Chapter 12

Insect Pest Management in Soybeans

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The importance of insect pests in Arkansas soybeans is extremely variable from year to year due in large part to environmental conditions. For example, hot, dry years favor many lepidopterous pests such as the soybean podworm and the beet armyworm; and when drought conditions occur, these pests usually are abundant. Many other lepidopterous pests, such as the velvetbean caterpillar and the soybean looper, may cause problems following migrations from southern areas, particularly in concurrence with winds out of the Gulf region where they are a common problem. Generally, insect pressure is greater in the southern part of the state compared to northern Arkansas due to warmer temperatures and closeness to the aforementioned migration sources.

Production practices also have an impact on the occurrence of pest insects in soybeans. For example, insects such as the Dectes stem borer and grape colaspis usually occur at damaging levels only in soybean monocultures. Row width can also affect insect pest pressure. Soybean fields which fail to achieve canopy closure by bloom are the ones most susceptible to damage by the soybean podworm. Planting date, tillage and adjacent crops can also have an impact on pest species occurrence. The Early Soybean Production System (ESPS), which is the planting of indeterminate varieties (MG III and IV) in April, has gained increasing popularity in the state. Fields planted to the ESPS are susceptible to pests such as the foliage-feeding bean leaf beetle and the pod-feeding stink bug complex. Because of the limited acreage in this system, such fields are a virtual "oasis" as a preferred host for these insects which normally would be found primarily on wild hosts.

A soybean field in Arkansas will contain millions of insects comprising a multitude of different species, both pests and beneficials, in a growing season. Proper insect identification and knowledge of the injury associated with pest species are the keys to any soybean insect pest management (IPM) program. Secondly, we must be able to determine the level of pest insects in the field by sampling and assessing the threat of the pest(s) to the crop using such strategies as percent defoliation, stand loss, etc. Finally, it is important to determine what management tactics are available and whether or not they are economically feasible.

Insect Identification

The three types of insect pests found in soybeans in Arkansas are:

1. **Foliage feeders**, which comprise the biggest group of insect pests,
2. **Pod feeders**, which are probably the most detrimental to yield, and
3. **Stem, root and seedling feeders**, which are often the hardest to sample and are not detected until after they have caused damage.

Some insects, such as the bean leaf beetle, may feed on both foliage and pods but are primarily considered foliage feeders. The following information on individual insects is meant to provide the reader with basic information on some of the more common pests found in soybeans including the injury they cause, important descriptive information, relevant life history details and management considerations.

Foliage Feeders

Management Tip

Treatment levels for all foliage feeders (except thrips) are at 40 percent defoliation prior to bloom and 25 percent defoliation after bloom, with foliage feeders present.

Green Cloverworm

The green cloverworm larva is light green in color with white stripes running down each side of the body. A full-size larva is approximately one inch in length. Green cloverworms can be distinguished from all other lepidopterous larvae because they are the only ones that have three pairs of abdominal prolegs. When disturbed, larvae wiggle violently and fall to the ground, similar to the velvetbean caterpillar. The green cloverworm is usually the

Figure 12.1. Green Cloverworm.

first foliage-feeding lepidopteran found in soybeans. Although it is considered an important pest in northern states, it rarely reaches damaging levels in Arkansas. Many entomologists feel the green cloverworm may be more beneficial than harmful because it provides a feeding source for beneficial insects, allowing them to build up for the time when more damaging larvae may occur. When the green cloverworm does reach damaging levels, it can be controlled with the lowest labeled rates of insecticides. Commercial formulations of *Bacillus thuringiensis* (*B.t.*) are very effective for control, even at the lowest labeled rates.

Loopers

The soybean looper and the cabbage looper are both commonly found in Arkansas. Although the two species are almost indistinguishable, particularly in the larval stage, control methods are extremely different. The cabbage looper is not hard to control while the soybean looper is resistant to pyrethroids and requires the use of more expensive insecticides to control.

The main characteristic for separation of loopers from other lepidopterous larvae is that they have only two pairs of abdominal prolegs. The body is thickest at the posterior end of the larva and tapers toward the head. The larva is light to dark green with longitudinal stripes on each side of the body and two stripes along the back. Soybean loopers often have black legs and markings on the head and body; however, this is not a reliable technique for identification because some soybean loopers do not have these markings.

The most reliable technique to identify larvae of the two species is examination of mandibles. Soybean looper larvae have mandibles with ribs terminating in an enlargement near the outer margins while cabbage loopers have ribs which extend to the outer margins of the mandible.

Larvae of both species can become quite large, reaching almost 1.5 inches in length. Larvae generally feed in the lower one-half to one-third of the canopy. As the larvae develop, they eat irregular areas of leaves, leaving the larger leaf veins. Loopers are voracious feeders, particularly the large larvae (fourth-sixth instar) which consume 90 percent of the total food required by the developing larvae. Soybean loopers have been observed to occasionally feed on pods.

Generally, loopers do not reach damaging levels in Arkansas due to the natural enemy complex of beneficial insects and pathogens. However, when they do occur, it is usually late in the season and typically in areas where cotton is also grown. Cotton nectar provides a carbohydrate source which can greatly increase the egg production of the female moth.

Figure 12.2. Soybean Looper.

Management decisions should be based on estimates of defoliation and the number of larvae present. Also, when scouting, attention should be given to the appearance of larvae. As previously mentioned, there are many natural enemies of loopers. The ability to spot dead or diseased larvae can often mean the saving of an expensive insecticide application. If treatment is warranted, consider the use of a registered, effective formulation of *B.t.* in areas where resistance to insecticides has been a problem. Finally, remember that loopers often occur with other lepidopterous foliage feeders such as the green cloverworm and velvetbean caterpillar. If the combination of these larvae produces 25 percent defoliation after bloom, then control measures are warranted.

Figure 12.3. Bean pod mottle virus transmitted by bean leaf beetle.

Figure 12.4. Bean Leaf Beetle Adult.
(Photo by L.G. Higley, University of Nebraska-Lincoln)

Bean Leaf Beetles

The bean leaf beetle is a small beetle which primarily feeds on leaves but will occasionally feed on pods. Adults are about one-fourth inch long with color ranging from light yellow to red with four black spots on their back and a black margin around the edge of the wing covers. Also, a black triangle will be present just behind the prothorax or "neck." This triangle is always present, but the four black spots may or may not be seen. The grub or immature stage is found in the soil where it feeds on roots and nodules. It is white with a black head and anal shield. Damage by bean leaf beetle adult is characterized by small circular holes between leaf veins as opposed to jagged leaf damage from caterpillars and grasshoppers.

The time of greatest concern with the bean leaf beetle is early in the season when plants are small (growth stages V1-V3). Defoliation levels exceeding 50 percent on these small plants can occur in a very short time span. In Arkansas, early planted (especially ESPS) soybean fields are particularly vulnerable to attack. Late in the season, defoliation by bean leaf beetles in conjunction with other leaf-feeding pests can result in reaching the economic threshold of 25 percent defoliation.

Current research indicates that the pod feeding of bean leaf beetles may be even more important than the defoliation it causes. Beetles feeding on the pod result in increased susceptibility to secondary pathogens, such as *Alternaria*, damage to the seed and seed loss. Adults have also been observed to feed on the pod peduncle causing loss of soybean pods. Also, the bean leaf beetle is known to transmit bean pod mottle virus (BPMV). The earlier this disease is transmitted to soybean plants, the more devastating the effects of the disease can be. Yield losses can range from 10 to 17 percent. However, when plants are infected with both BPMV and soybean mosaic virus (SMV), yields can be reduced by 60 percent. SMV is often a seed-transmitted disease.

Velvetbean Caterpillars

The velvetbean caterpillar is usually not a problem in Arkansas. However, every five to ten years this pest is found in damaging levels, usually only in the southern region of the state. The velvetbean caterpillar is a voracious feeder and can strip a soybean field of leaves in a short time.

When larvae are very small, first to third instar, they can be misidentified as green cloverworms. However, when the larvae reach the third instar (medium-size larvae), dark longitudinal lines with alternating lighter colored stripes are visible. Larvae typically range in color from pale green to dark green or even brown or black. Larger larvae are easily distinguished from green cloverworms

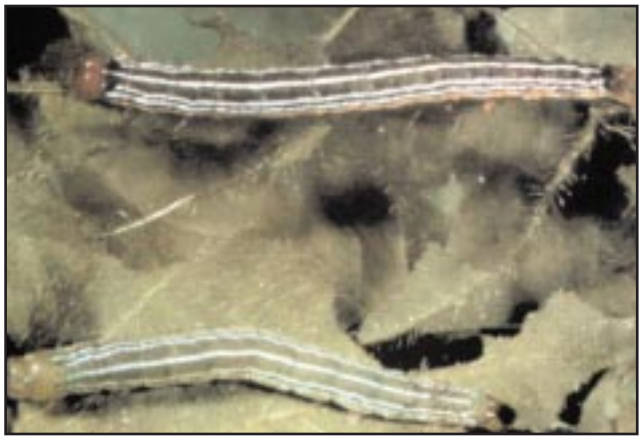


Figure 12.5. Velvetbean Caterpillars.

and loopers because they have four pairs of prolegs. When disturbed, they exhibit violent wiggling behavior much like the green cloverworm which helps separate them from other species with four pairs of prolegs (such as the corn earworm or any of the armyworm complex). The adult is characterized by being dark brown with a darker line running laterally across the middle of both wings.

This pest is susceptible to many natural enemies, particularly the fungus *Nomuraea rileyi*, which can decimate a population of velvetbean caterpillar in short order. Numerous insecticides are effective for control, including several commercially available *B.t.* formulations.

Armyworms

Several species of armyworms may be found in soybeans during the growing season including the yellowstriped armyworm, the fall armyworm and the beet armyworm.

Figure 12.6. Beet Armyworms.

The yellowstriped armyworm occasionally occurs on seedling soybeans in large enough numbers to cause damage, but usually the plants can recover with no loss to yield potential, and control is seldom necessary. The yellowstriped armyworm larva is dark to black with a yellow stripe running down each side of the body. Also, there is usually a black spot on each side of the first abdominal segment. As with the fall armyworm and beet armyworm, the yellowstriped armyworm has four pairs of prolegs.

Usually fall armyworm populations occur late in the season and do not build up to damaging levels. However, the fall armyworm has occasionally been observed to be present in the early spring on seedling soybeans at levels high enough to cause damage. Control is usually not required. The fall armyworm larvae can vary from tan to green in color and have black bumps with dark black hairs on the body. On the eighth abdominal segment there are four distinct black spots on the upper half of the body. Also, the fall armyworm has an inverted "Y" on front of the head.

In recent years the beet armyworm has been observed to develop large populations in soybeans late in the season. Larvae feed on blooms, pods and foliage and have caused significant yield loss in isolated incidents. Mature larvae are green in color with prominent lateral stripes. Unlike the fall armyworm, the beet armyworm has no stout black hairs on the body, and there is usually a black spot on each side of the body on the second thoracic segment, just above the middle pair of true legs. The beet armyworm and fall armyworm have shown resistance to pyrethroids and can be difficult to control.

Blister Beetles

The margined blister beetle and the striped blister beetle are both common in Arkansas. The adults are elongate with a broad head, narrow neck and long, slender legs. The margined blister beetle

Figure 12.7. Striped Blister Beetle.

Figure 12.8. Margined Blister Beetle.

is dark gray to black, while the striped blister beetle is yellowish orange with brown stripes on the wing covers. Adults usually feed in groups in the field and can virtually strip all the leaves in spots in a soybean field. If enough areas in a field are infested, spot treatment may be required.

Grasshoppers

The redlegged grasshopper and the differential grasshopper are two grasshopper species that are common in soybeans in Arkansas. Grasshoppers are rarely a problem. However, when grasshopper populations build to damaging levels, it usually

occurs in fields with undisturbed pastures or hay fields close by. Typically they are found first along the edge of the field in large numbers early in the season and then disperse throughout the field as the season develops. Often treatments can be made along the field edge to control grasshoppers before they disperse if necessary. Grasshoppers will feed on leaves and pods, if they are available. Grasshoppers are favored by drought conditions and are often associated with two or more consecutive years of drought conditions.

Garden Webworms

Larvae of the garden webworm usually appear early in the season. They are green with black spots on every body segment. Webworms are easily distinguished from other larvae by the silken webbing they produce. Also, when disturbed the garden webworm will back away from the

Figure 12.9. Garden Webworm.
(Photo by M.E. Rice, Iowa State University)

disturbance. Control is normally not required. However, in situations of high populations or in conjunction with other foliage feeders, severe defoliation can occur. Garden webworms are generally found first on pigweed, and localized field infestations are generally associated with this weed.

Thrips

Thrips are one of the most abundant arthropods found in soybeans. They are very small, less than one-tenth of an inch in length. The most common species found in soybeans is the soybean thrips. Adults of this species have characteristic transverse bands of brown and white on the abdomen. Larval stages are yellow to orange in color. Thrips injury is characterized by a silvery appearance to the leaves, blackening of the terminal and a general reduction of plant vigor. Plants are most susceptible to thrips injury during drought conditions or other stress situations that result in stunted growth. Usually thrips are not a problem. However, when they occur in large numbers (especially under stressful conditions), seedling mortality can occur. In these situations, control measures may be necessary. Under normal conditions, plants outgrow any injury and can withstand very high thrips populations (even up to 100 per plant).

Pod Feeders

Management Tip

Scout fields closely at least once a week starting at bloom and examine the plants for visual signs of damage.

The pod feeders represent the insects that have the greatest potential for causing economic losses to soybeans. The soybean plant does not have the ability to compensate for damage at this stage of growth, and injury to pods and/or seed is directly reflected in lower yields.

Corn Earworms

The number one insect pest of soybeans in Arkansas is considered by many to be the corn earworm. In cotton, this pest is referred to as the cotton bollworm. While in soybeans, it is often called the soybean podworm. It has an extremely wide host range and is a major pest of not only corn, cotton and soybeans but also grain sorghum and tomato (in tomato it is called the tomato fruitworm).

Figure 12.10. Corn Earworm.

While small larvae feed on new, tender leaves and blooms, larger larvae can be found on any part of the plant and will feed on leaves, stems or pods but prefer blooms. Small larvae are off-white in color, but larger larvae can vary in color from

yellowish-green to green, pink, brown or even black, each having longitudinal light-colored lines along the body. Compared to armyworms, they generally have much more hair over the body. The head is most often orange in color. When disturbed, these larvae usually curl up into a "C" shape. Larvae, particularly small ones, are subject to high mortality from natural enemies. For this reason, pesticide treatment recommendations are generally aimed at medium and large larvae.

The most vulnerable time for soybean fields to infestation by the corn earworm is during bloom (R2 growth stage), which usually coincides with the second field generation. Fields should be closely monitored at this time, particularly fields that are blooming and have not achieved canopy closure. Also, the treatment level for corn earworm is reduced for drought-stressed beans because the ability of plants to compensate is reduced in this situation. Studies have shown that, under normal conditions, when larvae eat one bean out of a pod, the other beans in the pod will increase in size to overcome the loss.

The rates of insecticide needed for control are typically lower for soybeans than cotton because the larvae are much more exposed to the insecticide. The treatment level for corn earworm in soybeans prior to bloom is 40 percent defoliation. After bloom, treat when populations approach four larvae that are one-half inch or longer per row foot (38-inch rows). For dryland soybeans under stress, treat at three larvae per row foot. For thresholds at different row widths, consult the table provided later in this chapter.

Stink Bugs

Three species of stink bugs are found in Arkansas. They are the green stink bug, the southern green stink bug and the brown stink bug. Both the adult and nymphal stages of the stink bug complex can cause injury to soybeans. Damage is caused when they insert their piercing-sucking mouthparts into the plant and extract plant juices. The stink bug will feed on the stems, foliage, pods and blooms. Damage is greatest when they feed on the seed in the developing pod. Stink bug feeding can cause abortion of blooms and pods resulting in yield reduction. Stink bug feeding early in the development of pods can result in shriveling of seed or seed size reduction. Feeding on large-sized seed results in seed discoloration and lowering of seed quality. When stink bugs feed on the developing seed, digestive juices are injected into the seed causing deterioration of tissue.

Figure 12.11. Stink Bug.

Stink bug eggs are distinctively laid on the leaves of soybeans in clusters in tight rows. Individual eggs are barrel-shaped. As nymphs, they are gregarious in habit and remain close to the egg mass from which they hatched. As they develop, they begin to feed and disperse. Southern green stink bug nymphs are, at first, reddish black or black. Later they develop a white spot on the back. As they reach mid-size, they turn black in color or green with pink markings on the back and white spots on the abdomen. Late instar nymphs are lighter green than the adult stink bugs with pink and black markings and white spots on the margin of the abdomen. Southern green stink bug adults can be differentiated from green stink bug adults by the red bands on the antennae. Green stink bug nymphs are, at first, reddish brown, then light green with black and white stripes on the abdomen. Late-stage nymphs are green and have stripes on the abdomen colored yellow and black or green with a black spot in the center of the abdomen. Adult green stink bugs have black bands on the antennae. Brown stink bug nymphs are light brown with brown spots down the middle of the abdomen. The brown stink bug adult is brown and has rounded shoulders. They are often confused with the spined soldier bug, a predaceous stink bug which has sharp points on each shoulder.

Stink bugs are often found along field borders, particularly along tree lines where they overwinter as adults. **Threshold levels in Arkansas are one per row foot (38-inch rows) after blooming and pod formation begins. For thresholds at various row widths, consult the table later in this chapter.**

Root and Stem Feeders

Threecornered Alfalfa Hoppers

The threecornered alfalfa hopper adult has a distinct triangular shape, from which it derives its name, and is bright green in color. Adults are about one-fourth inch in length. Nymphs have 12 pairs of spines along the top of the body. First instar nymphs are extremely small and translucent. As the nymphs grow, they become green like the adult although the later instar nymphs can also be brown in color.

Threecornered alfalfa hoppers overwinter as adults in a reproductive diapause state. That is, they are active on warm days but do not reproduce. They are often found in the winter beneath pine trees where they reside under plant debris in unfavorable weather and move up into pine trees

Figure 12.12. Threecornered Alfalfa Hopper Adult.

and feed on warm days. In the early spring they leave pine and move into alternate hosts such as clovers, vetch, dock, wild geraniums and other hosts for the first generation. As the first generation of nymphs becomes adults, they move into soybeans in May and June. Usually two to three generations occur in soybeans.

Damage to soybeans caused by threecornered alfalfa hoppers is caused by their unique feeding behavior. Nymphs and adults are phloem feeders and will often feed in a circular pattern around a stem or petiole resulting in girdling. This girdling disrupts the vascular flow. Plants girdled on the mainstem near the soil surface may die or may survive the damage only to break over later in the season due to high winds and/or rain. When the latter occurs, growers are often prone to treat the

Figure 12.13. Girdling Caused by Threecornered Alfalfa Hopper.

field although the damage occurred several weeks before. Plants are susceptible to the hopper feeding that causes this type of damage until they are about 10 inches tall. Scouting for this damage should be done from emergence until plants are 10 inches tall. During this period, treatment should be considered if 50 percent of the plants are girdled or if less than four to six ungirdled plants per row foot remain in conventional rows (30- to 38-inch rows) and hoppers are present. Later as the plant develops, the hoppers will move up into the canopy and cause girdling on vegetative branches and petioles. However, this damage does not appear to cause economic damage in Arkansas. Studies in Louisiana have shown economic yield losses when these pests girdle stems attaching blooms and pods.

Grape Colaspis

Figure 12.14. Grape Colaspis Adult.
(Photo by M. Kogan, Oregon State University)

The grape colaspis is considered to be a minor pest of soybeans. Larvae and adults are common in soybean fields throughout the state but rarely at economic levels. In recent years, however, growers in Lee, Monroe, St. Francis and Woodruff counties have had a serious problem with this pest.

The adult is a small light brown-colored beetle about one-fourth inch long. The adult is a foliage feeder but has not been known to cause economic injury. In contrast, the soil-dwelling larval stage can cause problems. The larvae or grubs are white to tan in color with a brown head capsule and cervical shield.

Figure 12.15. Grape Colaspis Grub.

Figure 12.16. Grape Colaspis Grub Feeding Symptoms on Root.

Grubs can be up to about one-third inch in length. These grubs feed on the roots and underground stem portions of the plant. This feeding can cause stunting or even loss of stand when populations are high. The damage remains unnoticed in many cases until after larvae have finished development. Also, the damage is often mistaken for soybean cyst nematode damage. In severe cases, reports of growers losing three stands of soybean plants in one field in a season have been observed. At the present time there are no effective insecticides for control.

Cutworms

Several species of cutworms are found in Arkansas. Occasionally, cutworms can destroy a stand of soybeans. Damage is generally spotty in the field. Infestations most often occur during early wet seasons in conjunction with heavy vegetative cover. With the increase in reduced- and no-till throughout the state, this pest has the potential to become more of a problem. In reduced- and no-till situations, it is important to rid the field of grass and weeds three to five weeks prior to planting to help reduce the chances of a problem.

Cutworm feeding is easily detected by walking the field and looking for seedling plants which have been damaged or cut off just above or below the soil surface. Usually a small hole will be seen around the damaged plant. This is where the larva resides during daylight hours. Often the larva will cut the plant and drag the top part of the plant back to its lair.

Figure 12.17. Cutworm.

(Photo by M.E. Rice, Iowa State University)

If you suspect cutworms, dig up the soil around the plants to find if cutworms are still present. Spot treatments should be made when 30 percent or more of the plants are damaged or if plant stand counts indicate less than four to six plants per row foot (30- to 38-inch rows) and larvae are present.

Insect Scouting

Insect scouting is essential in determining pest levels in soybeans. All of the thresholds used to make insecticide application decisions are based on the number of insects found and/or the extent of damage caused by insects. Soybean fields should be scouted weekly. The time period from the onset of bloom (R1-R2) through physiological cutout (R7) is especially critical. When sampling, at least four areas in the field should be chosen at random that will provide adequate coverage of the field. Samples should be taken from each side of the field to adequately detect early insect infestations from one side of the field. Samples should be taken no less than 50 to 100 feet from the edges of the field. Remember, many insects such as grasshoppers, stink bugs and others often feed on wild hosts before entering a field and can often be detected on one side of the field which has suitable habitat before dispersing throughout the field.

In Arkansas two tools are used to sample soybean insect pests: (1) the drop cloth or shake sheet and (2) the sweepnet. Each of these methods has advantages and disadvantages.

Drop Cloth

The drop cloth is also referred to as the shake cloth or shake sheet. The drop cloth is made of heavy cloth or plastic, 36 inches in length, with a one-half inch or larger doweling about 42 inches long at both ends. Samples are taken by extending the cloth with the dowels parallel to the soybean rows and shaking the 3 feet of plants on each row over the cloth. Insects that fall onto the cloth are then counted and the total divided by six to obtain the number of insects per row foot. Some keys to taking good drop cloth counts are:

- **Bend the plants gently over the cloth, then shake vigorously** to dislodge insects onto the cloth.
- **Minimize disturbance of the plants prior to sampling** – that is, do not walk through the plants to be sampled then turn around and sample the plants.

- **Be aware of your shadow**. Many insects are triggered to fly by a shadow.
- Check the soil at the base of the plants and the areas just below and above the shake sheet. Count any insects found.
- **Count flying insects first** such as stink bugs and threecornered alfalfa hoppers before they can get away.
- Later in the season, as plants get larger, shake only one row per site. Remember to divide by three (not six) to obtain the number of larvae per row foot.

The drop cloth is very effective for sampling soybeans. It is easy to use and make. Sample uniformity is easily maintained. Late in the season, particularly when insect populations are high, the drop cloth is faster to use than the sweepnet and samples more of the plant. However, the drop cloth cannot be used effectively on narrow rows (less than 19-inch rows), drilled or broadcast soybeans.

Sweepnet

Sweepnet sampling is conducted with a heavy-duty 15-inch diameter sweepnet. Swing the net briskly through the top 15 inches of the canopy. Some of the keys to taking good samples with the sweepnet are as follows:

- The bottom of the net should be angled up so dislodged insects will fall into the net. Each pass of the net through the canopy counts as one sweep.
- Sample only one row per sweep in soybeans planted on 36-inch or greater row widths. In narrow rows, let the normal arc of the sweep continue through the adjacent row(s).
- Sweeps should be made 2 1/2 to 3 feet apart down the row, and be aware of your shadow.

The sweepnet has several advantages for sampling soybean insects. It can be used on any row width. It is more efficient to use than the drop cloth in short- to moderate-height soybeans, once the correct technique is learned. Also, the sweepnet is quicker than the drop cloth early in the season when insect populations are low. Disadvantages of the sweepnet are that sample uniformity is hard to maintain, less of the plant is sampled compared to the drop cloth, it is less efficient than the drop cloth late in the season, and sweepnets are not readily available.

Insect Management

Integrated Pest Management (IPM) is the use of all available control tactics to effectively keep pests from reaching population levels which will cause economic crop injury. These control tactics may include cultural control, biological control, host plant resistance and chemical control.

Table 12.1. Treatment Levels for Various Larval Insect Pests of Soybeans for Different Row Spacings Using a Drop Cloth

Row Spacing (inches	Larvae/Row Ft.		Comments
	CEW	SL/CL/ BAW/VBC	
38	4	6-8	Treat when worms are 1/2 inch or larger. For loopers and other defoliaters, the number of larvae is in addition to 25 percent defoliation after bloom. For drought-stressed fields, reduce CEW threshold levels by one for 30-38 inch rows and by 1/2 for 9-19 inch rows.
30	3	4.5-6	
19	2	3-4	

CEW=corn earworm; SL=soybean looper; CL=cabbage looper; BAW=beet armyworm; VBC=velvetbean caterpillar

Table 12.2. Equivalent Economic Threshold Conversion Between Drop Cloth and Sweepnet

	Drop Cloth	Sweepnet		
Insect	Number/ Ft. of Row	Number/ 25 Sweeps	Number/ 50 Sweeps	Number/ 100 Sweeps
Stink bugs	1	9	18	36
SL, CL, VBC, GCW[1]	6	29	58	116
CEW[2]	4	15	30	60

[1] SL=soybean looper; CL=cabbage looper; VBC=velvetbean caterpillar; GCW=green cloverworm. Threshold numbers in association with 40 percent defoliation before bloom and 25 percent after bloom. Number represents medium and large larvae.

[2] CEW=corn earworm. Since CEW are difficult to sample with a sweepnet, sweep deeper into the canopy using extra force. Supplement with visual checks for bloom and pod feeding.

Management Tip

Assessing pest population and damage levels is an essential component in developing a sound insect management program. Remember, it is important to check fields at least once per week, especially once bloom (R2) begins, and this should be continued through physiological maturity (R7).

Cultural Control

Cultural control of insects involves agricultural practices such as crop rotation, planting dates, tillage practices, row patterns, etc., which may help in the control of a pest. It is important to remember that such practices must be in harmony with agronomic practices that promote maximum economic yield.

Tillage such as disking, chisel plowing or other practices can expose many soil insects to an unsuitable environment. Insects such as wireworms, grape colaspis larvae, bean leaf beetle larvae, Dectes stem borer and others may be affected by stirring the soil. The effect of no-till or minimum tillage on insect pests is not well understood. However, it is theorized that no-till cultural practices may aggravate problems of soil-dwelling insect pests.

Crop rotation is one method of cultural control that has been proven effective for control of diseases, nematodes and weeds. However, little is known in regard to insect pests. Experience in Arkansas seems to indicate that problems with Dectes stem borer and grape colaspis are worse in fields with no crop rotation.

Planting date can also impact the outbreak of an insect pest. However, planting dates are generally determined by climatic conditions, varietal and economic considerations. Insect management normally should not play a major role in determining when to plant. As mentioned earlier, the early planting of MG III and IV varieties often provides insect pests such as the bean leaf beetle and stink bug with a food source which is not usually available and may result in pest populations of damaging levels. Late planting may help in avoiding problems with pests such as the bean leaf beetle and grape colaspis. However, late planting can extend the growing cycle of soybeans, resulting in greater potential to pod and seed damage by corn earworm and stink bugs. By avoiding the extremes of planting too early or too late, it may be possible to avoid some insect problems.

Row width can have a definite impact on insect problems. For agronomic as well as pest management concerns, it is critical that canopy closure be achieved by bloom (R2). It has long been realized that soybean fields which do not reach canopy closure by bloom are more susceptible to damage by the corn earworm.

Biological Control

Biological control in soybeans is, for the most part, the conservation and utilization of natural enemies of insect pests to keep them from reaching damaging levels. In the soybean IPM system, the major objective is to allow natural enemies to do their work without disruption from insecticides. Growers who make insecticide applications only when they are absolutely necessary take full economic advantage of the natural enemies. Also, when insecticides are needed, consideration should be given to products that are less disruptive to beneficial insects. *Bacillus thuringiensis* may be used for lepidopterous pests such as velvetbean caterpillar, green cloverworm and the looper complex and can provide good control.

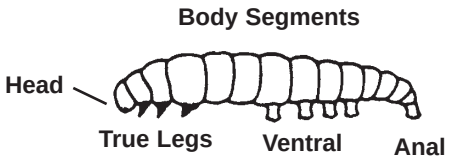
Chemical Control

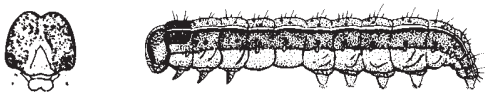
Insecticides should be thought of as a "last resort" to prevent insect damage when cultural and biological controls have failed to keep insect pests below economically damaging levels. When insect pest levels reach economic thresholds and action must be taken to avoid economic losses, conventional insecticides have been proven to provide effective and economical control. The only way to determine if an insecticide application is necessary is by scouting the field to determine pest population levels. Never assume that if one field is at treatment level, all fields should be treated. Differences in planting date, growing conditions, stage of maturity and other factors often influence pest population levels. Scout every field.

Correct insect identification is critical to ensure the use of a labeled and effective insecticide. Always read the label of any pesticide before use. Insecticides are an important component of any soybean IPM program. The careful and judicious use of the proper insecticide in accordance with instructions on the pesticide label is crucial for maintaining an effective insect management program.

Figure 12.18. Identification Guide
To Caterpillars on Soybeans Using Number of Ventral Prolegs and Description

GENERAL INSECT



Number of Ventral Prolegs and Description	Physical Appearance
ONE PROLEG	
Geometrid Larvae Various colors.	
TWO PROLEGS	
Soybean Looper Green colored, often black true legs, white stripes.	
THREE PROLEGS	
Green Cloverworm Green colored, wiggles violently when touched.	
FOUR PROLEGS	
Corn Earworm Various colors, often balls up when touched.	
Velvetbean Caterpillar Green to black colored, white stripe, wiggles violently when touched.	
Fall Armyworm Usually brown, smooth appearance, prominent white to creme colored inverted “Y” on front of head.	
Beet Armyworm Green to black, prominent black spot above second true leg.	
Yellow Striped Armyworm Double row of triangular shaped markings on back, with bright yellow stripe on side.