plus	carbaryl	32	1	44.1/4.0	4	Caution	Carbamate	12	21	
	Brigadier	bifenthrin + imidacloprid	3.6–6.1	0.06–0.095	11.30 + 11.30/1.0 + 1.0	36–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Baythroid XL	beta-cyfluthrin	0.8–1.6	0.007–0.013	12.70/1.0	160–80	Warning	Pyrethroid	12	21	
Velvetbean Caterpillar											
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	Pre-bloom: When defoliation exceeds 40% and worms are present R1 to R6: When defoliation exceeds 20% and worms are present
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Warrior II	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Asana XL	esfenvalerate	2.9–5.8	0.015–0.03	8.4/0.66	44–22	Warning	Pyrethroid	12	21	
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	3.5–4.0	0.0563–0.0644	9.48 + 12.60/0.88 + 1.18	37–32	Warning	Pyrethroid + Neonicotinoid	24	30	
	Sevin XLR Plus	carbaryl	16–32	0.5–1.0	44.1/4.0	8–4	Caution	Carbamate	12	21	
	Lannate LV	methomyl	6.4–12	0.12–0.225	29.0/2.4	20–11	Danger	Carbamate	48	14	
	Tracer	spinosad	1.0–2.0	0.0313–0.0625	44.2/4.0	128–64	n/a	Spinosad	4	28	
	Karate Z	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Nufos 4E	chlorpyrifos	8.0–16.0	0.25–0.50	44.9/4.0	16–8	Warning	Organophosphate	24	28	
	Declare	gamma-cyhalothrin	0.77–1.28	0.0075–0.0125	14.4/1.25	166–100	Caution	Pyrethroid	24	45	
	Mustang Maxx	zeta-cypermethrin	2.8–4.0	0.0175–0.025	9.15/0.8	46–32	Warning	Pyrethroid	12	21	
	Fastac EC	alpha-cypermethrin	2.8–3.8	0.018–0.025	10.9/0.83	46–34	Danger	Pyrethroid	12	21	
	Besiege	lambda-cyhalothrin + chlorantraniliprole	5.0–8.0	0.0489–0.0783	4.63 + 9.26/0.417 + 0.835	26–16	Warning	Pyrethroid + Diamide	24	30	
	Prevathon	chlorantraniliprole	14.0–20.0	0.047–0.067	5.0/0.43	9–6	n/a	Ryanoid	4	1	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Velvetbean Caterpillar (continued)											
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	Pre-bloom: When defoliation exceeds 40% and worms are present R1 to R6: When defoliation exceeds 20% and worms are present
	Belt SC	flubendiamide	2.0–3.0	0.0625–0.09375	39.0/4.0	64–43	Caution	Diamide	12	14	
	Intrepid 2F	methoxyfenozide	4.0–8.0	0.06–0.12	22.6/2.0	32–16	Caution	Insect growth regulator	4	14	
	Steward EC	indoxacarb	5.6–11.3	0.055–0.11	15.84/1.25	23–11	Caution	Indoxacarb	12	21	
	Orthene 97	acephate	12–16	0.7305–0.974	97.4/0.974	1.3–1.0	Caution	Organophosphate	24	14	
	Dimilin 2L	diflubenzuron	2.0–4.0	0.0313–0.0625	22.0/2.0	64–32	Caution	Insect growth regulator	12	21	
	Stallion	zeta-cypermethrin + chlorpyrifos	5.0–11.75	0.1182–0.2777	3.08 + 30.80/0.275 + 2.75	26–11	Warning	Pyrethroid + Organophosphate	24	28	
	Ambush	permethrin	3.2–6.4	0.05–0.1	25.6/2.0	40–20	Warning	Pyrethroid	12	60	
Green Cloverworm											
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	Pre-bloom: When defoliation exceeds 40% and worms are present R1 to R6: When defoliation exceeds 20% and worms are present
	Fastac EC	alpha-cypermethrin	2.8–3.8	0.018–0.025	10.9/0.83	46–34	Danger	Pyrethroid	12	21	
	Warrior II	lambda-cyhalothrin	0.96–1.60	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	3.5–4.0	0.0563–0.0644	9.48 + 12.60/0.88 + 1.18	37–32	Warning	Pyrethroid + Neonicotinoid	24	30	
	Sevin XLR Plus	carbaryl	16–32	0.5–1.0	44.1/4.0	8–4	Caution	Carbamate	12	21	
	Asana XL	esfenvalerate	2.9–5.8	0.015–0.03	8.4/0.66	44–22	Warning	Pyrethroid	12	21	
	Lannate LV	methomyl	6.4–12	0.12–0.225	29.0/2.4	20–11	Danger	Carbamate	48	14	
	Tracer	spinosad	1.0–2.0	0.0313–0.0625	44.2/4.0	128–64	n/a	Spinosad	4	28	
	Nufos 4E	chlorpyrifos	8.0–16.0	0.25–0.50	44.9/4.0	16–8	Warning	Organophosphate	24	28	
	Steward EC	indoxacarb	4.6–11.3	0.045–0.11	15.84/1.25	28–11	Caution	Indoxacarb	12	21	
	Belt SC	flubendiamide	2.0–3.0	0.0625–0.09375	39.0/4.0	64–43	Caution	Diamide	12	14	
	Karate Z	lambda-cyhalothrin	0.96–1.6	0.015–0.025	22.8/2.08	133–80	Warning	Pyrethroid	24	30	
	Ambush	permethrin	3.2–6.4	0.05–0.1	25.6/2.0	40–20	Warning	Pyrethroid	12	60	
	Declare	gamma-cyhalothrin	0.77–1.28	0.0075–0.0125	14.4/1.25	166–100	Caution	Pyrethroid	24	45	
	Dimilin 2L	diflubenzuron	2.0–4.0	0.0313–0.0625	22.0/2.0	64–32	Caution	Insect growth regulator	12	21	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Green Cloverworm (continued)											
	Orthene 97	acephate	12–16	0.7305–0.974	97.4/0.974	1.3–1.0	Caution	Organophosphate	24	14	Pre-bloom: When defoliation exceeds 40% and worms are present
	Mustang Maxx	zeta-cypermethrin	2.8–4.0	0.0175–0.025	9.15/0.8	46–32	Warning	Pyrethroid	12	21	
	Intrepid 2F	methoxyfenozide	4.0–8.0	0.06–0.12	22.6/2.0	32–16	Caution	Insect growth regulator	4	14	
	Baythroid XL	beta-cyfluthrin	0.8–1.6	0.007–0.013	12.70/1.0	160–80	Warning	Pyrethroid	12	21	
	Besiege	lambda-cyhalothrin + chlorantraniliprole	5.0–8.0	0.0489–0.0783	4.63 + 9.26/0.417 + 0.835	26–16	Warning	Pyrethroid + Diamide	24	30	R1 to R6: When defoliation exceeds 20% and worms are present
	Prevathon	chlorantraniliprole	14.0–20.0	0.047–0.067	5.0/0.43	9–6	n/a	Ryanoid	4	1	
	Hero	zeta-cypermethrin + bifenthrin	2.6–6.1	0.025–0.06	3.75 + 11.25/1.24	49–21	Caution	Pyrethroid	12	21	
	Brigadier	bifenthrin + imidacloprid	5.1–6.1	0.08–0.095	11.30 + 11.30/1.0 + 1.0	25–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Stallion	zeta-cypermethrin + chlorpyrifos	5.0–11.75	0.1182–0.2777	3.08 + 30.80/0.275 + 2.75	26–11	Warning	Pyrethroid + Organophosphate	24	28	
Fall Armyworm											
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	Pre-bloom: When defoliation exceeds 40% and worms are present
	Mustang Maxx	zeta-cypermethrin	3.2–4.0	0.02–0.025	9.15/0.8	40–32	Warning	Pyrethroid	12	21	
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	
	Nufos 4E	chlorpyrifos	16–32	0.5–1.0	44.9/4.0	8–4	Warning	Organophosphate	24	28	
	Karate Z	lambda-cyhalothrin	1.6–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	R1 to R6: When defoliation exceeds 20% and worms are present or when larvae are feeding on flowers.
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Fastac EC	alpha-cypermethrin	3.2–3.8	0.02–0.025	10.9/0.83	40–34	Danger	Pyrethroid	12	21	
	Warrior II	lambda-cyhalothrin	1.60–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Justice	acetamiprid + bifenthrin	3.0–5.0	0.04–0.07	13.0 + 10.0/1.0 + 0.8	43–26	Warning	Neonicotinoid + Pyrethroid	12	30	
	Dimilin 2L	diflubenzuron	4.0	0.0625	22.0/2.0	32	Caution	Insect growth regulator	12	21	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.0–4.5	0.0644–0.0724	9.48 + 12.60/0.88 + 1.18	32–28	Warning	Pyrethroid + Neonicotinoid	24	30	
	Sevin XLR Plus	carbaryl	32–48	1.0–1.5	44.1/4.0	4–3	Caution	Carbamate	12	21	
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
	Lannate LV	methomyl	12.0–16.0	0.225–0.3	29.0/2.4	11–8	Danger	Carbamate	48	14	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
Fall Armyworm (continued)											
	Tracer	spinosad	1.5–2.0	0.0469–0.0625	44.2/4.0	85–64	n/a	Spinosad	4	28	Pre-bloom: When defoliation exceeds 40% and worms are present R1 to R6: When defoliation exceeds 20% and worms are present or when larvae are feeding on flowers.
	Steward EC	indoxacarb	4.6–11.3	0.045–0.11	15.84/1.25	28–11	Caution	Indoxacarb	12	21	
	Intrepid 2F	methoxyfenozide	4.0–8.0	0.06–0.12	22.6/2.0	32–16	Caution	Insect growth regulator	4	14	
	Stallion	zeta-cypermethrin + chlorpyrifos	9.25–11.75	0.2186–0.2777	3.08 + 30.80/0.275 + 2.75	14–11	Warning	Pyrethroid + Organophosphate	24	28	
	Belt SC	flubendiamide	2.0–3.0	0.0625–0.09375	39.0/4.0	64–43	Caution	Diamide	12	14	
	Orthene 97	acephate	12–16	0.7305–0.974	97.4/0.974	1.3–1.0	Caution	Organophosphate	24	14	
	Besiege	lambda-cyhalothrin + chlorantraniliprole	8.0–10.0	0.0783–0.0978	4.63 + 9.26/0.417 + 0.835	16–13	Warning	Pyrethroid + Diamide	24	30	
	Prevathon	chlorantraniliprole	14.0–20.0	0.047–0.067	5.0/0.43	9–6	n/a	Ryanoid	4	1	
	Brigadier	bifenthrin + imidacloprid	5.1–6.1	0.08–0.095	11.30 + 11.30/1.0 + 1.0	25–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Declare	gamma-cyhalothrin	1.28–1.54	0.0125–0.015	14.4/1.25	100–83	Caution	Pyrethroid	24	45	
***Soybean Looper and Cabbage Looper**											
	Mustang Maxx	zeta-cypermethrin	3.2–4.0	0.02–0.025	9.15/0.8	40–32	Warning	Pyrethroid	12	21	Pre-bloom: When defoliation exceeds 40% and worms are present R1 to R6: When defoliation exceeds 20% and worms are present
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Warrior II	lambda-cyhalothrin	1.92; 0.96–1.60	0.03; 0.015–0.025	22.8/2.08	67; 133–80	Warning	Pyrethroid	24	30	
	Besiege	lambda-cyhalothrin + chlorantraniliprole	5.0–8.0; 10	0.0489–0.0783; 0.0978	4.63 + 9.26/0.417 + 0.835	26–16; 13	Warning	Pyrethroid + Diamide	24	30	
	**Karate Z	lambda-cyhalothrin	1.92; 0.96–1.6	0.03; 0.015 0.025	22.8/2.08	67; 133–80	Warning	Pyrethroid	24	30	
	Asana XL	esfenvalerate	5.8–9.6	0.03–0.05	8.4/0.66	22–13	Warning	Pyrethroid	12	21	
	Tracer	spinosad	1.0–2.0	0.0313–0.0625	44.2/4.0	128–64	n/a	Spinosad	4	28	
	Justice	acetamiprid + bifenthrin	5.0	0.07	13.0 + 10.0/1.0 + 0.8	26	Warning	Neonicotinoid + Pyrethroid	12	30	
	Fastac EC	alpha-cypermethrin	3.2–3.8	0.02–0.025	10.9/0.83	40–34	Danger	Pyrethroid	12	21	
	Steward EC	indoxacarb	4.6–11.3	0.045–0.11	15.84/1.25	28–11	Caution	Indoxacarb	12	21	
	Declare	gamma-cyhalothrin	1.54; 0.77–1.28	0.015; 0.0075–0.0125	14.4/1.25	83; 166–100	Caution	Pyrethroid	24	45	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
***Soybean Looper and Cabbage Looper (continued)**											
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	Pre-bloom: When defoliation exceeds 40% and worms are present
	Belt SC	flubendiamide	2.0–3.0	0.0625–0.09375	39.0/4.0	64–43	Caution	Diamide	12	14	
	Prevathon	chlorantraniliprole	14.0–20.0	0.047–0.067	5.0/0.43	9–6	n/a	Ryanoid	4	1	
	Dimilin 2L	diflubenzuron	4.0	0.0625	22.0/2.0	32	Caution	Insect growth regulator	12	21	R1 to R6: When defoliation exceeds 20% and worms are present
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	
	Orthene 97	acephate	12–16	0.7305–0.974	97.4/0.974	1.3–1.0	Caution	Organophosphate	24	14	
	Intrepid 2F	methoxyfenozide	4.0–8.0	0.06–0.12	22.6/2.0	32–16	Caution	Insect growth regulator	4	14	
	Stallion	zeta-cypermethrin + chlorpyrifos	9.25–11.75	0.2186–0.2777	3.08 + 30.80/0.275 + 2.75	14–11	Warning	Pyrethroid + Organophosphate	24	28	
	Brigadier	bifenthrin + imidacloprid	5.1–6.1	0.08–0.095	11.30 + 11.30/1.0 + 1.0	25–21	Warning	Pyrethroid + Neonicotinoid	12	45	
	Ambush	permethrin	6.4–12.8; 3.2–6.4	0.1–0.2; 0.05–0.1	25.6/2.0	20–10; 40–20	Warning	Pyrethroid	12	60	
^Southern Green Stink Bug/Green Stink Bug											
	Besiege	lambda-cyhalothrin + chlorantraniliprole	8.0–10.0	0.0783–0.0978	4.63 + 9.26/0.417 + 0.835	16–13	Warning	Pyrethroid + Diamide	24	30	R1 to R6: 1 bug per row foot or 36 bugs/100 sweeps
	Orthene 97	acephate	8–16	0.487–0.974	97.4/0.974	2.0–1.0	Caution	Organophosphate	24	14	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.0–4.5	0.0644–0.0724	9.48 + 12.60/0.88 + 1.18	32–28	Warning	Pyrethroid + Neonicotinoid	24	30	
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	
	Asana XL	esfenvalerate	5.8–9.6	0.03–0.05	8.4/0.66	22–13	Warning	Pyrethroid	12	21	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Nufos 4E	chlorpyrifos	32	1	44.9/4.0	4	Warning	Organophosphate	24	28	
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
	Justice	acetamiprid + bifenthrin	5.0	0.07	13.0 + 10.0/1.0 + 0.8	26	Warning	Neonicotinoid + Pyrethroid	12	30	
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
^Southern Green Stink Bug/Green Stink Bug (continued)											
	Belay	clothianidin	3.0–6.0	0.05–0.1	23.0/2.13	43–21	Caution	Neonicotinoid	12	21	R1 to R6: 1 bug per row foot or 36 bugs/100 sweeps
	Fastac EC	alpha-cypermethrin	3.2–3.8	0.02–0.025	10.9/0.83	40–34	Danger	Pyrethroid	12	21	
	Karate Z	lambda-cyhalothrin	1.6–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Declare	gamma-cyhalothrin	1.28–1.54	0.0125–0.015	14.4/1.25	100–83	Caution	Pyrethroid	24	45	
	Mustang Maxx	zeta-cypermethrin	3.2–4.0	0.02–0.025	9.15/0.8	40–32	Warning	Pyrethroid	12	21	
	Warrior II	lambda-cyhalothrin	1.60–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Stallion	zeta-cypermethrin + chlorpyrifos	9.25–11.75	0.2186–0.2777	3.08 + 30.80/0.275 + 2.75	14–11	Warning	Pyrethroid + Organophosphate	24	28	
	Sevin XLR Plus	carbaryl	32–48	1.0–1.5	44.1/4.0	4–3	Caution	Carbamate	12	21	
^Brown Stink Bug											
	Besiege	lambda-cyhalothrin + chlorantraniliprole	8.0–10.0	0.0783–0.0978	4.63 + 9.26/0.417 + 0.835	16–13	Warning	Pyrethroid + Diamide	24	30	R1 to R6: 1 bug per row foot or 36 bugs/100 sweeps
	Karate Z	lambda-cyhalothrin	1.6–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Warrior II	lambda-cyhalothrin	1.60–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Orthene 97	acephate	8–16	0.487–0.974	97.4/0.974	2.0–1.0	Caution	Organophosphate	24	14	
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
	Belay	clothianidin	3.0–6.0	0.05–0.1	23.0/2.13	43–21	Caution	Neonicotinoid	12	21	
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.5	0.0724	9.48 + 12.60/0.88 + 1.18	28	Warning	Pyrethroid + Neonicotinoid	24	30	
	Declare	gamma-cyhalothrin	1.28–1.54	0.0125–0.015	14.4/1.25	100–83	Caution	Pyrethroid	24	45	
	Justice	acetamiprid + bifenthrin	5.0	0.07	13.0 + 10.0/1.0 + 0.8	26	Warning	Neonicotinoid + Pyrethroid	12	30	
	Fastac EC	alpha-cypermethrin	3.2–3.8	0.02–0.025	10.9/0.83	40–34	Danger	Pyrethroid	12	21	
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	
	Stallion	zeta-cypermethrin + chlorpyrifos	9.25–11.75	0.2186–0.2777	3.08 + 30.80/0.275 + 2.75	14–11	Warning	Pyrethroid + Organophosphate	24	28	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61–20	Warning	Pyrethroid	12	18	
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	
	Sevin XLR Plus	carbaryl	32–48	1.0–1.5	44.1/4.0	4–3	Caution	Carbamate	12	21	
	Mustang Maxx	zeta-cypermethrin	3.2–4.0	0.02–0.025	9.15/0.8	40–32	Warning	Pyrethroid	12	21	

Insecticides Labeled for Control of Insect Pests of Soybeans (continued)

Insect	Insecticide	Active Ingredient (AI)	Formulated Rate (fl oz or oz/A)	lb AI/A	% AI by wt/lb AI per gallon or lb	Acres Treated per gallon/lb	Signal Word	Insecticide Class	Re-entry Interval (h)	Pre-harvest Interval (d)	When to Treat/ Treatment Threshold
^Redbanded Stink Bug											
	Mustang Maxx	zeta-cypermethrin	3.2–4.0	0.02–0.025	9.15/0.8	40–32	Warning	Pyrethroid	12	21	R1 to R6: 16 bugs per 100 sweeps **Caution:** Acephate applied alone at 0.9 lb/A gave unsatisfactory control of redbanded stink bug in field trials conducted at Texas A&M AgriLife Research Center at Beaumont
	Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.5	0.0724	9.48 + 12.60/0.88 + 1.18	28	Warning	Pyrethroid + Neonicotinoid	24	30	
	Leverage 360	imidacloprid + beta-cyfluthrin	2.8	0.0656	21.0 + 10.5/2.0 + 1.0	46	Caution	Neonicotinoid + Pyrethroid	12	21	
	Brigade 2 EC	bifenthrin	2.1–6.4	0.033–0.10	25.1/2.0	61– 20	Warning	Pyrethroid	12	18	
	Hero	zeta-cypermethrin + bifenthrin	4.0–10.3	0.04–0.10	3.75 + 11.25/1.24	32–12	Caution	Pyrethroid	12	21	
	Fastac EC	alpha-cypermethrin	3.2–3.8	0.02–0.025	10.9/0.83	40–34	Danger	Pyrethroid	12	21	
	Justice	acetamiprid + bifenthrin	5.0	0.07	13.0 + 10.0/1.0 + 0.8	26	Warning	Neonicotinoid + Pyrethroid	12	30	
	Belay	clothianidin	3.0–6.0	0.05–0.1	23.0/2.13	43–21	Caution	Neonicotinoid	12	21	
	Besiege	lambda-cyhalothrin + chlorantraniliprole	8.0–10.0	0.0783–0.0978	4.63 + 9.26/0.417 + 0.835	16–13	Warning	Pyrethroid + Diamide	24	30	
	Karate Z	lambda-cyhalothrin	1.6–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Stallion	zeta-cypermethrin + chlorpyrifos	9.25–11.75	0.2186–0.2777	3.08 + 30.80/0.275 + 2.75	14–11	Warning	Pyrethroid + Organophosphate	24	28	
	Warrior II	lambda-cyhalothrin	1.60–1.92	0.025–0.03	22.8/2.08	80–67	Warning	Pyrethroid	24	30	
	Declare	gamma-cyhalothrin	1.28–1.54	0.0125–0.015	14.4/1.25	100–83	Caution	Pyrethroid	24	45	
	Orthene 97	acephate	8–16	0.487–0.974	97.4/0.974	2.0–1.0	Caution	Organophosphate	24	14	
	Sevin XLR Plus	carbaryl	32–48	1.0–1.5	44.1/4.0	4–3	Caution	Carbamate	12	21	
	Baythroid XL	beta-cyfluthrin	1.6–2.8	0.013–0.022	12.70/1.0	80–46	Warning	Pyrethroid	12	21	

*Pyrethroid resistance is common in soybean looper. Some products are used for suppression only. Check the product labels before use.
**Suppression only.
***Will not control western flower thrips.
^No Texas data available for stink bug treatment thresholds at R7.
See product labels for information on toxicity to fish and other aquatic organisms and wildlife.

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