Insect Control Guide

— FOR —

CORN, COTTON, & SOYBEANS 2008

CORN INSECT MANAGEMENT

Managing Corn Insects

A number of insects may attack corn, and some carry diseases. For example, aphids carry maize dwarf mosaic, and leafhoppers carry corn stunt. In some years heavy infestations of insects may drastically reduce yields. In other years insect populations never reach damaging levels. In order to prevent losses due to insect damage, you must know about the pest, its biology, and recommended control methods. The following information contains brief descriptions of insect pests often found in Mississippi corn fields. This information is presented to help you identify insect pests, the resulting damage, current economic thresholds, and control practices.

To minimize the impact of pests and pest control costs,

a. Scout fields regularly. Make careful counts of insect pest populations.
b. Use all available, practical noninsecticidal IPM tools.
c. Apply insecticides promptly when needed.
d. Use the most cost-efficient insecticide recommended for the target pest. Apply insecticide during the most susceptible stage of development.
e. Follow recommended guidelines for practicing insecticide-resistance management.

Before deciding to treat and before choosing the insecticide, consider such factors as the potential to intensify secondary pest problems and insecticide resistance.

Warning

Information in this guide is provided for educational and planning purposes only. When using agricultural chemicals, you (the user) are responsible for making sure the intended use complies with current regulations and conforms to the product label. Before applying any insecticide, be sure to get current usage information. Read and heed the product label.

Precautions

Before using a pesticide, read the label carefully. Follow the directions. Pay attention to all precautions on the pesticide container label. Observe all regulations on worker protection and pesticide record keeping. Store pesticides in plainly labeled containers safely away from livestock, pets, and children. Store pesticides in an area where they will not contaminate food or feed.

Integrated Pest Management

The best approach for pest control is to combine all available management practices to reduce damage. Proper selection of corn varieties and planting dates, regular scouting for pest infestations, wise use of insecticides, timely harvest, and sanitation of crop residue will reduce the likelihood of insect damage.

Scouting

Regularly scouting cornfields is the best way to find damaging insect populations. Sample at least ten consecutive plants at each of four to five representative sites within a field. Treatment thresholds for many corn pests are much higher than in other crops, such as cotton. Therefore, you can generally check a fairly small number of plants to determine the presence of a particular pest species. If pests are present, step up scouting efforts to determine infestation levels more precisely. Corn is most open to insect injury in the seedling stage. From emergence until plants are approximately 10 inches tall, scout fields every 4 to 5 days. When plants are taller than 10 inches, sample for insect pests every week until crops mature.

Plants less than 6 inches tall: Record the number of plants examined and the number with five or more chinch bugs. Observe plants for signs of feeding or wilting from cutworms or other soil insects. Cutworms often cleanly cut plants off near the soil surface. If cut plants are found, determine whether anticipated stand loss will reduce the plant population below acceptable levels.

Emergence until tassel development: Look for signs of leaf feeding by caterpillars, flea beetles, or other pests on leaves within the whorl. As leaves emerge and unfurl from within the whorl, feeding damage usually appears as small, often regularly spaced holes or long scars on the leaves. Cut plants below the whorl. Check the leaves for worms. Record the species and the average number of worms present per plant.

After tassel development to maturity: Concentrate plant examinations from the tassel to the ear zone of the plant. In late-planted corn, look for second and third generation corn borers. Eggs are deposited on the upper and lower leaf surfaces. Look for evidence of recent feeding by small larvae on the leaf surface, at the base of the leaf, or behind the leaf sheath. When there is evidence of a corn borer infestation, randomly select plants from representative areas of the field and examine the stalks and ears. Larvae tunneling in the stalk cannot be controlled with insecticides. Corn earworm, fall armyworm, and corn borers may all be found in the ear, so species identification is important.

Suggested Planting Dates for Corn

South Mississippi: February 25 - March 15
South-Central: March 5 – April 10
North-Central: March 15 – April 20
North Mississippi: March 20 – April 25

Thresholds

Making insect management decisions based on established treatment thresholds rather than applying treatments based on schedules or presence of pests is a proven method of reducing insect management costs. Effective use of thresholds requires frequent, intensive scouting to get accurate estimates of populations of various pest species that may be present in a field.

The term "treatment threshold" means the pest population level at which treatment must be applied to avoid economic loss that would be greater than the cost of the treatment. Thresholds can vary, depending on species of pest present, stage of crop development, yield potential of the crop, cost of the treatment, market price, populations of other pests present, number of beneficial insects, potential for flaring secondary pests, ability to control secondary pests, and other factors. The thresholds recommended in this guide vary according to pest species and stage of crop development, but fixed thresholds cannot fully consider the many other factors that can influence a treatment decision.

Additional Information

In addition to the Corn Insect Control Guide, you can get several other Extension publications on corn insect biology and management from your county Extension agent.

Publication IS864 – Corn Fertilization
Publication IS1563 – Minimizing Alflatoxin in Corn
Publication IS1547 – Corn Hybrid Selection
Publication IS1548 – Corn Plant Population
Publication IS866 – Corn Planting Dates
Publication P475 – Corn Weed Control Recommendations

Insecticide Resistance and Resistance Management

CAUTION: Recommendations of specific insecticides are based on information on the manufacturer's label and performance in a limited number of tests. Levels of insecticide resistance, environmental conditions, and methods of application by growers may vary widely. For this reason, insecticide performance will not always match the safety and pest control standards indicated by experimental data.

Insecticides are listed alphabetically, not in order of their effectiveness. Effectiveness of a particular insecticide can vary a lot from field to field, depending on previous insecticide use, pest species, levels of resistance, and many other factors. A group of insecticides recommended for control of a specific pest will vary a lot in cost, effectiveness against the primary target pest, and secondary pests controlled. When selecting insecticides, growers must consider each of these factors plus the need to rotate among different insecticide classes to limit insecticide resistance problems.

Classes of insecticides: Effective resistance management requires rotation among the various classes of available insecticide chemistry. Often when one insecticide in a class fails because of insecticide resistance, other insecticides in the same class will also be ineffective. Selection of an insecticide from a different class will improve the chances of obtaining control. Growers need to be very aware of the type of insecticide chemistry being used. Classes of insecticides recommended in this guide are identified by the following abbreviations:

Avermectins – (AV)	Chloro-nicotinyl – (CN)	Organophosphate – (OP)	Pyridine Carboxamide – (PC)
Biologicals – (B)	Insect Growth Regulators – (IGR)	Oxadiazine – (OX)	Spinosyns – (SPN)
Carbamate – (C)	Organochlorine – (OC)	Pyrethroid – (P)	Tetronic Acid – (TA)

Bt Corn

Varieties of transgenic *Bt* corns, in which plants express a toxin from *Bacillus thuringensis*, are available. Currently there are restrictions on the amounts of *Bt* corn that can be planted in Mississippi. **Only 50 percent of a grower's corn acreage can be planted to *Bt* corn in cotton-growing regions.** The refuge corn can be treated with an insecticide only when pest densities exceed economic thresholds. Sprayable Bt insecticides cannot be applied to refuge corn.

PESTS BELOW GROUND

Southern Corn Rootworm, Seedcorn Maggot, Sugarcane Beetle, Lesser Corn Stalk Borer, Corn Billbug, White Grub, Wireworm, Cutworms

Most insects that attack plants at or beneath the soil surface are most damaging to corn in the seedling stage. Although many of these insects may damage older plants, seedling corn is the most likely to be injured. Many late season pests can usually be avoided by early planting. Early planting reduces the chances of insect infestations and increases yield potential. A major factor in corn insect pest management is controlling soil insects that threaten corn stands and overall plant health. The occurrence of soil insects is often spotty. But certain factors, such as reduced tillage, no-till corn, and fields with a history of soil insects warrant the use of insecticides or seed treatments at planting. The use of these products is justified when the potential for infestation is high and when rescue treatments offer less control. These products are used for prevention.

Southern Corn Rootworm

The adult southern corn rootworm is also known as the twelve-spotted cucumber beetle. Adults are found on many plants throughout the growing season. Females deposit their eggs at the base of the plants. Upon hatching, the larvae move into the root zone and begin feeding. The larva is about ½ inch long when full sized. It has three pairs of small legs just behind the head and brownish patches on the head and tail end.

Damage: Larvae damage corn seedling by feeding on and tunneling inside the roots. Larvae may also bore inside the stem just above the roots to feed on the crown of the plants, eventually killing the bud. Damaged plants often wilt, and you can find evidence of rootworm feeding if you dig up the plant and examine the root system. Severe feeding and root pruning may cause plants to lodge. This is often called "goose necking."

Control: Pre-emergence insecticides are recommended when planting after a legume crop. Treated seed will also offer control of southern corn rootworm.

Threshold: Treatment is preventive. See the table below for products used as seed treatments, in-furrow, or banded applications to control/suppress belowground pests.

Seedcorn Maggot

The seedcorn maggot is the larval stage of a fly. It feeds on decaying organic matter in the soil. Larvae are less than ¼ inch long, pale white, and they lack legs or an obvious head.

Damage: This pest attacks the germinating seed planted in cool, wet weather or corn planted to fields with freshly decaying vegetation. Heavy infestations will reduce stands and cause stunting of the plants.

Control: Damage can be prevented with the use of soil insecticides at planting or seed treatments.

Threshold: Treatment is preventive. See the table below for products used as seed treatments, in-furrow, or banded applications to control/suppress below-ground pests.

Sugarcane Beetle

This insect occurs sporadically from year to year. This beetle is black and about ½ inch long. When this pest is abundant, it can destroy stands in isolated fields. Control of this pest has been inconsistent with soil insecticides.

Damage: The sugarcane beetle feeds on the stem at or slightly below the soil surface. Feeding damage appears as a ragged hole in the base of the stem.

Control: The use of soil insecticides at planting or seed treatments may suppress sugarcane beetle infestations.

Threshold:: Treatment is preventive. See the table below for products used as seed treatments, in-furrow, or banded applications to control/suppress below-ground pests.

Lesser Cornstalk Borer

Infestations of lesser corn stalk borer are most likely during dry weather conditions in sandy soils. Sometimes silken tubes containing larvae can be found attached to plants when they are dug up for inspection. Larvae are slender, greenish, and usually wiggle violently when disturbed.

Damage: Larvae damage the corn plant by boring into the base of the stem. Damage can cause deadheart and may greatly reduce stands. Plants that experience deadheart die or are severely stunted and never produce a harvestable ear.

Control: The use of soil insecticides at planting or seed treatments offer control/suppression of infestations.

Threshold: Treatment is preventive. See the table below for products used as seed treatments, in-furrow, or banded applications to control/suppress below-ground pests.

Corn Billbug

The larvae of billbugs (snout-beetles) feed on roots and bore into the stems of corn plants.

Damage: Feeding by the adults will appear as a row of holes across the leaf when it unfurls.

Control: The uses of soil insecticides at planting or seed treatments offer some control/suppression of infestations.

Threshold: Treatment is preventive. See the table below for products used as seed treatments, in-furrow, or banded applications to control/suppress below-ground pests.

White Grub

White grubs are the larvae of May or June beetles. They are C-shaped and white to cream in color. Adult beetles lay their eggs in grass or sod.

Damage: The damage caused by white grubs is similar to that of corn rootworm larvae.

Control: The uses of soil insecticides at planting or seed treatments offer some control/suppression of infestations.

Threshold: Treatment is preventive. See the table below for products used as seed treatments, in-furrow, or banded applications to control/suppress below-ground pests.

Wireworm

Wireworms are the larval stages of click beetles. The larvae are elongated, slender, and usually brown. Depending on species, larvae may take 2 to 5 years to mature. This pest is often difficult to control in fields that were fallow or in pasture before being planted in corn. Large larvae in the field at planting are the most destructive.

Damage: Wireworm larvae feed on the seed and roots and will bore into the underground portion of the plants. This boring may lead to deadheart, a condition that severely stunts or kills the plant.

Control: The uses of soil insecticides at planting or seed treatments offer some control/suppression of infestations.

Threshold: Treatment is preventive. See the table below for products used as seed treatments, in-furrow or banded applications to control/suppress below-ground pests.

PESTS BELOW GROUND

Southern Corn Rootworm, Seedcorn Maggot, Sugarcane Beetle, Lesser Corn Stalk Borer, Corn Billbug, White Grub, Wireworm

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres One Gallon or 1.0 lb. Dry Will Treat	Application and Comments
Seed Treatments **clothianidin** (CN) Poncho 250	0.25 mg ai/ kernel			**Commercially treated seed**
thiamethoxam (CN) Cruiser 5FS	0.25 mg ai/ kernel			**Commercially treated seed**
imidacloprid (CN) Gaucho 600	0.64 mg ai/ kernel			Can be applied on farm or treated commercially
In Furrow, Banded or T-Banded **chlorpyifos** (OP) Lorsban 15G	8 oz. /1,000 row ft.			**Recommended use as T-band application** Lorsban 15G is compatible with all ALS inhibitor herbicides applied in accordance with the label.
phosphorothioate (OP) Aztec 2.1G	6.7 oz. /1,000 row ft.			Apply as a 3- to 4-inch band.
tefluthrin (P) Force 3G	3-4 oz./1,000 row ft.			Banded: Place granules in a 7-inch band directly behind planter shoe in front of or behind press wheel. Do not apply product as a band or T-band unless it can be incorporated into the top 1 inch of soil using tines, chains, or other suitable equipment.
terbufos (OP) Counter 15G	6-8 oz. /1,000 row ft.			**In-furrow treatment only. ALS-inhibiting herbicides should not be used if Counter 15G has been applied at the time of planting. See product label for additional information.**
phorate (OP) Thimet 20G	4.5-6.0 oz./1,000 row ft.			**Do not use for in-furrow application.** Banded: place granules in a 7-inch band over the row or directly behind the planter shoe in front of or behind the press wheel and lightly incorporate. Accent® herbicide and Beacon® herbicide may be applied after **banded** applications of Thimet 20G Lock'n Load.

Cutworms

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Application and Comments
Seed Treatments				
In Furrow, Banded or T-Banded				
chlorpyifos (OP) Lorsban 15G	8oz./1,000 row ft.			**Only provides cutworm control when T-banded** Lorsban 15G is compatible with all ALS inhibitor herbicides applied in accordance with the label.
phosphorothioate (OP) Aztec 2.1G	6.7 oz./1,000 row ft.			Apply as a 3-4 inch band.
tefluthrin (P) Force 3G	3-4 oz./1,000 row ft.			Banded: Place granules in a 7-inch band directly behind planter shoe in front of or behind press wheel. Do not apply product as a band or T-band unless it can be incorporated into the top 1 inch of soil using tines, chains, or other suitable equipment.
Foliar Sprays				
bifenthrin (P)				For best control, direct sprays toward base of the plants. Apply with a minimum of 15 gallons of water per acre.
Bifenture EC	2.1-6.4 oz	0.033-0.1	61-20	
Brigade 2EC	2.1-6.4 oz.	0.033-0.1	61-20	
Discipline 2EC	2.1-6.4 oz.	0.033-0.1	61-20	
Fanfare 2EC	2.1-6.4 oz.	0.033-0.1	61-20	
chlorpyifos (OP) Lorsban 4E	1-2 pt.	0.5-1.0	8-4	Lorsban may not work as well if the top of soil is dry and crusty. Some incorporation may be necessary. **Do not spray liquid Lorsban formulations in-furrow. They can injure corn.**
cyfluthrin (P) Tombstone 2E	0.8-1.6 oz.	0.007-0.013	160-80	
beta-cyfluthrin Baythroid XL	0.8-1.6 oz.	0.013-0.025	160-80	
esfenvalerate (P) Asana XL 0.66EC	5.8-9.6 oz.	0.03-0.05	22-13	
gamma-cyhalothrin (P) Prolex 1.25	0.77-1.28 oz.	0.0075-0.0125	166-100	
lambda-cyhalothrin (P)				
Karate Z 2.08	0.96-1.60 oz.	0.015-0.025	133-80	
Lambda-Cy 1EC	1.92-3.20 oz.	0.015-0.025	66.7-40	
Silencer 1EC	1.92-3.20 oz.	0.015-0.025	66.7-40	
permethrin (P)				
Ambush 2EC	6.4-12.8 oz.	0.1-0.2	20-10	
Pounce 3.2EC	4-8 oz.	0.1-0.2	32-16	
zeta-cypermethrin (P)				
Mustang Max 0.8EC	1.28-2.8 oz.	0.008-0.0175	100-45.7	
Respect 0.8EC	1.28-2.8 oz.	0.008-0.0175	100-45.7	
Pre Mixes				
bifenthrin + zeta-cypermethrin (P)				
Hero 1.24EC	2.1-6.1 oz.	0.025-0.06	49-21	

Several species of **CUTWORM** attack corn seedlings. The black cutworm is the most common pest from this group. Depending on species, most cutworms overwinter in the soil as larvae or pupae. The female moths tend to deposit their eggs in low places or areas of the fields that have been flooded. Eggs may be deposited alone or in small clusters on the leaves and stems of young plants.

DAMAGE: Depending on growth stage, larvae of the cutworm feed one of three ways. Young larvae (first and second instars) feed on the leaf surface, giving it a scuffed appearance. Late second and third instars eat holes in the leaves. Larger larvae move into the soil and feed by cutting plants at the soil surface.

CONTROL: Seedbed preparation and weed control help control cutworms. Cutworm infestations are rare in fields kept weed free by cultivation or herbicides 2 to 3 weeks before planting.

THRESHOLD: Treat with foliar sprays if populations threaten to reduce stands below acceptable levels. Infestations causing 5 percent or greater "cutting" of seedling corn generally justify treatment with insecticides.

Chinch Bug

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Application and Comments
Seed Treatments				
clothianidin (CN) Poncho 250	0.25 mg ai/kernel			**Commercially treated seed**
thiamethoxam (CN) Cruiser 5FS	0.25-0.5 mg ai/kernel			**Commercially treated seed**
imidacloprid (CN) Gaucho	0.64 mg ai/ kernel			Can be applied on farm or treated commercially
In Furrow, Banded or T-Banded				
chlorpyifos (OP) Lorsban 15G	8oz./1,000 row ft.			Lorsban 15G is compatible with all ALS inhibitor herbicides applied in accordance with the label.
tefluthrin (P) Force 3G	4-5 oz./1,000 row ft.			Suppression only **Banded:** Place granules in a 7-inch band directly behind planter shoe in front of or behind press wheel. Do not apply product as a band or T-band unless it can be incorporated into the top 1 inch of soil using tines, chains, or other suitable equipment.
terbufos (OP) Counter 15G	6-8 oz./1,000 row ft.			Controls early season light to moderate populations of chinch bug. Do not exceed 8.7 lbs. Counter 15G per acre. **Banded:** Place granules in a 7-inch band over the row, in front of the press wheel and incorporate evenly into top 1 inch of soil. **In-furrow:** Place granules directly in the seed furrow behind the planter shoe ALS-inhibiting herbicides SHOULD NOT be used if Counter 15G has been applied at planting.
Foliar Sprays				
bifenthrin (P)				For best control, direct sprays toward base of the plants. Apply with a minimum of 15 gallons of water per acre.
Bifenture EC	2.1-6.4 oz.	0.033-0.1	61-20	
Brigade 2EC	2.1-6.4 oz.	0.033-0.1	61-20	
Discipline 2EC	2.1-6.4 oz.	0.033-0.1	61-20	
Fanfare 2EC	2.1-6.4 oz.	0.033-0.1	61-20	
carbaryl (C)				
Sevin 80S	1.25-2.5 lbs.	1-2	0.64-0.32	
Carbaryl 4L	1-2 qts.	1-2	4-2	
chlorpyifos (OP) Lorsban 4E	1-2 pt.	0.5-1.0	8-4	**DO NOT apply by air in Mississippi.**
cyfluthrin (P) Tombstone 2EC	1.6-2.8 oz.	0.025-0.044	80-45.7	
beta-cyfluthrin Baythroid XL	1.6-2.8 oz.	0.013-0.022	80-45.7	
esfenvalerate (P) Asana XL 0.66EC	5.8-9.6 oz.	0.03-0.05	22-13	
gamma-cyhalothrin (P) Prolex 1.25	1.54 oz.	0.015	83	
lambda-cyhalothrin (P)				
Karate Z 2.08	1.92 oz.	0.03	66.7	
Lambda-Cy 1EC	3.84 oz.	0.03	33	
Silencer 1EC	3.84 oz.	0.03	33	
zeta-cypermethrin (P)				
Mustang Max 0.8EC	3.2-4.0 oz.	0.02-0.025	40-32	
Respect 0.8EC	3.2-4.0 oz.	0.02-0.025	40-32	
Pre Mixes				
bifenthrin + zeta-cypermethrin (P) Hero 1.24EC	4.0-10.3 oz.	0.04-0.10	32-12.4	

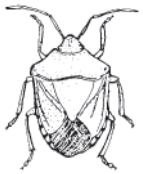
The adult **CHINCH BUG** is about ⅛ of an inch long and is black with white patches on the wings. Nymphs are reddish orange with a white band across their backs. Later instar nymphs turn darker and resemble adults as they mature. Chinch bugs overwinter on wild grasses and move into fields to feed on young plants. This pest is more likely to cause problems in dry years. Seedling plants are most susceptible to injury.

Damage: Adults and nymphs damage the plant by piercing the plant and sucking the plant juices. Extensive feeding causes plants to wilt; seedlings may die. Plants that survive heavy infestations are stunted and will develop slowly.

Control: Soil-applied insecticides and seed treatments provide control/suppression of chinch bugs. When you use foliar-applied insecticides, thorough coverage is essential.

Threshold: Count both adults and nymphs when scouting for this pest. Look for chinch bugs at the base of the plant and behind the leaf sheaths. Treatments are recommended for plants that are up to 6 inches tall when 20 percent or more of the plants have 5 or more chinch bugs per plant. Plants that are growing and healthy and taller than 6 inches can tolerate higher populations of chinch bugs.

Stink Bug



Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Application and Comments
Foliar Sprays				
bifenthrin (P)				
Bifenture EC	2.1-6.4 oz.	0.033-0.010	61-20	
Brigade 2EC	2.1-6.4 oz	0.033-0.010	61-20	
Discipline 2EC	2.1-6.4 oz	0.033-0.010	61-20	
Fanfare 2EC	2.1-6.4 oz	0.033-0.010	61-20	
cyfluthrin (P)				
Tombstone 2EC	1.6-2.8 oz.	0.025-0.044	80-45.7	
beta-cyfluthrin			80-45.7	
Baythroid XL	1.6-2.8 oz	0.013-0.022		
gamma-cyhalothrin (P)				
Prolex 1.25	1.02-1.54 oz.	0.01-0.015	125-83	
lambda-cyhalothrin (P)				
Karate Z 2.08	1.28-1.92 oz.	0.02-0.03	100-66.7	
Lambda-Cy	2.56-3.84 oz.	0.02-0.03	50-33	
Silencer 1EC	2.56-3.84 oz.	0.02-0.03	50-33	
methyl parathion (OP)				Do not apply during pollen shed if bees are foraging.
Methyl 4EC	0.5 pt.	0.25	16	
Penncap-M	1-3pt.	0.25-0.75	8-2.7	
zeta-cypermethrin (P)				
Mustang Max 0.8EC	2.72-4.0 oz.	0.017-0.025	47-32	
Respect 0.8EC	2.72-4.0 oz.	0.017-0.025	47-32	
Pre Mixes				
bifenthrin + zeta-cypermethrin (P)				
Hero 1.24EC	4.0-10.3 oz.	0.04-0.10	32-12.4	

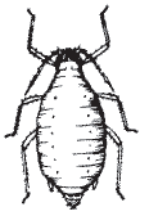
Several species of **STINK BUG** occasionally attack corn and cause extensive damage. Stink bugs can be found feeding in the whorl of young plants or on developing ears before silking. Populations of stink bugs are often higher following mild winters.

DAMAGE: Damage from stink bugs feeding on seedling and whorl stage corn may cause the whorl to turn yellow or even kill the plant. Feeding during ear development (about 2 weeks before silking) may result in total ear loss or what is called "cow-horned" ears. Stinkbugs also feed on the developing ears, piercing the shuck to feed on individual kernels.

CONTROL: When you use foliar-applied insecticides, thorough coverage is essential.

THRESHOLD: Treat corn shorter than 2 feet tall when 10 percent of the plants have one or more stink bugs present. For protection during ear development (before silking), treat when 5 percent of plants have stink bugs at or before ear shoot development. Treatments are not recommended for stink bug control at or beyond the silking stage. Pyrethroids are less effective on brown stink bugs.

Aphids



Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Application and Comments
Seed Treatments				
clothianidin (CN) Poncho 250	0.25 mg ai/kernel			**Commercially treated seed**
thiamethoxam (CN) Cruiser 5FS	0.25 mg ai/kernel			**Commercially treated seed**
imidacloprid (CN) Gaucho 600	0.64 mg ai/kernel			Can be applied on farm or treated commercially
Foliar Sprays				
bifenthrin (P)				
Bifenture EC	2.1-6.4 oz.	0.033-0.10	61-20	
Brigade 2EC	2.1-6.4 oz.	0.033-0.10	61-20	
Discipline 2EC	2.1-6.4 oz	0.033-0.10	61-20	
Fanfare 2EC	2.1-6.4 oz	0.033-0.10	61-20	
esfenvalerate (P)				
Asana XL 0.66EC	5.8-9.6 oz.	0.03-0.05	22-13	
gamma-cyhalothrin (P)				
Prolex 1.25	1.02-1.54 oz.	0.01-0.015	125-80	
lambda-cyhalothrin (P)				
Karate Z 2.08	1.28-1.92 oz.	0.02-0.03	100-66.7	
Lambda-Cy 1EC	2.56-3.84 oz.	0.02-0.03	50-33	
Silencer 1EC	2.56-3.84 oz.	0.02-0.03	50-33	
zeta-cypermethrin (P)				
Mustang Max 0.8EC	2.72-4.0 oz.	0.017-0.025	47-32	Control may vary depending on species and host-plant relationships.
Respect 0.8EC	2.72-4.0 oz.	0.017-0.025	47-32	
Pre Mixes				
bifenthrin + zeta-cypermethrin (P)				
Hero 1.24EC	4.0-10.3 oz.	0.025-0.10	32-12.4	

APHIDS (plant lice) are soft-bodied insects that feed by sucking plant juices. The corn leaf aphid is the most common aphid found in corn, but several other species may also occur.

Damage: Aphids can be found in clusters on the leaves or in the whorl. Heavy infestations may cause sticky "honeydew" on leaves.

Control: Beneficial insects usually control aphid populations in the field. Insecticide treatments are seldom warranted. Aphids are parasitized by small parasitoid wasps and are susceptible to a fungal disease. Parasitized aphids are usually brown and larger than other aphids in the colony.

Threshold: Very young corn plants (shorter than 3 inches) may require treatment when an average of 10 or more corn leaf aphids are present. Control measures are not typically recommended because infestations rarely cause yield reductions.

Corn Earworm/ Armyworm

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Application and Comments
Foliar Sprays				Use insecticides as coarse spray in 15 gallons or more spray per acre. Apply directly into the whorl.
bifenthrin (P)				
Bifenture EC	2.1-6.4 oz.	0.033-0.10	61-20	
Brigade 2EC	2.1-6.4 oz.	0.033-0.10	61-20	
Discipline 2EC	2.1-6.4 oz	0.033-0.10	61-20	
Fanfare 2EC	2.1-6.4 oz	0.033-0.10	61-20	
cyfluthrin (P)				
Tombstone 2EC	1.6-2.8 oz.	0.025-0.044	80-45.7	Use the highest rate for FAW larvae (first and second instar).
beta-cyfluthrin				
Baythroid XL	1.6-2.8 oz.	0.013-0.022	80-45.7	
esfenvalerate (P)				
Asana XL 0.66EC	5.8-9.6 oz.	0.03-0.05	22-13	
gamma-cyhalothrin (P)				
Prolex 1.25	0.77-1.54 oz.	0.0075-0.015	166-83	CEW rate 0.77-1.28 oz., FAW rate 1.02-1.54 oz. (suppression only for FAW).
lambda-cyhalothrin (P)				
Karate Z 2.08	0.96-1.92 oz.	0.015-0.03	133-66.7	Use higher rates for larger armyworm larvae.
Lambda-Cy 1EC	1.92-3.84 oz.	0.015-0.03	66.7-33.3	Target first and second instar FAW only.
Silencer 1EC	1.92-3.84 oz.	0.015-0.03	66.7-33.3	
methomyl (C)				
Lannate SP	0.25-0.5 lb.	0.225-0.45	4-2	
permethrin (P)				
Ambush 2EC	6.4-12.8 oz.	0.1-0.2	20-10	
Pounce 3.2EC	4-8 oz.	0.1-0.2	32-16	
zeta-cypermethrin (P)				
Mustang Max 0.8EC	1.76-4.0 oz.	0.011-0.025	72.7-32	Use the higher rate for FAW larvae 3.2-4.0 oz.
Respect 0.8EC	1.76-4.0 oz.	0.011-0.025	72.7-32	
Spinosad (SPN)				
Tracer 4SC	1-3 oz.	0.03-0.094	128-42.6	CEW rate 2-3 oz. FAW rate 1-3 oz. Do not apply more than 6 oz. of Tracer per acre per year.
Pre Mixes				
bifenthrin + zeta-cypermethrin (P)				
Hero 1.24EC	4-10.3 oz.	0.04-0.10	32-12.4	

CORN EARWORMS and fall **ARMYWORMS** are common pests that feed in the whorl before tassel. It is very important to identify the species present in the field properly because some products recommended for corn earworm will not control fall armyworms. Choose an insecticide effective against the complex of caterpillars when both species are present and control is necessary. Corn earworm larvae vary greatly in color, from light green or pink to dark brown with alternating light and dark stripes running lengthwise on the body. The surface of the larva is covered with small thorn-like projections (hairs). The fall armyworm has a darker head capsule with a prominent white inverted Y. This is a distinguishing characteristic of the fall armyworm.

Damage: Corn plants can tolerate considerable amounts of damage from whorl-feeding caterpillars. Populations seldom build to damaging levels unless corn is planted after the recommended planting dates. Feeding by heavy, sustained infestations may lead to deadheart and can damage yield.

Control: Timely planting is the preferred method of management. Plants in the seedling to early whorl stage are the most susceptible to damage. Check plants in this early-whorl stage regularly if planted after April 25. Whorl-feeding insects are in a protected area, and the use of adequate spray volume is critical to get control. Apply insecticides in a minimum of 15 gallons of spray volume per acre. Set nozzles to spray directly in the whorl. Aerial application will not give good control of worms feeding in the whorl.

Threshold: Treatments are warranted when you detect an average of one or more larvae per plant from emergence to mid-whorl stage corn. It is not considered economical to treat for corn earworm or fall armyworm in the ear.

European Corn Borer

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Application and Comments
Foliar Sprays				
bifenthrin (P)				
Bifenture EC	2.1-6.4 oz.	0.033-0.10	61-20	
Brigade 2EC	2.1-6.4 oz.	0.033-0.10	61-20	
Discipline 2EC	2.1-6.4 oz	0.033-0.10	61-20	
Fanfare 2EC	2.1-6.4 oz	0.033-0.10	61-20	
cyfluthrin (P)				
Tombstone 2EC	1.6-2.8 oz.	0.025-0.044	80-45.7	
beta-cyfluthrin				
Baythroid XL	1.6-2.8 oz.	0.013-0.022	80-45.7	
esfenvalerate (P)				
Asana XL 0.66EC	7.8-9.6 oz.	0.04-0.05	16-13	
gamma-cyhalothrin (P)				
Prolex 1.25	1.02-1.54 oz.	0.01-0.015	125.5-83	
lambda-cyhalothrin (P)				
Karate Z 2.08	1.28-1.92 oz.	0.02-0.03	100-66.7	
Lambda-Cy 1EC	2.56-3.84 oz.	0.02-0.03	50-33.3	
Silencer 1EC	2.56-3.84 oz.	0.02-0.03	50-33.3	
methoxyfenozide (IGR)				
Intrepid 2F	4-8 oz.	0.06-0.12	32-16	
permethrin (P)				
Ambush 2EC	6.4-12.8 oz.	0.1-0.2	20-10	
Pounce 3.2EC	4-8 oz.	0.1-0.2	32-16	
zeta-cypermethrin (P)				
Mustang Max 0.8EC	2.72-4.0 oz.	0.017-0.025	47-32	
Respect 0.8EC	2.72-4.0 oz.	0.017-0.025	47-32	
Spinosad (SPN)				
Tracer 4SC	1-3 oz.	0.03-0.094	128-42.6	
Pre Mixes				
bifenthrin + zeta-cypermethrin (P)				
Hero 1.24EC	4-10.3 oz.	0.04-0.10	32-12.4	

EUROPEAN CORN BORERS are found mostly in north Mississippi. The larvae are gray or tan with rows of light brown spots. Normally there are three generations per year in Mississippi. First-generation corn borers attack plants in the early stages of development. Second- and third-generation corn borers may cause plant lodging and ear drop.

DAMAGE: Feeding signs show up as rows of pinholes or rectangular lesions in the leaf as it unfolds from the whorl. Larvae begin boring into the stalk tissue at about 10 days old. After entering the stalk, larvae may tunnel throughout the plant, including the ear shank.

CONTROL: To achieve adequate control, apply insecticide to prevent tunneling when you find egg masses or young larvae. Good coverage is a must for satisfactory control. Insecticides must be applied before larvae enter the stalk. Fall tillage reduces overwintering populations of corn borers. Corn varieties expressing *Bacillus thuringiensis* (Bt corn) provide excellent control for European and Southwestern corn borer. Current restrictions only allow 50 percent of the corn acreage in cotton-growing regions to be planted to Bt corn. When using pyrethroids for control, multiple applications are usually required because of extended egg laying and short residual of products.

THRESHOLD: Apply insecticides when larvae or egg masses are present on 50 percent or more of the plants. Good coverage is essential for satisfactory control. Insecticides must be applied before larvae enter the stalk.

Southwestern Corn Borer

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Application and Comments
Foliar Sprays				
bifenthrin (P)				
Bifenture EC	2.1-6.4 oz.	0.033-0.10	61-20	
Brigade 2EC	2.1-6.4 oz.	0.033-0.10	61-20	
Discipline 2EC	2.1-6.4 oz	0.033-0.10	61-20	
Fanfare 2EC	2.1-6.4 oz	0.033-0.10	61-20	
cyfluthrin (P)				
Tombstone 2EC	1.6-2.8 oz.	0.025-0.044	80-45.7	
beta-cyfluthrin				
Baythroid XL	1.6-2.8 oz.	0.013-0.022	80-45.7	
esfenvalerate (P)				
Asana XL 0.66EC	7.8-9.6 oz.	0.03-0.05	22-13	
gamma-cyhalothrin (P)				
Prolex 1.25	1.02-1.54 oz.	0.01-0.015	125.5-83	
lambda-cyhalothrin (P)				
Karate Z 2.08	1.28-1.92 oz.	0.02-0.03	100-66.7	
Lambda-Cy 1EC	2.56-3.84 oz.	0.02-0.03	50-33.3	
Silencer 1EC	2.56-3.84 oz.	0.02-0.03	50-33.3	
methoxyfenozide (IGR)				
Intrepid 2F	4-8 oz.	0.06-0.12	32-16	
permethrin (P)				
Ambush 2EC	6.4-12.8 oz.	0.1-0.2	20-10	
Pounce 3.2EC	4-8 oz.	0.1-0.2	32-16	
zeta-cypermethrin (P)				
Mustang Max 0.8EC	2.72-4.0 oz.	0.017-0.025	47-32	
Respect 0.8EC	2.72-4.0 oz.	0.017-0.025	47-32	
Spinosad (SPN)				
Tracer 4SC	2-3 oz.	0.0625-0.094	64-42.6	
Pre Mixes				
bifenthrin + zeta-cypermethrin (P)				
Hero 1.24EC	4-10.3 oz.	0.04-0.10	32-12.4	

The **SOUTHWESTERN CORN BORER** occurs statewide but is now more abundant in the Delta than in other areas of the state. Larvae are white with distinct black spots covering the body. There are three generations of SWCB each year. Part of the second generation and all of the third generation will overwinter. Pheromone traps can be used to detect peak emergence for each generation. These traps can also be used as an indicator for intensified scouting efforts in the field.

Damage: SWCB causes plant damage by leaf feeding, stalk tunneling, ear feeding, and girdling the base of the plant. Young larvae will feed in the whorl or on leaves for about 10 days before boring into the stalk. Overwintering larvae will girdle the inside of the stalk at the base of the plants, just above the soil line. The girdling causes lodging of plants, especially in late-planted corn. Fields with a high percentage of lodging will slow harvest operations.

Control: Corn planted within the recommended planting dates and harvested in a timely fashion will generally not be susceptible to girdling damage by the third generation corn borers. To achieve adequate control, you must apply insecticide to prevent tunneling while there are egg masses or young larvae. Good coverage is essential for satisfactory control. Insecticides must be applied before larvae enter the stalk. Fall tillage is also an important management practice to reduce overwintering populations of corn borers. Corn varieties expressing *Bacillus thuringiensis* (Bt corn) provides excellent control for European and Southwestern corn borer. Current restrictions only allow 50 percent of the corn acreage in cotton-growing regions to be planted to Bt corn.

Threshold: Apply insecticides when larvae or egg masses are present on 25 percent or more of the plants. Currently, there is no threshold for insecticide applications based on SWCB pheromone trap captures. Good coverage is essential for satisfactory control and insecticides must be applied before larvae enter the stalk.

SPRAY DRIFT PRECAUTIONS

- Keep all aerial and ground application equipment maintained and calibrated using appropriate carriers.
- Do not make aerial or ground applications during temperature inversions.
- Make aerial or ground applications when wind speed favors on-target product placement (approximately 3-10 mph). Do not apply when wind speed exceeds 15 mph.
- For aerial applications, mount the spray boom on the aircraft to reduce drift caused by wing tip or rotor vortices. Boom length must not exceed 75 percent of wing span or rotor diameter.
- When using pyrethroid insecticides, do not apply by ground within 25 feet or by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries, commercial fish ponds, or other bodies of water. Increase the buffer zone to 450 feet when ultralow volume (ULV) applications are made. Be sure to observe all other label restrictions regarding drift precautions for pyrethroids and all other insecticides.

COTTON INSECT MANAGEMENT

Integrated Pest Management

Successful, economical control of cotton insect pests requires using a variety of control methods instead of only one, such as scheduled insecticide use. This approach to insect control is called integrated pest management, or IPM. Current cotton insect control recommendations are based on the IPM concept.

Insecticides are a key part of cotton IPM, but relying only on insecticides is not possible in Mississippi.

The objective of cotton IPM is to use all available, practical, nonchemical methods of suppressing insect populations; to monitor pest populations closely; and, when scouting indicates that pest populations have exceeded economic thresholds, to integrate insecticides in a way that optimizes crop production and minimizes ecosystem disruption.

Because of the number of insect pests that attack cotton and the relatively high unit value of the crop, cotton IPM is quite complex. Management tactics applied against one pest may be favorable or unfavorable to the development of other pests in the system. Also, treatments applied during one part of the season may affect future pest populations or your ability to control those pests at later points during the season or in the following years. An overall cotton IPM program must consider these types of long-term effects. They greatly influence the ability of Mississippi growers to maintain economical cotton production.

There are many aspects of IPM that must be used to manage cotton insect pests effectively. These include using resistant varieties, managing for early crop maturity, various cultural practices, insecticide resistance management, using economic thresholds, thorough scouting, and timely application of insecticides when needed.

Objective

To produce an early high-yielding crop, follow recommended practices for soil preparation, variety, planting dates, use of fungicides and herbicides, and protection from insect and mite damage.

To minimize the impact of pests and pest control costs,

a. Scout fields regularly. Make careful counts of insect pest populations.
b. Use all available, practical noninsecticidal IPM tools.
c. Apply insecticides promptly when needed.
d. Use the most cost-efficient insecticide recommended for the target pest. Apply insecticide during the most susceptible stage of development.
e. Follow recommended guidelines for practicing insecticide-resistance management.

Before deciding to treat and before choosing the insecticide, consider such factors as the potential to intensify secondary pest problems and insecticide resistance.

Warning

Information in this guide is provided for educational and planning purposes only. When using agricultural chemicals, you (the user) are responsible for making sure the intended use complies with current regulations and conforms to the product label. Before applying any insecticide, be sure to get current usage information. Read and heed the product label.

Precautions

Before using a pesticide, read the label carefully. Follow the directions. Pay attention to all precautions on the pesticide container label. Observe all regulations on worker protection and pesticide record keeping. Store pesticides in plainly labeled containers safely away from livestock, pets, and children. Store pesticides in an area where they will not contaminate food or feed.

Resistance

Research indicates most cotton pests are pesticide resistant. Some pesticides control pests in one area and not another. Excessive use of pesticides will intensify the problem.

Scouting

Proper scouting is the backbone of an effective cotton insect management program. The goal of any scouting program should be to minimize insecticide use and insect control costs by avoiding unnecessary treatments and by timing required treatments properly. Effective scouting requires spending enough time in the field and taking enough samples to make an accurate decision on whether or not treatment is required. Frequency of scouting is critical. During most of the growing season, scout fields thoroughly every 3 to 4 days. Allow enough time in the scouting schedule to allow more frequent "spot checks" when necessary.

Thresholds

Making insect management decisions based on established treatment thresholds rather than applying treatments based on schedules or presence of pests is a proven method of reducing insect management costs. Effective use of thresholds requires frequent, intensive scouting to get accurate estimates of populations of various pest species that may be present in a field.

The term "treatment threshold" means the pest population level at which treatment must be applied to avoid economic loss that would be greater than the cost of the treatment. Thresholds can vary, depending on species of pest present, stage of crop development, yield potential of the crop, cost of the treatment, market price, populations of other pests present, number of beneficial insects, potential for flaring secondary pests, ability to control secondary pests, and other factors. The thresholds recommended in this guide vary according to pest species and stage of crop development, but fixed thresholds cannot fully consider the many other factors that can influence a treatment decision. Although the thresholds recommended in this guide are generally somewhat conservative (quick to treat), factors such as multiple pest species or unusually low fruit retention could indicate a need to reduce thresholds. Factors like high beneficial insect populations, risk of flaring difficult-to-control secondary pests, high treatment costs, or low price potential could indicate a need to use higher thresholds.

Variety Selection

Available varieties have different levels of susceptibility to certain insect pests. Consider insect resistance/tolerance when selecting seed varieties. Some key traits and their general effect on certain insects are as follows:

Early Maturity — Early maturing, short-season varieties are more likely to escape attack/damage from late-season infestations of budworm/bollworm, beet armyworm, fall armyworm, etc.

Smooth Leaf — Aphid and whitefly populations tend to be reduced on smooth leaf varieties. Budworm/bollworms tend to deposit fewer eggs than on hairy varieties. The smooth leaf trait may somewhat favor plant bugs.

Okra Leaf – Varieties with okra leaf trait allow improved canopy penetration of foliar insecticide treatments. This trait also has been associated with resistance to whiteflies.

Nectariless—Plant bug populations tend to be lower on nectariless varieties. Also, the nectariless trait tends to reduce egg production capacity of most moth species because of reduced nectar availability. Populations of beneficial insects that help suppress bollworm/budworm are also generally lower in nectariless cotton.

High Glanding — Varieties with the high glanding trait have additional gossypol glands, increasing resistance to budworm/bollworm.

Bt-transgenic Varieties —Transgenic varieties containing the Bollgard Bt gene provide good resistance to tobacco budworm and bollworm and suppression of some other caterpillar pests. Dual gene transgenic varieties (Bollgard II and Widestrike) provide better suppression of bollworms and other caterpillar pests than Bollgard cotton does.

Cultural Practices

Cultural practices can affect populations of specific insect pests. Here are effects of some common cultural practices:

Fall Stalk Destruction — Destroying stalks as soon as possible after harvest helps reduce populations of overwintered boll weevils dramatically.

Fall Tillage — Budworm/bollworm overwinter as pupae 1 to 3 inches deep in the soil. Fall tillage destroys some pupae and disrupts exit tunnels, reducing numbers that emerge from overwintering.

Spring Tillage — Destroying weeds and/or cover crops by tillage or herbicide at least 3 weeks before planting minimizes risk of cutworm problems. Tilling in early spring, before April 15, will also destroy many overwintering tobacco budworm and bollworm pupae.

No-till Planting — No-till planting has both negative and positive effects on cotton insect populations. Fields planted no-till are at greater risk for cutworm infestations. They are much more likely to have stand-threatening infestations of occasional early-season seedling pests, such as grasshoppers, false chinch bugs, and a variety of other pests. Scout fields planted no-till very frequently during the first 3 to 4 weeks after emergence. One of the most significant features of no-till production is the establishment of high populations of fire ants. Fire ants will tend and protect certain sucking pests, such as aphids and three-cornered alfalfa hoppers, causing their numbers to be higher in no-till cotton. But fire ants are also very aggressive predators of the eggs, larvae, and pupae of caterpillar pests. The impact of fire ants on caterpillar populations in no-till cotton can be very significant, and it is not unusual for fire ants and other beneficial insects together to suppress caterpillar pests in both Bt and non-Bt fields that are planted no-till. High numbers of snails and negro bugs often occur in no-till fields, but neither of these species has been observed to cause damage to cotton, even when populations are extremely high.

Plant Stand Density — Excessive plant stand density can result in delayed fruit initiation and delayed maturity, increasing exposure to late-season insects.

Early Maturity — Early maturing crops are more likely to escape attack/damage from late-season infestations of tobacco budworm, bollworm, armyworms, loopers, and other pests. Cultural practices such as excessive nitrogen use, late irrigation, or excessive stand density can result in delayed maturity and increased exposure to late-season insects.

Insecticide Treatment Termination —End insecticide treatments for tobacco budworm, bollworm, and other pests as soon as crop maturity monitoring indicates the crop is reasonably safe from further damage. This step will reduce insecticide use, control costs, and reduce future insecticide resistance.

Border Vegetation Management — Plant bugs can build up on flowering plants growing around field borders. They may move into cotton fields when the flowering plants are destroyed or begin to dry up. Timely mowing of such areas can help reduce available hosts for plant bugs. Mow before cotton is established. Mowing after these weed hosts begin forming flower buds will only force plant bugs into nearby cotton. Wild geranium is an important spring host of tobacco budworm, and controlling it by mowing or displacing it with a non-host plant may help reduce tobacco budworm populations. Caution: do not spray field borders with insecticides. Such use is not labeled and may worsen pesticide resistance.

Biological Control

Mississippi cotton producers are fortunate to have a wide array of naturally occurring biological control agents that play an important role in managing pest populations. Collectively, these biological control agents are the main method of controlling cotton insect pests in Mississippi. Often the full economic value of these biological agents is not recognized or appreciated. Severe outbreaks resulting in high levels of crop loss or unusually high control costs seldom occur unless natural control has been disrupted. Profitable cotton production would not be possible in Mississippi without the help of these biological control agents. These biological agents include predators such as big-eyed bugs, lady beetles, spiders, and minute pirate bugs; parasites such as Cardiochiles, a wasp that parasitizes tobacco budworms; and diseases such as the Neozygites fungal disease, which helps control aphid outbreaks. To gain the maximum economic benefit from the control provided by these natural control agents, growers need to know which species are beneficial, how to identify these species, which pests they attack, what factors enhance their usefulness, when they are most useful, and when they may not provide effective control.

Predators and Parasites

Predators and parasites can often prevent a pest population from reaching treatable levels, and the control they provide is often cheaper, better, and longer lasting than that provided by insecticides. Be aware of population levels of naturally occurring predators and parasites and recognize that treatment thresholds can often be increased when predator and population levels are high. Certain cultural practices may favor populations of specific predators. (For example, reduced tillage encourages fire ants.) When insecticide treatment is necessary, choose treatments that have minimal impact on populations of certain beneficial insects but still control the target pest.

Pathogens or Diseases

Most species of insect pests are susceptible to one or more known diseases. In some cases, the impact of the disease is relatively subtle and slows population development. In other cases, the disease is quite dramatic, providing quick, almost total control of a pest population that has neared or exceeded damaging levels. Growers should be especially aware of these latter types of diseases because an outbreak of this type can eliminate the need for any insecticide treatment. Two examples of diseases of this type are the Neozygites fungal disease, which attacks cotton aphid populations, and a similar fungal disease, which attacks loopers.

Eradication

When feasible, eradication of a pest can be a highly effective IPM tool. Eradication is seldom feasible for native pests, but it is sometimes possible to eradicate nonnative pests, such as the boll weevil. Since it invaded the state in the early 1900s, the boll weevil has been considered to be a "key pest" of cotton. This is because the early season insecticide treatments that had to be applied to control boll weevil also destroyed beneficial insects and caused a flare-up of "secondary pests," such as tobacco budworms and cotton aphids. Eradication of the boll weevil eliminates the yield losses and control costs that are directly caused by boll weevil. Eradication also eliminates yield losses and control costs from secondary pest problems that are caused by boll weevil control efforts.

Currently, all cotton in Mississippi is involved in some phase of a boll weevil eradication program, but low numbers of boll weevils remain in most areas of the state. Producers and consultants can help support boll weevil eradication efforts in a variety of ways: • Avoid planting cotton in small, tree-bound fields that are difficult to treat. • Make boll weevil eradication personnel aware of all cotton fields. • Provide boll weevil eradication personnel access to all cotton fields. • Assure that pheromone traps are kept standing and operational. • **Promptly alert eradication personnel of any field detections of live boll weevils or weevil-punctured squares.** • Destroy stalks as soon as possible after harvest.

Additional Information

In addition to the Cotton Insect Control Guide, several other Extension publications on cotton insect biology and management are available at **www.MSUcares.com** or from your county Extension agent.

Publication 1614—Pests, Thresholds, and the Cotton Plant

Publication 1640—Cotton Insect ID Guide

Publication 2294—The Boll Weevil in Mississippi: Gone but Not Forgotten
Publication 2108—Insect Scouting and Management in Bt-Transgenic Cotton
Publication 2302—Biology and Control of Thrips on Seedling Cotton
Cotton Insect Situation Newsletters (call 662-325-2085 for information)

MSU Cotton Entomology web site: **MSUcares.com/insects/cotton**

NOTE: The scientific name of the cotton bollworm, formerly *Heliothis zea*, has been changed to *Helicoverpa zea*. However, in this guide the use of *Heliothis* or *Heliothis spp*. continues to refer to both **cotton bollworm** and **tobacco budworm**.

Insecticide Resistance and Resistance Management

"Insecticide Resistance" can be defined as "increased tolerance to a particular insecticide by a pest population to the point the insecticide no longer controls effectively." This definition applies to insecticides delivered through transgenic crops as well as to foliar applied insecticides.

Resistance develops as a result of repeated or continuous exposure of a pest population to a particular insecticide or class of insecticides. Following an insecticide application, the death rate for susceptible insects is considerably higher than the death rate of resistant insects. The numbers of resistant insects increase, and the resistance genes are passed down to the next generation. If the same insecticide or class of insecticide is used against the next generation of pests, the level of resistance increases even more. At first the number of resistant individuals within a population may be really low — 1 in every 10,000 or more — and the pesticide is very effective. However, if you keep using the same insecticide or class of insecticides, the percent of the population made up of resistant insects increases. As a result, that pesticide or pesticide class becomes less efficient, and field failures begin to occur.

High Cost of Resistance: Resistance is costly to cotton producers because it creates the need to increase insecticide rates, shorten treatment intervals, use expensive mixtures of insecticides, or use more costly alternative insecticides to maintain effective control. Reduced control means lower yield, which further reduces profits. Without effective treatment alternatives, outbreaks of resistant pests can result in disastrous levels of crop destruction.

Resistance Management: "Insecticide resistance management" can be defined as "a plan of insecticide use that limits exposure of a pest population to a particular class of insecticide chemistry in order to prolong the useful life of that insecticide or class of insecticides." It is important to note that the goal of resistance management is not necessarily to prevent resistance from ever occurring, but to slow the development of resistance.

To be most effective, resistance management must be started before resistance is evident (while the frequency of resistance genes is very low) rather than after resistance is evident in the field (when the frequency of resistance is high). Because most cotton insects can readily move from farm to farm, resistance management efforts are most effective when all producers in a large geographic area practice them.

With foliar insecticides, selection for resistance may occur whenever an insecticide is used, simply because the pests that survive exposure to the treatment are more likely to be resistant. After an insecticide has been applied, the proportion of the pest population that carries genes for resistance to that insecticide is higher. With foliar insecticides, you can delay resistance by not exposing successive generations of pests to insecticides from the same class. Rotating different classes of insecticides against different generations of pests is an effective resistance management tool because insects resistant to one class of chemistry are often susceptible to insecticides from a different class. This provides immediate benefits in terms of improved control and long-term benefits in terms of reduced selection for resistance.

The risk of resistance developing to transgenic control methods is especially high because the toxicant is present throughout the life of the plant, and any target pests that attack the crop are subjected to selection for resistance. With transgenic crops, resistance can be delayed by limiting the planting of crops that express a particular insecticide and by planting significant acreage of non-transgenic crops close to the transgenic crops. The objective is to let nonresistant insects from the non-transgenic crops interbreed with any resistant insects that survive in the transgenic crop.

In past years cotton growers have had difficulty effectively managing resistance because of the limited availability of effective alternative control tools. Mississippi growers are now very fortunate to have a wide array of tools available to control many of the most damaging pests. These include boll weevil eradication, transgenic Bt cotton, and an impressive array of highly effective foliar-applied insecticides. By effectively using all of these tools and avoiding overuse of any single method of control, Mississippi cotton producers have a greater opportunity than ever before to practice resistance management effectively.

Resistance Management Plan, Caterpillar Pests: Growers can optimize their ability to manage resistance to both Bt cotton and foliar applied insecticides by observing the following precautions:

1) Continue to support boll weevil eradication/eradication maintenance and take advantage of the benefits it offers in managing caterpillar pests. These benefits include increased ability to rely on beneficial insects to suppress populations of caterpillar pests and an overall reduction in the number of foliar insecticide treatments required to control caterpillar pests.
2) Plant the crop in a timely manner (April 15 to May 15 is the optimum planting window). Manage crop to promote early maturity.

3) Plant both Bt and non-Bt varieties. (See additional resistance management guidelines for Bt cotton.)
4) Avoid planting large blocks of either Bt or non-Bt varieties. Plant fields in a manner that results in a patchwork of Bt and non-Bt fields so no Bt field is more than ½ mile from a non-Bt field.
5) Plant fields that historically experience heaviest tobacco budworm infestations to Bt varieties.
6) Scout Bt fields for caterpillar pests and treat promptly with supplemental foliar insecticides if you detect damaging levels of caterpillar pests.
7 When non-Bt fields require treatment for caterpillar pests, rotate use of different classes of foliar insecticides against different generations of pests. Do not use the same insecticide or class of insecticides on successive generations of pests.
8) Stop insecticide applications as soon as the majority of the harvestable crop reaches maturity.

Resistance Management Guidelines, Bt Cotton: Because Bollgard cotton provides season-long activity against tobacco budworm and bollworm, there is a high potential for one or both of these pests to develop resistance unless an effective resistance management plan is implemented. Resistance management in Bollgard cotton uses the refuge approach to maintain a pool of susceptible moths to mate with resistant moths that may survive on Bollgard cotton. Success of this approach depends strongly on how close non-Bollgard refuges are planted to Bollgard cotton and on how well cotton producers manage refuge acres and comply with refuge requirements.

One of three refuge options is required for growers who plant Bt cotton. **Of these three options, the 20 percent non-Bt refuge option is recommended.** Remember that 20 percent is the minimum recommended refuge size. Growers are encouraged to plant higher percentages of non-Bt cotton to make the best use of available varieties and insect management tools and to slow development of resistance.

CAUTION: Before choosing and planting a refuge option, check the grower licensing agreement and refuge guidelines (Bollgard Refuge Guide) provided by the company for full details and requirements of each option. The following is a general overview of each refuge option.

OPTION 1:
20 Percent, Sprayed Refuge Option (treated for budworm/bollworm)
At least 20 percent of total acreage must be planted to non-Bt varieties.
• All Bollgard fields must be within 1 mile (preferably ½ mile) of a non- Bollgard field.
• The refuge may be treated to control tobacco budworm, bollworm, and other cotton pests.
• Foliar Bollgard products should not be used on designated refuge areas.

OPTION 2:
5 Percent, Unsprayed Refuge Option (untreated for budworm/bollworm)
Five percent of total acreage must be planted to non-Bollgard varieties.
- All Bollgard fields must be within ½ mile of a non-Bollgard refuge planting.
- Non-Bollgard refuge plantings must average at least 150 feet wide.
- The five percent refuge should not be treated for control of caterpillar pests.
- Non-caterpillar pests such as thrips and plant bugs should be controlled on the refuge crop.
- The refuge crop should be planted and managed similarly to the Bollgard cotton, with a goal of producing a refuge crop with high vigor, fruit production, and yield potential.

OPTION 3:
5 Percent, Embedded Refuge Option (treated for budworm/bollworm only when Bt fields are treated)
Five percent of total acreage must be planted to non-Bollgard varieties.
- For large fields, each field must contain a refuge planting (embedded refuge).
- Small fields may be grouped into "field units" consisting of an area of 1 mile square or less. Each field unit must contain a non-Bollgard refuge.
- Non-Bollgard refuge plantings must average at least 150 feet wide.
- Non-Bollgard refuge may be treated for caterpillar pests only when surrounding Bollgard cotton is treated.
- Non-Bollgard refuge may not be treated for caterpillar pests independently of surrounding Bollgard cotton.

NOTE: The recommendations on resistance management in Bollgard cotton are intended as general recommendations only. They are not intended to represent or replace the full details or requirements of any use agreement into which producers may enter with suppliers of transgenic seed or technology. Producers should know all details of such agreements.

Dual gene Bt Cottons (Bollgard II and Widestrike): Currently, the U.S. Environmental Protection Agency does not require the planting of a non-Bt cotton refuge for plantings of Bollgard II and Widestrike.

Resistance Management Plan, Tarnished Plant Bugs and Cotton Aphids:

1) When choosing insecticides for use at planting or as foliar sprays for early season thrips control, avoid using products that will be used later to control cotton aphids.
2) When choosing insecticides for use against aphids or plant bugs, avoid making repeated applications of the same insecticide or insecticides from the same class against following generations of pests.

Responding to Control Failures

Key considerations and responses following suspected insecticide failures

1) Don't panic! Do not automatically assume that the presence of live insects following an insecticide application is the result of an insecticide failure.
2) Examine the possible reasons that unsatisfactory control may have occurred. Control decisions should consider a wide range of variables that influence insecticide efficacy and damage potential: species complex, population density and age structure, application timing, insecticide dosage rate, application methods and carriers, treatment evaluation timing, need for multiple applications, environmental conditions, and **levels of insecticide resistance**.
3) **Under continuous pressure, multiple insecticide applications are required to reduce crop damage. Against high, sustained infestations, multiple close interval (3 to 5 days) applications of recommended economical treatments are often more effective than applications of expensive mixtures at high rates applied at longer intervals.**
4) Selected combinations of insecticides are recommended to manage tobacco budworm at discrete time periods throughout the growing season. Do not use excessive rates of one or more insecticides in these mixtures. Using more than the recommended rate may not improve control.
5) If a field failure is suspected to be due to insecticide resistance, do not reapply the same insecticide. Change to another class of insecticides or use mixtures of insecticides from different classes.
6) Do not apply insecticides to control tobacco budworm beyond the time the major portion of the crop is resistant to insect damage. Protecting fruit that will not be harvested is not cost effective and further selects for insecticide resistance.

IMPORTANT: The following cotton insect control recommendations include treatment thresholds, insecticides, and suggested rates for specific pests. The **recommendations are divided into three distinct sections based on stage of plant development** (Emergence to First Square, First Square to First Bloom, and After First Bloom). Because important pests, thresholds, and control recommendations depend on stage of plant development, **be sure you are referring to the proper section when using this guide**.

CAUTION: Recommendations of specific insecticides are based on information on the manufacturer's label and performance in a limited number of efficacy trials. Because levels of insecticide resistance, environmental conditions, and methods of application by growers may vary widely, insecticide performance will not always match the safety and pest control standards indicated by experimental data.

Insecticides are listed alphabetically, not in order of their effectiveness. Effectiveness of a particular insecticide can vary greatly from field to field, depending on previous insecticide use, pest species, levels of resistance, and many other factors. Within a group of insecticides recommended for control of a specific pest, there is often considerable variability in cost, effectiveness against the primary target pest, and secondary pests controlled. When selecting insecticides, growers must consider each of these factors as well as the need to rotate among different insecticide classes for resistance management purposes.

Classes of insecticides: Effective resistance management requires rotation among the various classes of available insecticide chemistry. Often when one insecticide in a class fails because of insecticide resistance, other insecticides in the same class will also be ineffective. Selection of an insecticide from a different class will improve the chances of obtaining control. **Growers need to be very aware of the type of insecticide chemistry being used.** Classes of insecticides recommended in this guide are identified by the following abbreviations:

Avermectins – (AV)	Chloro-nicotinyl – (CN)	Organophosphate – (OP)	Pyridine Carboxamide – (PC)
Biologicals – (B)	Insect Growth Regulators – (IGR)	Oxadiazine – (OX)	Spinosyns – (SPN)
Carbamate – (C)	Organochlorine – (OC)	Pyrethroid – (P)	Tetronic Acid – (TA)

Thrips

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
In Furrow				
acephate (OP)				
Orthene 90S	1.1 lb	1.0	1	Spray in drill
aldicarb		0.53 - 0.75		
Temik 15 G	3.5 – 5 lb		-	Hill dropped 2-4 lb/acre
Seed Treatments				
acephate (OP)				
Orthene 90S	20 – 32 oz		-	Per 100 lb seed depending on seeding rate (Hopper Box: 2.5 – 3.5 oz 90S/Acre)
imidacloprid (CN)				Per seed
Gaucho Grande		0.375 mg	-	
Aeris		0.375 mg	-	
thiamethoxam (CN)				Per seed
Cruiser 5FS		0.34 mg	-	
Avicta CP		0.34 mg	-	
Foliar Treatments				
acephate (OP)				Pyrethroids and acephate are not recommended for control of thrips. Their use at this time in the season will intensify insecticide resistance problems in tarnished plant bugs and increase the likelihood of flaring spider mites.
Orthene 90S	0.22 lb	0.2	4.5	
dicrotophos (OP)				
Bidrin 8E	3.2 oz	0.2	40	Bidrin may only be used before first square and after first bloom.
dimethoate (OP)				
dimethoate 4EC	6.4 oz	0.2	20	
methamidophos (OP)				
Monitor 4E	6.4 oz	0.2	20	

Cotton plants are most susceptible to injury from **THRIPS** from emergence to the third or fourth leaf stage. Treatment for thrips is seldom necessary on plants that are beyond this stage.

When disulfoton (Di-Syston) or phorate (Thimet) are used as "safeners" for certain herbicides, they will suppress thrips.

In-furrow insecticides can result in increased susceptibility to seedling diseases. Use a recommended fungicide when using in-furrow insecticide treatments.

These recommendations on in-furrow systemic materials are directed specifically toward insect control. Some in-furrow insecticides, such as aldicarb, also provide nematode control, but most in-furrow insecticides do not control nematodes. See publications about nematode control for information on controlling these non-insect pests. Where Nemacur 15G is used for nematode control, it will suppress thrips.

CAUTION: Several of the systemic thrips insecticides interact with some of the herbicides used on cotton and influence the cotton plants' susceptibility to herbicide injury. For example, the organophosphate insecticides, disulfoton (Di-Syston) or phorate (Thimet), are used to "safen" cotton to injury from the herbicide clomazone (Command); however, herbicides containing diuron or fluometuron should not be used on cotton treated with either disulfoton (Di-Syston) or phorate (Thimet) because of the potential for a phytotoxic interaction.

THRESHOLD: Make foliar treatments if thrips numbers reach one per plant on seedling cotton with immatures present.

Cutworms

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate (OP)				
Orthene 90S	0.88 lb	0.8 lb	1.14	
bifenthrin (P)				
Brigade 2EC	2.6 – 6.4 oz	0.04 - 0.1	49.2 – 20	
Discipline 2EC	2.6 – 6.4 oz	0.04 - 0.1	49.2 – 20	
Fanfare 2EC	2.6 – 6.4 oz	0.04 - 0.1	49.2 – 20	
beta-cyfluthrin (P)				
Baythroid XL 1E	0.08 – 1.6 oz	0.007 - 0.013	160 - 80	
cyhalothrin (P)				
Karate Z 2.08CS	1.28 – 1.96 oz	0.02 - 0.03	166 - 65	
cypermethrin (P)				
Ammo 2.5EC	1.28 oz	0.025	100	
deltamethrin (P)				
Delta Gold 1.5EC	1.1 – 1.6 oz	0.013 - 0.019	116 - 79	
esfenvalerate (P)				
Asana XL 0.66	5.8 oz	0.03	22	
zetamethrin (P)				
Mustang Max 0.8EC	1.28 – 1.98 oz	0.008 - 0.012	100 - 65	
Respect 0.8EC	1.28 - 1.98 oz	0.008 - 0.012	100 - 65	
gamma-cyhalothrin (P)				
Prolex 1.25	0.77 – 1.02 oz	0.0075 - 0.01	166 - 125	

In no-till or limited-till situations, **CUTWORMS** may become established on existing vegetation and move to emerging cotton seedlings once this vegetation is killed. Risk of cutworm attack can be greatly reduced by destroying all existing vegetation 3 to 4 weeks before planting. Treatment at planting may be warranted in situations where cutworms are already established and vegetation cannot be destroyed 3 to 4 weeks before planting. Pyrethroid insecticides are highly effective against cutworms and can be used in ground treatments applied at planting with limited risk of contributing to increased resistance in tobacco budworm.

Bt Cotton: Bt cotton will not control cutworms.

THRESHOLD: Treat if cutworm infestations threaten to reduce stand below 35,000 plants/acre (3 plants/row foot) in a field or part of a field. Area considered is smallest area a producer will treat. Repeat treatment if needed.

Plant Bugs and Flea-hoppers

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate (OP) Orthene 90S	.55 – 1.1 lb	0.5 – 1.0	1.8 – 1.0	**Under heavy infestations, use highest labeled rates.** Acephate - Not recommended for control of plant bugs before first bloom. After first bloom: 0.5 – 1.0 lb ai/A
acetamiprid (CN) Intruder 70 WP	1.1 oz	0.05	14	
novaluron (IGR) Diamond 0.83 EC	6 – 9 oz	0.04 - 0.06	21.3 – 14.2	Novaluron (Diamond) acts only on immature plant bugs and should be tank-mixed with a labeled adulticide.
dicrotophos (OP) Bidrin 8E	4 – 8 oz	0.25 - 0.5	32 – 16	Bidrin may only be used before first square and after first bloom, with a minimum of 14 days between applications.
imidacloprid (CN) Trimax Pro 4.4 SC	1.35 – 1.8 oz	0.047 - 0.062	95 - 71	
malathion (OP) Fyfanon ULV 9.9C	11.9 – 15.8 oz	0.92 – 1.22	10.8 – 8.1	
methamidophos (OP) Monitor 4E	10.6 – 16 oz	0.33 - 0.5	12 - 8	
oxamyl (C) Vydate C-LV 3.77	11.2 - 17 oz	0.33 - 0.5	11.4 – 7.5	
thiamethoxam (CN) Centric 40WG	1.5 – 2.5 oz	0.0375 - 0.0625	10.7 – 6.4	
flonicamid (PC) Carbine 50WG	1.7 – 2.8 oz	0.054 - 0.089	9.4 – 5.7	

The sweep net is a very effective tool for monitoring adult **PLANT BUG** populations, but the ground cloth is more effective for monitoring nymphs. Thorough scouting requires the use of both the sweep net and ground cloth. Visual scouting is a less reliable method of sampling for plant bugs. Before first bloom, sample fields twice weekly for plant bugs. Treat if populations exceed levels given for the specified growth stage.

Mapping plants to determine percent square retention is an important part of monitoring before first bloom. Plants that are fruiting normally should retain at least 80 percent of the first and second position fruiting sites on the upper five branches. However, there are many factors besides plant bugs that can cause poor square retention. If you notice low square retention or a sudden decline in square retention, intensify sampling for plant bugs to determine if they are the cause. When square retention is lower than 80 percent before first bloom, plant bug thresholds should be lowered accordingly. Note: Research has shown that there is no benefit from maintaining excessively high square retention rates. (Plots with square retention rates in the range of 70 to 85 percent at first bloom often produce slightly higher yields than plots with higher retention rates.) Attempting to maintain excessively high early season square retention rates through the use of additional insecticide treatments will result in increased costs and increased risks of secondary pest outbreaks.

Avoid automatic/prophylactic-type treatments.

After plants begin to bloom, effective use of the sweep net becomes difficult and more emphasis is placed on drop cloths. When visual scouting examine randomly selected plant terminals for presence of adults or nymphs and by checking inside the bracts of squares, blooms, and small bolls for presence of nymphs. **Drop cloths, black in color**, remain very effective for detecting small nymphs throughout the season.

"Dirty blooms," blooms in which many of the anthers are dried and brown colored, are a sign of established infestations of plant bug nymphs feeding on larger squares. No threshold exists for percent dirty blooms, but if you find them, intensify visual scouting for plant bugs.

Some pyrethroids act against plant bugs and, when applied against budworm/bollworm as the primary target, provide control of low to moderate levels of plant bugs. Do not assume that treatments targeting budworm/bollworm will always provide effective control of plant bugs. Resistance to both pyrethroids and organophosphates has been documented in populations of plant bugs at some locations. Because of insecticide resistance and/or difficulty obtaining adequate coverage in larger cotton, a single application of insecticide may not effectively control heavy established populations of plant bugs. Multiple applications applied at 4- to 5-day intervals may be required in such cases.

Plant bug populations are often highest along field borders. This is especially true for field borders next to maturing fields of corn, sorghum, or early maturing soybeans. In such situations it is often helpful to scout and manage such field borders separately from the remainder of the crop. Such areas may require spot treatments that are not needed on the remainder of the field.

Thresholds: Clouded Plant Bugs: Tarnished Plant Bug thresholds can be used for Clouded Plant Bugs, but Clouded Plant Bugs should be counted 1.5 times when using sweep net. **Emergence to first square:** Treat if you find one plant-bug-flagged plant and one or more plant bugs per 10 row feet.

First 2 weeks of squaring:
Drop Cloth: 1 plant bug/6 row ft **Visual:** 5 bugs/100 terminals **Sweep Net:** 8 bugs/100 sweeps

Third week of squaring to first bloom:
Drop Cloth: 2 bugs/6 row ft **Visual:** 10 bugs/100 terminals **Sweep Net:** 15 bugs/100 sweeps

After first bloom:
Drop Cloth: 3 bugs/5 row ft on black drop cloth
Visual: 9 bugs/100 plants (Examine terminal area for adults. Search inside the bracts of large squares and small bolls and inside blooms for nymphs and adults.)
Sweep Net: 12 bugs/100 sweeps

Bollworms and Budworms

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
Transgenic Control: (Bt cotton) Bollgard, Bollgard II, WideStrike				
Ovicides: **methomyl** (C) Lannate 2.4LV	13.3 oz	0.25	9.7	Lannate - A minimum of 10 days should elapse between 0.45 lb methomyl (Lannate) applications. The lower rate of methomyl (0.25-0.33 lb) may be applied as needed. If reddening of leaves is excessive, stop using the combination or alternate with other insecticides.
thiodicarb (C) Larvin 3.2SC	10 oz	0.25	12.8	
profenofos (OP) Curacron 8E	4 oz	0.25	32	Before bloom, avoid using the organophosphate profenofos (Curacron). Profenofos is an organophosphate insecticide that has high risk of fish kill when it contaminates aquatic habitats by drift or runoff. Carefully follow label restrictions and avoid applications that have a risk of getting the product into bodies of water.
Foliar Larvicides: **indoxacarb** (OX) Steward 1.25EC	9.2 – 11.3 oz	0.09 - 0.11	14 – 11.3	Use higher rates of products under heavy infestations. **CAUTION: Pyrethroid insecticides (P) are not recommended for use against infestations that are primarily composed of tobacco budworms** because of high levels of pyrethroid resistance. Tobacco budworms also tend to resist some other classes of insecticides. However, pyrethroids (P) are a cost-effective option for control of infestations that are composed primarily of bollworms. Pyrethroids have potentially high negative effects on aquatic animals. Adhere strictly to label precautions, especially near aquatic habitats. Before bloom, avoid using pyrethroid insecticides.
thiodicarb (C) Larvin 3. SC	24.0 – 36.0 oz	0.6 - 0.9	5.33 – 3.55	
spinosad (SPN) Tracer 4SC	1.4 – 2.9 oz	0.045 - 0.089	91.4 – 45.7	
emamectin benzoate (AV) Denim 0.16EC	8 – 12 oz	0.01 - 0.015	16 – 10.7	
profenofos (OP) Curacron 8E	12 – 16 oz	0.75 – 1.0	10.7 - 8	
methomyl (C) Lannate 2.4LV	24 oz	0.45	5.3	
bifenthrin (P) Brigade 2EC Discipline 2EC Fanfare 2EC	3.84 – 6.4 oz 3.84 – 6.4 oz 3.84 – 6.4 oz	0.06 - 0.10 0.06 - 0.10 0.06 - 0.10	33.3 - 20 33.3 - 20 33.3 - 20	
beta-cyfluthrin (P) Baythroid XL1E	1.6 – 2.6 oz	0.013 - 0.021	80 – 49.2	
cyhalothrin (P) Karate Z 2.08CS	1.6 – 2.56 oz	0.025 - 0.04	83 - 52	
cypermethrin (P) Ammo 2.5EC	2.0 – 5.0 oz	0.04 - 0.10	64 – 25	
esfenvalerate (P) Asana XL 0.66	5.8 – 9.6 oz	0.03 - 0.05	22 – 13	
zetamethrin (P) Mustang Max 0.8EC Respect 0.8EC	2.64 – 3.6 oz 2.64 – 3.6 oz	0.0165 - 0.0225 0.0165 - 0.0225	49.5 – 35.6 49.5 – 35.6	
gamma-cyhalothrin (P) Prolex 1.25	1.28 – 2.05 oz	0.0125 - 0.02	100 – 62.4	

Infestations of **BOLLWORM AND TOBACCO BUDWORM** may occur together at any time in the growing season, but these two insects are difficult to distinguish from one another as small larvae. Infestations of small larvae may be mostly bollworm, mostly tobacco budworm, or some combination of both. Knowing which is the primary species present can greatly influence choice and costs of treatments. Information obtained from moth flushing counts or pheromone trap counts may help you estimate the species composition of an infestation and make treatment choices.

Bt Cotton: Bt-transgenic cotton primarily targets control of tobacco budworm and bollworm and should initially provide good to excellent control of these pests. However, high populations, especially high populations of bollworms, may require treatment in some situations. Bollworms are less susceptible to Bt cotton than are tobacco budworms. Intensify scouting of Bt cotton when high numbers of bollworm moths are present. Scout for larvae in blooms, bolls, and terminal area.

Dual Toxin Bt Cotton: Varieties of Bt cotton that express two Bt toxins are more effective against bollworms than are single toxin Bt cottons. They may still require supplemental treatments because of unusually high insect populations or compromised toxin expression.

CAUTION: Transgenic Bt cotton is available in several varieties. Efficacy of Bt cotton may vary, depending on seed source and variety.

If insecticide resistance is thought to be the cause of a treatment failure, switch to another chemistry immediately. Do not re-treat with a second application of the same class of material.

Other pests controlled or suppressed:

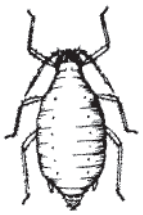
acephate — thrips, plant bugs, fleahoppers, cabbage loopers, whiteflies
profenofos — fall armyworms
thiodicarb — armyworms, loopers
spinosad — armyworms, loopers
pyrethroids — plant bugs, fleahoppers, thrips, cutworms
bifenthrin — all pests controlled by other pyrethroids plus spider mites.
Indoxacarb — tarnished plant bugs, loopers, armyworms

THRESHOLDS: ***Before bloom:*** treat when population reaches or exceeds **8 larvae/100 plants**. ***After bloom:*** treat when counts reach or exceed **4 larvae/100 plants**. ***After cutout:*** Treat when counts reach or exceed **8 larvae/100 plants**. Apply treatments before larvae are ½ inch long.

Bt cotton

Larvae/acre thresholds for Bt cotton are the same as for non-Bt cotton. However, damaged fruit or boll count thresholds are also considered. ***Before bloom:*** treat when damaged fruit counts exceed 5 percent or the number of larvae about ⅛ inch long exceeds 8 larvae/100 plants. ***After bloom:*** Treat when larvae ⅛ inch long or longer exceed 4 larvae/100 plants (or 8 larvae/100 plants after "cutout"). Regardless of size of larvae, treatment may be warranted if damaged-boll counts exceed 2 percent and significant numbers of larvae are present and continuing to cause damage.

Aphids



Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acetamiprid (CN) intruder 70WP	0.6 – 1.1 oz	0.025 - 0.05	26.7 – 14.5	
dicrotophos (OP) Bidrin 8E	4.8 – 8 oz	0.30 - 0.50	26.7 – 16	Aphids may be resistant to dicrotophos in some areas of Mississippi.
flonicamid (PC) Carbine 50WG	1.4 – 2.8 oz	0.044 - 0.089	11.4 – 5.7	
imidacloprid (CN) Trimax Pro 4.4SC	0.9 – 1.8 oz	0.031 - 0.062	93.4 – 71.1	Trimax Pro - Two applications of Trimax Pro applied at a 7- to 10-day interval may be needed to achieve control of heavy aphid infestations. Trimax Pro may not provide adequate control if cotton is under stress from heat, drought, diseases, extreme pest pressure, or when cotton "hardens off" as it begins to mature.
thiamethoxam (CN) Centric 40WG	2 oz	0.05	8	

In some areas, **APHIDS** may be resistant to some labeled insecticides. The impact of aphids on yield varies greatly, depending on a variety of factors, including number of aphids, duration of infestation, and presence of other stress factors such as drought. In some cases, relatively high populations caused no yield loss. In other cases, research has shown that untreated infestations that peaked as low as 35 aphids per leaf caused yield losses of approximately 45 pounds of lint. Higher yield losses have been recorded from heavier, more prolonged infestations.

Before treating aphids between first square and first bloom, consider ability to obtain control and potential impact on other pest populations, such as the tobacco budworm and beet armyworm.

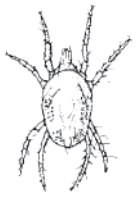
Efficacy of various recommended chemicals varies by location; therefore, it is advisable to seek current information about what is working locally. (Talk to county Extension agents, Extension specialists, consultants, neighbors, and others). When selecting aphicides, consider which classes of materials were used on the field earlier during the season, including in-furrow treatments. An aphicide from the least commonly used class may provide best control. Control may be improved by applying a second application 4 to 7 days after the initial treatment. Rotating classes of insecticide chemistry used may enhance control.

THRESHOLDS: Consider treatment when spots of high aphid populations are causing heavy localized honeydew accumulation, aphid numbers are increasing over the remainder of the field, and no signs of diseased aphids are present. Under heavy infestations use highest labeled rates. Important factors to consider before treatment include the following: 1) possibility of a fungal epizootic that will likely occur under high aphid infestation (this usually occurs during early to mid-July); 2) possibility of control failure with recommended insecticides (control must exceed 80 percent to give benefit); 3) predator and parasite populations that may suppress aphids; 4) presence of additional plant stress factors, such as drought or low plant vigor; 5) need to apply insecticide for control of other pests.

Treatment may be beneficial in avoiding yield reduction when the following conditions exist together: 1) isolated spots occur through the field where heavy aphid infestations cause honeydew-coated plants; 2) aphid numbers are increasing on remaining plants throughout the field; and 3) no indication of aphid fungal disease is present.

When treating aphids, try to get good coverage, particularly to undersides of leaves.

Spider Mites



Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
abamectin (AV)				
Zephyr 0.15 EC	4.27 – 16 oz	0.005 - 0.01875	29.98 - 8	
Abba 0.15 EC	4.27 – 16 oz	0.005 - 0.01875	29.98 - 8	
Zoro 0.15 EC	4.27 – 16 oz	0.005 - 0.01875	29.98 - 8	
bifenazate Acramite 4 SC	16 – 24 oz	0.5 – 0.75	8 – 5.3	
bifenthrin (P)	3.84 – 6.4 oz	0.06 – 0.1	33.7 - 20	When using bifenthrin and dicofol, you'll often need to repeat applications on a 5 to 7 day interval.
Brigade 2 EC	3.84 – 6.4 oz	0.06 – 0.1	33.7 - 20	
Discipline 2 EC	3.84 – 6.4 oz	0.06 – 0.1	33.7 – 20	
Fanfare 2 EC				Bifenthrin has performed more consistently on spider mites mid- to late-season.
dicofol (OC)				
Kelthane 4 EC	1.0 – 1.5 qt	1.0 – 1.5	4 – 2.67	
Dicofol 4	1.0 – 1.5 qt	1.0 – 1.5	4 – 2.67	
etoxazole (IGR) Zeal 72 WSP	0.67 – 1 oz	0.03 - 0.045	23.88 – 16	
propargite Comite II 6	20 –36 oz	.94 – 1.68	6.4 – 3.55	
spiromesifen (TA) Oberon 4 SC	3 – 8 oz	0.94 - 0.25	42.7 - 16	

SPIDER MITE populations often increase during hot and dry conditions. Spider mites often develop around field borders and ditch banks. Henbit and other winter annuals can serve as hosts for spider mites. Removal of winter annuals well in advance of planting may reduce risk of spider mite infestation.

NOTE: When applied at recommended rates to control caterpillar pests, Denim will suppress spider mites. If mites are present in the field, applications of acephate and pyrethroids (except bifenthrin) can flare mites when targeting other pests. *Lower product rates should be used only in early season. Always read the label. Many miticides are restricted to 1 to 2 applications per year.

THRESHOLDS: Treatment is essential when 40 to 50 percent or more of plants are infested, and populations are increasing.

Loopers

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
emamectin benzoate (AV) Denim 0.16EC	8 - 12 oz	0.01 - 0.015	16 – 10.67	
indoxacarb (OX) Steward 1.25EC	9.22 – 11.26 oz	0.09 – 0.11	13.88 – 11.37	
methoxyfenozide (IGR) Intrepid 2F	3.84 – 6.4 oz	0.06 – 0.1	33.33 – 20	
spinosad (SPN) Tracer 4SC	2.14 – 2.85 oz	0.067 – 0.089	59.7 – 44.91	
thiodicarb (C) Larvin 3.2SC	24 – 36 oz	0.60 – 0.90	5.33 – 3.56	

Two species of **LOOPERS** (cabbage looper and soybean looper) occur in cotton. These insects differ in their susceptibility to insecticides and diseases.

Bt Cotton: Bollgard cotton provides only limited suppression of loopers.

DualToxin Bt Cotton: Varieties of Bt cotton that express two Bt toxins are considerably more effective against loopers than are single toxin Bt cottons. They may still require supplemental treatments because of unusually high insect populations or compromised toxin expression.

THRESHOLD: Treat only when populations threaten premature defoliation.

Beet Armyworms

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
emamectin benzoate (AV) Denim 0.16 EC	6 - 8 oz	0.0075 - 0.01	21.33 – 16	
indoxacarb (OX) Steward 1.25 EC	9.22 – 11.26 oz	0.09 – 0.11	13.88 – 11.37	
methoxyfenozide (IGR) Intrepid 2F	3.84 – 6.4 oz	0.06 – 0.1	33.33 – 20	
spinosad (SPN) Tracer 4 SC	2.14 – 2.85 oz	0.067 – 0.089	59.81 – 44.91	
thiodicarb (C) Larvin 3.2 SC	32 oz	0.80	4	

Production of an early crop and preservation of beneficial insects are the most important factors in reducing risks of **BEET ARMYWORM** (BAW) outbreaks. Certain organophosphate and pyrethroid insecticides are particularly damaging to the beneficial insects that help control BAW. Prior to bloom, use short residual organophosphates and other nonpyrethroid materials only when necessary to control other pests. Reserve use of pyrethroids until midseason in order to help minimize reliance on organophosphates at this time. Established populations of BAW can be difficult and expensive to control. Late-season foliage-feeders cause less damage than do midseason fruit-feeders. Cotton nearing maturity can tolerate relatively higher populations without losing yield. When treating BAW, multiple, close interval applications (3 to 5 days) may be needed against high populations. Apply treatments against hatching to ¼-inch long larvae. Maximize coverage to undersides of leaves. Increasing spray volume and pressure may improve control when treating by ground.

Bt Cotton: Bollgard cotton provides only limited suppression of beet armyworms.

Dual Toxin Bt Cotton: Varieties of Bt cotton that express two Bt toxins are considerably more effective against beet armyworms than are single toxin Bt cottons but may still require supplemental treatments because of unusually high insect populations or compromised toxin expression.

THRESHOLD: During early to mid-season, if beneficial insect numbers are low and risk factors favorable to development of BAW outbreaks are present, initiate treatment at 2 to 5 "hits" (egg masses and/or clusters of small larvae) per 100 feet of row. Treatment thresholds vary greatly, depending on time of year and stage of crop when BAW outbreaks occur, plant parts being attacked, and presence or absence of other predisposing factors.

Fall Armyworms

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate (OP) Orthene 90S	1.1 lb	1.0	-	Some pyrethroids may help suppress fall armyworm when applied against newly hatched larvae. The growth regulator diflubenzuron (Dimilin) may also be useful in suppressing developing fall armyworm populations (use rate is 0.0625-0.125 lb ai/a). **Lannate footnote:** A minimum of 10 days should elapse between 0.45 lb methomyl (Lannate) applications. The lower rate of methomyl (0.25-0.33 lb) may be applied as needed. If reddening of leaves is excessive, stop using the combination or alternate with other insecticides.
emamectin benzoate (AV) Denim 0.16EC	8 - 12 oz	0.01 - 0.015	16 – 10.67	
indoxacarb (OX) Steward 1.25EC	9.22 – 11.26 oz	0.09 – 0.11	13.88 – 11.37	
methoxyfenozide (IGR) Intrepid 2F	6.4 – 10.24 oz	0.1 – 0.16	20 – 12.5	
methomyl (C) Lannate 2.4LV	24 oz	0.45	5.33	
novaluron (IGR) Diamond 0.83EC	6 – 9 oz	0.04 – 0.08	21.3 – 14.2	
profenofos (OP) Curacron 8E	16 oz	1.0	8	
spinosad (SPN) Tracer 4SC	2.14 – 2.85 oz	0.067 – 0.089	59.81 – 44.91	
thiodicarb (C) Larvin 3.2SC	24 – 36 oz	0.60 – 0.90	5.33 – 3.56	

Bt Cotton: FALL ARMYWORMS may be more common in Bollgard cotton because of the decrease in mid- to late-season sprays against budworm/bollworm. But Bollgard cotton does act against fall armyworms, and infestations that are initially heavy often dwindle without causing significant boll damage. Intensify scouting for fall armyworms in Bollgard cotton, particularly in July and August. Treatment of Bollgard cotton is recommended when the number of larvae longer than ¼ inch is greater than 4 per 100 bolls and/or blooms.

Dual Toxin Bt Cotton: Varieties of Bt cotton that express two Bt toxins are considerably more effective against fall armyworms than are single toxin Bt cottons but may still require supplemental treatments because of unusually high insect populations or compromised toxin expression.

THRESHOLD: Treat when you find 4 or more worms per 100 blooms and/or bolls. Time applications against young larvae and maximize coverage deep within the plant canopy by increasing spray volume and pressure.

Banded-winged Whiteflies

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate (OP) Orthene 90S	0.56 – 1.1 lb	0.5 – 1.0	1.8 - 1	Large populations can reduce yield and affect quality. Thorough coverage of foliage is necessary for adequate control. Whiteflies can be difficult to control and can rebound quickly following treatment. Two to three applications at approximately 5-day intervals are usually necessary to control heavy infestations.
acetamiprid (CN) intruder 70 WP	1.1 oz	0.05	14	
methamidophos (OP) Monitor 4E	8 – 16 oz	0.25 – 0.50	16 - 8	
spiromesifen (TA) Oberon 4 SC	2-8 oz	0.94 - 0.25	42.7 - 16	
thiamethoxam (CN) Centric 40 WG	2 -2.5 oz	0.05 – 0.0625	8 – 6.4	

THRESHOLD: Apply control when 50 percent or more of the terminals are infested with adults.

Silver Whiteflies

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
pyriproxyfen (IGR) Knack 0.86	8.04 – 9.97 oz	0.054 – 0.067	15.92 – 12.84	When using non-IGR type treatments, you must make repeated applications at 5-day intervals.

Infestations of **SILVER WHITEFLIES** are uncommon but are most likely to occur on cotton grown close to nursery crops or greenhouses. Heavy, prolonged infestations can cause substantial yield loss. This insect is difficult and costly to control.

THRESHOLD: Apply control when 50 percent or more of the terminals are infested with adults.

Stink Bugs

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate (OP)				Pyrethroid insecticides are less effective against brown stink bug species.
Orthene 90S	0.83 – 1.1 lb	0.75 – 1.0	-	
bifenthrin (P)				
Brigade 2EC	3.84 – 6.4 oz	0.06 - 0.10	33.7 - 20	
Discipline 2EC	3.84 – 6.4 oz	0.06 - 0.10	33.7 - 20	
Fanfare 2EC	3.84 – 6.4 oz	0.06 - 0.10	33.7 - 20	
beta-cyfluthrin (P)				
Baythroid XL1E	1.6 – 2.62 oz	0.0125 - 0.0205	80 – 49.2	
cyhalothrin (P)				
Karate Z 2.08CS	1.54 – 1.85 oz	0.025 - 0.03	83.2 – 69.3	
dicrotophos (OP)				Bidrin may only be used before first square and after first bloom, with a minimum of 14 days between applications.
Bidrin 8E	6.4 – 8 oz	0.4 – 0.5	20 - 16	
gamma-cyhalothrin (P)				
Prolex 1.25	1.28 – 2.05 oz	0.0125 - 0.02	100 – 62.4	
methyl parathion (OP)				
Methyl Parathion 4	16 oz	0.5	8	
zetamethrin (P)				
Mustang Max 0.8EC	2.64 – 3.6 oz	0.0165 - 0.0225	49.2 – 35.6	
Respect 0.8EC	2.64 – 3.6 oz	0.0165 - 0.0225	49.2 – 35.6	

STINK BUGS usually appear in late season but sometimes occur earlier. These insects feed on squares, blooms, and bolls, but most damage is concentrated on young bolls. High numbers of stink bugs can develop in crops such as corn, sorghum, or early maturing soybeans and then migrate into nearby cotton during late season. Intensify scouting for stink bugs when nearby alternative hosts begin to mature. Scout for stink bugs by randomly pulling and cracking soft, quarter-sized bolls and checking for internal signs of stink bug feeding injury (stained lint, pierced areas or warts on internal boll wall, or damaged seed).

CAUTION: Spined soldier bugs are beneficial stink bugs that sometimes occur in high numbers in fields infested with caterpillar pests. These beneficial insects are often mistaken for brown stink bugs. Be sure of species identification before treating. Stink bugs are difficult to detect. Supplement by scouting for damaged bolls.

Bt Cotton: Stink bugs and clouded plant bugs are more likely to occur in Bt cotton because of the reduction in mid- to late-season treatments targeting budworm/bollworm. Intensify scouting for these pests in Bt cotton.

THRESHOLDS: ***Visual:*** **Average of 5 or more adults and/or nymphs (1/4 inch or greater) per 100 plants.** ***Ground Cloth:*** **Average of 1 bug per 6 feet of row (¼ inch or greater).** ***Damaged Bolls:*** **Treat when 15 to 20 percent or more of the soft, quarter-sized bolls show internal signs of stink bug feeding (damaged seed, stained lint, pierced areas or warts on internal boll wall) and stink bugs are present.**

Boll Weevils

Contact Boll Weevil Eradication personnel immediately to report any fields where you find live boll weevils or squares with boll weevil oviposition punctures!

Premixed Insecticide Products

Insecticide	Amount of Formulation per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Primary Target Pests (see label for other pests that may be controlled)
Bidrin XP (**dicrotophos, bifenthrin**)*	5 – 6.4 oz	32 - 20	plant bugs, stink bugs, bollworm, spider mites *Bidrin XP may only be used before squaring or after flowering has begun.
Endigo ZC (**thiamethoxam, λ-cyhalothrin**)	4 – 5.5 oz	32 – 23.3	plant bugs, stink bugs, bollworm, aphids
Hero 1.24 (**bifenthrin, Z-cypermethrin**)	5.2 – 10.3 oz	24.6 – 12.4	stink bugs, bollworm, spider mites *10.3 oz rate only for spider mites.
Leverage 2.7 EC (**imidacloprid, cyfluthrin**)	3 – 5 oz	43 – 26	plant bugs, stink bugs, bollworm, aphids

These products are available as premixes of two insecticides. The use of these products may provide suppression or control of multiple pests. They are typically recommended when several pests are present at treatment level. Use of these products is suggested primarily after first bloom at mid-labeled rates.

Terminating Insecticide Applications

Insect Control Termination: In a normal healthy crop, "cutout" is defined as the point when Node Above White Flower averages 5 (NAWF = 5). In other words, cutout is the point when terminal growth slows to the point that the first position white flower is at the fifth node below the first "unfurled" leaf in the terminal. An "unfurled" leaf is about the size of a quarter. Sample at least 10 plants per site from 4 representative sites per field to determine average NAWF. Begin monitoring NAWF at weekly intervals shortly after first bloom.

Shift to twice weekly monitoring as NAWF counts begin to decline toward 5. Begin monitoring daily heat unit (DD60s) accumulation on the day the crop reaches NAWF = 5.

Recent research has shown that growth and development in a normal, healthy crop are such that the last population of bolls that will effectively contribute to yield will be represented by those white blooms that are present at "cutout" (when the crop reaches NAWF = 5). Research has also shown that when these bolls accumulate 350 to 400 heat units (HU), or DD60s, they have a low probability of sustaining economic damage **from tarnished plant bugs (nymphs or adults) or from budworm/bollworm larvae that emerge after this point**. Therefore, control of tarnished plant bugs and budworm/bollworm can generally be terminated at **NAWF = 5 + 350-400 HU (DD60s)**. Note, however, that threshold populations of larvae hatching before this point in the development of the crop should be controlled. Also note that this guideline for terminating insecticide treatments applies primarily to bollworm and tobacco budworm and tarnished plant bugs.

Control of **stinkbugs** can be terminated at **NAWF = 5 + 450 HU**.

Control of **fall armyworm** can be terminated at **NAWF = 5 + 500-550 HU**.

Bolls are also fairly safe from boll weevils at this point, but do not stop boll weevil control at this time. Doing so may allow high populations of weevils to build and overwinter. (See recommendations for Diapause Control.) Leaves help bolls mature, so protect the crop from excessive defoliation from pests such as loopers beyond the point of NAWF = 5 + 350 - 400 HUs.

NOTE: This technique for deciding when to end cotton insect control has not been tested under all weather and crop conditions, especially where early stress or insect damage results in poor square set or any other condition that causes late maturity. Growers and consultants must monitor crop maturity and insect populations carefully **on a field by field** basis and use all available information on crop development and status to decide when to end insecticide treatments. Ask your Extension entomologist or county Extension agent for more about how to use this technique.

SUPPLEMENTAL INFORMATION

Estimating plants/acre, squares/acre, bolls/acre, etc.

An acre of land is 43,560 square feet. If the crop is planted on 40-inch row centers, there are about 13,070 linear row feet on an acre. If crop is planted on 38-inch row centers, there are about 13,760 linear row feet on an acre. The following technique for estimating numbers of plants (and others) per acre involves making total counts on about 1/1,000 of an acre. Choose four 40-inch lengths of row from four different locations in the field. Count all plants, etc., on these 40-inch units. Add together the individual counts and multiply by 1,000. This gives an estimate of the number of plants, squares, etc., per acre.

Insect pests to expect at different stages of plant development

Based on historical data, the following pests could be expected at different stages of plant development. This is a generalized statement; your conditions may be different.

Stages of Plant Development	Major Pests	Occasional Pests
emergence to fourth true leaf	thrips	aphids, cutworms, armyworms, saltmarsh caterpillars, grasshoppers, spider mites
fourth true leaf to first square	none	plant bugs, spider mites, aphids, armyworms, saltmarsh caterpillars, grasshoppers
first square to first bloom	bollworms, plant bugs, tobacco budworms	spider mites, aphids, fleahoppers, armyworms
after first bloom	bollworms, tobacco budworms	aphids, whiteflies, plant bugs, beet armyworms, loopers, spider mites, fall armyworms, stink bugs

COTTON SPRAY DRIFT PRECAUTIONS

- Keep all aerial and ground application equipment maintained and calibrated using appropriate carriers.
- Do not make aerial or ground applications during temperature inversions.
- Make aerial or ground applications when wind speed favors on-target product placement (about 3-10 mph). Do not apply when wind is faster than 15 mph.
- For aerial applications, mount the spray boom on the aircraft to reduce drift caused by wing tip or rotor vortices. Boom le must not exceed 75 percent of wing span or rotor diameter.
- When using pyrethroid insecticides, do not apply by ground within 25 feet or by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries, commercial fish ponds, or other bodies of water. Increase the buffer zone to 450 feet when ultralow volume (ULV) applications are made. Be sure to observe all other label restrictions regarding drift precautions for pyrethroids and all other insecticides.

SOYBEAN INSECT MANAGEMENT

Variety Selection/Cultural Practices

Currently available varieties of soybeans differ in growth characteristics and the time required for maturity. Variety characteristics can affect susceptibility to insect injury. For example, early maturating varieties are less likely to be seriously damaged by soybean loopers or velvetbean caterpillars because they often mature before late season generations of the pests occur. Also, varieties with little pubescence (hairs) on the undersides of leaves are susceptible to potato leafhopper infestations.

Maturity differences can be used to manage some insect pests. For example, planting about 5 percent of the soybean acreage in an area 10 to14 days earlier than the remainder of the crop will concentrate overwintering bean leaf beetles into these earlier plantings. The early-planted soybeans serve as a trap crop for the adults, and a relatively small amount of insecticide can then be used to prevent their spread into later planted soybeans. If early maturing varieties are planted as the trap crop, they will also act as a trap crop for stink bugs during pod development.

Soybeans that do not have a closed canopy at the time of bloom, as often occurs in late-plantings and wider-row spacings, are more susceptible to bollworm infestations. No-till soybeans are at greater risk to cutworm damage than conventionally tilled soybeans.

The performance of many soybean varieties is tested every year in Mississippi at several locations. The information is published annually as a Mississippi Agricultural & Forestry Experiment Station (MAFES) Information Bulletin – Soybean Variety Trials.

Biological Control

Diseases – In mid to late season, naturally occurring diseases (fungi, bacteria, and viruses) of soybean insect pests can be important in control. A full leaf canopy, along with certain environmental conditions, apparently produces a microclimate favorable for insect disease development. Diseases often control armyworm, velvetbean caterpillar, green cloverworm, and soybean looper. After diseased larvae have died, they may have a whitish mold-like growth covering their body surface, a black coloration with their bodies filled with fluid, or a near normal appearance (depending on the disease).

The presence of diseased worms indicates the population is being reduced naturally. When you find diseased larvae, withhold treatment for a few days to see if the disease will spread to a level that can control the population.

Predators and Parasites – Beneficial predators and parasites are very important in reducing the number of early season insect pests. For this reason you should protect them to have their full benefit. Predators and parasites can often keep pests from reaching treatable levels. Some early season insecticide applications to soybeans can severely reduce predators and parasites. For best use of predators and parasites, regular scouting of fields is essential in detecting insect pests as well as beneficials.

Sampling for Soybean Insects

To minimize yield loss from insect pests attacking soybeans, you should sample fields at least once per week from emergence through maturity. There are several ways to sample soybeans for insect pests. The ground cloth and the sweep net are the two primary tools. Information you get by using either one of these sampling methods should be supplemented by visual examinations of plants for damage or insects.

Ground cloth – The ground cloth is the most accurate method for sampling insect pests in soybeans. A ground cloth is made of heavy white cloth 3 feet long on each side with a 1⁄2- to 3⁄4-inch dowel rod attached to each side. To use the ground cloth, you unroll it flat between two rows, then bend the plants on either side over the cloth, and shake them vigorously. The dislodged insects fall onto the cloth, where you can easily count them. You should count any insect that has fallen at the base of the plant to the soil surface. This gives the number of insects per 6 feet of row (3 feet on each side of the cloth). Dividing by 6 gives the number of insects per foot of row.

Most soybean producers in Mississippi have changed their production practice from wide-row to narrow-row or drilled soybeans. Soybeans planted on narrow rows are difficult to sample using a ground cloth. In narrow-row soybeans, a sweep net is the preferred method for sampling.

Sweep net – A sweep net is a heavy cloth or canvas net on a strong 15-inch diameter steel hoop attached to a 3-foot wooden handle. To use it, you walk parallel to a row and swing the net briskly through the top third of the foliage. Each pass of the net through the foliage counts as one sweep and should be made 2 1⁄2 to 3 feet apart down the row. Be sure to hold the net at an angle that lets dislodged insects fall into the net bag and pass the net completely through the row. In soybeans planted on 36-inch rows or wider, sweep only one row. In narrow-row soybeans, let the normal arch of a sweep continue through the adjacent row. Then count insects as they are picked or fly from the net. Counts are usually expressed as number per 25 or 100 sweeps.

When to Apply Insecticides for Stem Feeders

The three most common stem-feeding pests are lesser cornstalk borer, cutworms, and three-cornered alfalfa hoppers. Apply insecticide from plant emergence to 10 inches in height when plant stand is being reduced below recommended plant populations. Use Table 1 on page 41 to determine best plant populations for soybeans grown in Mississippi.

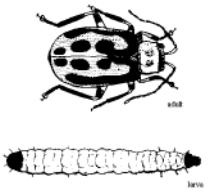
When to Apply Insecticides for Foliage Feeders

Soybean plants can withstand as much as 35 percent foliage loss up to the blooming period. During blooming and when pods begin to form and fill out, any foliage loss of more than 20 percent will decrease yield. After the soybeans are mature and pods have fully expanded, a 35 percent loss of foliage will not usually reduce yield. Once fruiting begins, the soybean plant does not add new leaves, although existing leaves may expand. If plants are near the fruiting stage, don't let more foliage be removed if that will cause total defoliation to be more than 20 percent in pod-set or pod-filling.

It requires four or more foliage-feeding larvae one-half inch long or longer per foot of row to cause 20 percent defoliation. It requires eight or more foliage-feeding larvae one-half inch long or longer per foot of row to cause 35 percent defoliation. Apply insecticides when larval populations are at or above the number required to cause defoliation levels listed for the developmental stage of the plants. Apply insecticide if these defoliation levels have already occurred and larvae are still present.

Often several species of foliage-feeding caterpillars will be in a field at the same time. When several species of foliage-feeding caterpillars are present, treatment is necessary if any combination of foliage-feeding caterpillars meets or exceeds the threshold. Foliage-feeding caterpillars such as loopers, velvetbean caterpillar, and green cloverworm consume roughly the same amount of foliage per caterpillar regardless of species. However, the sweep net conversion ratio is about two times higher for velvetbean caterpillar and green cloverworm than for loopers because they are dislodged from the plant easier than loopers, making the catch efficiency of the sweep net greater for these two pests. Because of this, for a complex of foliage-feeding caterpillars, use a threshold of 300 caterpillars/100 sweeps before bloom, counting each looper twice, and 150 caterpillars/100 sweeps after bloom, counting each looper twice.

Bean Leaf Beetle

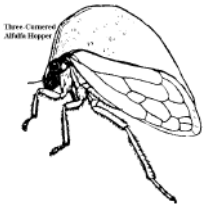


Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate Orthene 90S	.83 – 1.1 lb.	.75 – 1.0	1.2 – .9	Do not harvest for hay or forage. Do not apply within 14 days of harvest. Apply by air at 5-10 GPA and by ground at 10-50 GOA. Maximum AI per acre per season: 1.5 lb.
carbaryl Sevin XLR 4L Sevin 4F	1 – 2 pt. 1 – 2 pt.	.5 – 1.0 .5 – 1.0	8 – 4 8 – 4	Toxic to bees and aquatic invertebrates. Preharvest intervals: 21 days for grain, 14 days for grazing. Maximum AI per acre per season: 6 lbs. Toxic to bees. Pre-harvest interval for grazing: 21 days. Maximum AI per acre per season: 6 lbs.
beta-cyfluthrin Baythroid XL 1 EC	1.6 – 2.8 oz.	.0125 – .022	80 – 45.5	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08CS	.96 –1.6 oz.	.015 –.025	138 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
esfenvalerate Asana XL 0.66EC	5.8 –9.6 oz.	.03 –.05	22 – 13	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
gamma-cyhalothrin Prolex 1.25EC	.77 – 1.28 oz.	.0075 – .0125	166.7 – 100	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
methyl parathion Penncap-M 2EC	2 – 3 pt.	.5 – .75	4 – 2.7	Highly toxic to aquatic invertebrates, wildlife, and bees. Do not apply within 20 days of harvest or grazing. Do not apply more than 2 times per season.
permethrin Ambush 2EC Pounce 3.2EC	6.4 lb. 4 oz.	.1 .1	20 32	Toxic to fish and aquatic organisms. Do not graze or feed soybean forage to livestock. Preharvest interval: 60 days. Maximum AI per acre per season: 0.4 lb.
thiodicarb Larvin 3.2F	18 – 30 oz.	.45 – .75	7.1 – 4.3	Toxic to fish, aquatic invertebrates, birds, and mammals. Do not feed forage, hay, or straw to livestock. Preharvest interval: 28 days. Maximum AI per acre per season: 3 lbs. REI: 48 hours.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	2.8 – 4 oz. 2.8 – 4 oz.	.0175 – .025 .0175 – .025	45.7 – 32 45.7 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

The **BEAN LEAF BEETLE** adult is about one-fourth inch long and may have three or four pairs of black spots along the inner edge of each wing cover. The outer margin of the wing cover may be banded in black. The color patterns of the adult can vary, but typically they are reddish to yellowish. The adult beetle damages the plant by chewing holes in the leaves and occasionally feeding on stems and pods. Adults spend the winter in or near old bean fields. In the spring, they feed on weeds and are attracted to early-planted soybeans. Adults lay eggs in the soil where newly emerged larvae feed on soybean roots and nitrogen-fixing nodules. The immature stage of the beetle is a slender, white larva about one-half inch long with a dark brown area at each end. CruiserMaxx and Gaucho 600 insecticide seed treatments provide good control approximatley 3-4 weeks after planting.

THRESHOLD: If plants are not blooming or filling pods and beetles are present, apply insecticide if defoliation reaches 35 percent. If plants are blooming and filling pods and beetles are present, apply insecticide if defoliation reaches 20 percent or treat when 50 percent of plants show feeding injury on one or more pods per plant or two beetles per sweep after pod set.

Three-Cornered Alfalfa Hopper



Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate Orthene 90S	.83 – 1.1 lb.	.75 – 1.0	1.2 – .9	Do not harvest for hay or forage. Do not apply within 14 days of harvest. Apply by air at 5-10 GPA and by ground at 10-50 GOA. Maximum AI per acre per season: 1.5 lb.
beta-cyfluthrin Baythroid XL 1EC	1.6 – 2.8 oz.	.0125 – .022	80 – 45.5	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
dimethoate Dimethoate 4EC	1 pt.	.5	8	Preharvest interval: 21 days.
gamma-cyhalothrin Prolex 1.25EC	.77 – 1.28 oz.	.0075 – .0125	166.7 – 100	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
lambda-cyhalothrin Karate Z 2.08CS	.96 – 1.6 oz.	.015 – .025	138 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
esfenvalerate Asana XL 0.66EC	5.8 – 9.6 oz.	.03 – .05	22 – 13	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	2.8 – 4 oz. 2.8 – 4 oz.	.0175 – .025 .0175 – .025	45 – 32 45 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

The **THREE-CORNERED ALFALFA HOPPER** is a green triangular-shaped insect about one-fourth inch long. Young hoppers or nymphs are green to light brown, wingless, and covered with spines. They feed around the stem of young plants, girdling the stem near the soil surface. Young seedling plants may lodge from the girdling. When bean pods are set, maturing plants may break over from early seedling damage. Both adults and nymphs will also feed on the petioles of leaves, blooms, and pods. Pod petiole feeding will cause pods to drop to the ground, reducing yield. Soybean plants are most susceptible to main stem girdling when plants are 10 inches or less in height. Once the plant is taller than 10 inches, the main stem is not the preferred feeding site, but the leaf, bloom, and pod petioles may be fed upon. **NOTE:** Often plants that have been girdled and do not lodge will produce normal yields. CruiserMaxx and Gaucho 600 insecticide seed treatments provide good control approximatley 3-4 weeks after planting.

THRESHOLD: Plants less than 10 inches tall, treat when plant stand is being reduced below recommended plant population. See Table 1 on page 41. Plants greater than 10 inches tall, treat when you catch an average of 1 hopper per sweep. Plants less than 6 inches tall, examine near the soil level for girdling. Bend the plants over, and look for hoppers. Threshold is 25 insects per 25 sweeps when plants are more than 10 inches tall.

Cutworms

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres1 Gallon or 1.0 lb. Dry Will Treat	Comments
beta-cyfluthrin Baythroid XL 1EC	.8 – 1.6 oz.	.0065 – .0125	154 – 80	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08CS Warrior 1EC	.96 –1.6 oz. 1.92 – 3.2	.015 –.025 .015 –.025	138 – 83 66.7 – 40	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
esfenvalerate Asana XL 0.66EC	5.8 – 9.6 oz.	.03 – .05	22 – 13	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
gamma-cyhalothrin Prolex 1.25EC	.77 – 1.28 oz.	.0075 – .0125	166.7 – 100	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
permethrin Pounce 3.2EC Ambush	4 oz. 6.4 oz.	.1 .1	64 – 32 20	Toxic to fish and aquatic organisms. Do not graze or feed soybean forage to livestock. Preharvest interval: 60 days. Maximum AI per acre per season: 0.4 lb.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	1.28 – 4 oz. 1.28 – 4 oz.	.008 – .025 .008 – .025	100 – 32 100 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

CUTWORMS are rare pests of soybeans. Cutworms damage young soybean seedlings by cutting the plants off at the soil surface. Cutworms are about 1½ inches long when full grown. They hide under debris or clods during the hot part of the day. Cutworms are most active around dusk and dawn. They are often associated with grassy areas in the field. Burndown herbicides should be applied 2 to 3 weeks before planting. This will allow time for larvae already present feeding on winter vegetation to starve before soybean plants emerge.

THRESHOLD: Treat when plant stand is being reduced below the recommended plant population. See Table 1 on page 41. For best results, treat early in the morning or late in the evening when cutworms are active.

Grasshoppers

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate Orthene 90S	.28 – .56 lb.	.25 – .5	3.6 – 1.8	Do not harvest for hay or forage. Do not apply within 14 days of harvest. Apply by air at 5-10 GPA and by ground at 10-50 GOA. Maximum AI per acre per season: 1.5 lb.
carbofuran Furadan 4F	4 – 8 oz.	.125 – .25	32 – 16	Preharvest interval: 21 days.
beta-cyfluthrin Baythroid XL 1EC	2.0 – 2.8 oz.	.0155 – .022	60 – 45.5	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08CS	1.6 – 1.92 oz.	.025 – .03	83 – 69	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
diflubenzuron Dimilin 2L	2 oz.	.031	64	Apply Dimilin when most of the infesting grasshoppers have reached the second to third nymphal stage. Dimilin will not control adult grasshoppers. Check label for additional comments.
dimethoate Dimethoate 4EC	1 pt.	.5	8	Preharvest interval: 21 days
esfenvalerate Asana XL 0.66EC	5.8 – 9.6 oz.	.03 – .05	22 – 13	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
gamma-cyhalothrin Prolex 1.25EC	1.28 – 1.54 oz.	.0125 – .015	100 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
methyl parathion Penncap-M 2EC	2 – 3 pt.	.5 – .75	4– 2.7	Highly toxic to aquatic invertebrates, wildlife, and bees. Do not apply within 20 days of harvest or grazing. Do not apply more than 2 times per season. Must use higher rates if grasshoppers are large or if weather is cool.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	 3.2 – 4 oz. 3.2 – 4 oz.	 .02 – .025 .02 – .025	 40 – 32 40 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

The two most common species of **GRASSHOPPERS** attacking soybeans in Mississippi are the redlegged and the differential grasshopper. Grasshoppers are mainly foliage feeders but will feed on pods. Females lay eggs in a cemented pod below the soil surface most often in grassy undisturbed sites such as roadsides, prairies, field borders, or ditch banks. Nymphs go through five or six instars, depending on the species. Nymphs and adults are damaging. You can tell the difference between grasshopper nymphs and adults by the presence of wing pads (not fully developed wings). Weather is the most important factor influencing population densities. Grasshoppers are more numerous following drought, especially when it lasts for several years in a row. Populations usually build around field borders before spreading into the field.

THRESHOLD: If plants are not blooming or filling pods and grasshoppers are present, apply insecticide if defoliation reaches 35 percent. If plants are blooming and filling pods and grasshoppers are present, apply insecticide if defoliation reaches 20 percent. Treat when 50 percent of plants show feeding injury on one or more pods per plant.
***Mow ditch before crop development to prevent grasshoppers from moving into the crop.**

Green Cloverworm

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate Orthene 90S	.83 – 1.1 lb.	.75 – 1.0	1.2 – .9	Do not harvest for hay or forage. Do not apply within 14 days of harvest. Apply by air at 5-10 GPA and by ground at 10-50 GOA. Maximum AI per acre per season: 1.5 lb.
carbaryl Sevin XLR 4L Sevin 4F	1 – 2 pt. 1 – 2 pt.	.5 – 1.0 .5 – 1.0	8 – 4 8 – 4	Toxic to bees and aquatic invertebrates. Preharvest intervals: 21 days for grain, 14 days for grazing. Maximum AI per acre per season: 6 lbs. Toxic to bees. Pre-harvest interval for grazing: 21 days. Maximum AI per acre per season: 6 lbs.
beta-cyfluthrin Baythroid XL 1EC	.8 – 1.6 oz.	.0065 – .0125	154 – 80	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08EC	.96 –1.6 oz.	.015 – .025	138 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
diflubenzuron Dimilin 2L	2 – 4 oz.	.031 – .0625	64 – 32	Apply Dimilin when larvae are small (<0.5 inches) to give greater control and minimize insect damage to leaves. Consult label for more details.
esfenvalerate Asana XL 0.66EC	2.9 – 5.8 oz.	.015 – .03	44 – 22	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
gamma-cyhalothrin Prolex 1.25EC	.77 – 1.28 oz.	.0075 – .0125	166.7 – 100	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
indoxacarb Steward 1.25SC	5.6 – 11.3 oz.	.055 – .11	22.8 – 11.5	Toxic to fish, birds, and aquatic invertebrates. Do not feed or graze livestock on treated fields. Postharvest interval: 21 days. Maximum AI per acre per season: 0.44 lbs.
methomyl Lannate 2.4LV	¾ – 1½ pt.	.225 – .45	10.6 – 5.3	Toxic to fish, aquatic invertebrates, bees and wildlife. Do not graze forage within 3 days and hay within 12 days of last application. Do not apply within 14 days of harvest. Maximum AI per acre per season: 1.35 lbs.
methoxyfenozide Intrepid 2F	4 - 8 oz.	.06 - .12	32 - 16	Drift and runoff may be toxic to sensitive aquatic vertebrates. Do not apply by air within 150 feet or by ground within 25 feet of surface water. Preharvest interval: 14 days for seed; 7 days for hay or forage. Maximum AI per acre per season: 1 lb AI (or 4 applications per acre per season). REI: 4 hours.
methyl parathion Methyl 4EC Penncap-M 2EC	2 pt. 2 – 3 pt.	1.0 .5 – .75	4 4 – 2.7	Highly toxic to aquatic invertebrates, wildlife, and bees. Do not apply within 20 days of harvest or grazing. Do not apply more than 2 times per season.
permethrin Ambush 2 EC Pounce 3.2 EC	6.4 oz. 4 oz.	.1 .1	20 32	Toxic to fish and aquatic organisms. Do not graze or feed soybean forage to livestock. Preharvest interval: 60 days. Maximum AI per acre per season: 0.4 lb.
spinosad Tracer 4SC	1 – 2 oz.	.031 – .062	128 – 64	Toxic to bees and mollusks. Do not feed treated forage or hay to beef or dairy cattle. Preharvest treatment interval: 28 days. Maximum AI per acre per season: 0.186 lbs. REI: 4 hours.
thiodicarb Larvin 3.2F	10 – 30 oz.	.25 – .75	12.8 – 4.3	Toxic to fish, aquatic invertebrates, birds, and mammals. Do not feed forage, hay, or straw to livestock. Preharvest interval: 28 days. Maximum AI per acre per season: 3 lbs. REI: 48 hours.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	2.8 – 4 oz 2.8 – 4 oz	.0175 – .025 .0175 – .025	45.7 – 32 45.7 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

The **GREEN CLOVERWORM** feeds on soybean foliage. This pest is uniformly pale green with white stripes running along the sides. Green cloverworms have the same looping motion as the soybean looper and look similar, but the body is not tapered toward the head. An identifying characteristic of the green cloverworm is that it has three pairs of abdominal prolegs. When disturbed, this insect becomes very active. It is attacked by a number of predators, parasites, and diseases and rarely requires chemical treatment.

THRESHOLD: If plants are not blooming or filling pods and no diseased worms are present, apply insecticide when eight or more worms one-half inch long or longer are present per foot of row or when 35 percent foliage loss has occurred and worms one-half inch long or longer are present. If plants are blooming and filling pods and no diseased worms are present, apply insecticide when four or more worms one-half inch long or longer are present per foot of row or when 20 percent foliage loss has occurred and worms one-half inch long or longer are present. If you use a drop cloth to detect green cloverworm, threshold is eight worms per foot of row before bloom. Threshold is four worms per foot of row after bloom. If you use a sweep net, threshold is 75 worms per 25 sweeps before bloom. After bloom, threshold is 38 worms per 25 sweeps.

Velvetbean Caterpillar

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate Orthene 90S	.83 – 1.1 lb.	.75 – 1.0	1.2 – .9	Do not harvest for hay or forage. Do not apply within 14 days of harvest. Apply by air at 5-10 GPA and by ground at 10-50 GOA. Maximum AI per acre per season: 1.5 lb.
beta-cyfluthrin Baythroid XL 1EC	1.6 – 2.8 oz.	.0125 – .022	80 – 45.5	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08CS	.96 –1.6 oz.	.015 –.025	138 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
diflubenzuron Dimilin 2L	2 – 4 oz.	.031 – .0625	64 – 32	Dimilin should be applied when larvae are small (<0.5 inches) to give greater control and minimize insect damage to leaves. The lower rate of Dimilin may be used to prevent damage from velvetbean caterpillar when vegetative growth is completed and pod formation begins. Consult label for more details. Toxic to aquatic invertebrates. Do not apply within 21 days of harvest. Do not make more than two applications per season.
esfenvalerate Asana XL 0.66EC	2.9 – 5.8 oz.	.015 – .03	44 – 22	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
gamma-cyhalothrin Prolex 1.25EC	.77 – 1.28 oz.	.0075 – .0125	166.7 – 100	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
methomyl Lannate 2.4LV	¾ – 1½ pt.	.225 – .45	10.6 – 5.3	Toxic to fish, aquatic invertebrates, bees and wildlife. Do not graze forage within 3 days and hay within 12 days of last application. Do not apply within 14 days of harvest. Maximum AI per acre per season: 1.35 lbs.
methoxyfenozide Intrepid 2F	4 - 8 oz.	.06 - .12	32 - 16	Drift and runoff may be toxic to sensitive aquatic vertebrates. Do not apply by air within 150 feet or by ground within 25 feet of surface water. Preharvest interval: 14 days for seed; 7 days for hay or forage. Maximum AI per acre per season: 1 lb AI (or 4 applications per acre per season). REI: 4 hours.
methyl parathion Methyl 4EC Penncap-M 2EC	¾ – 2 pt. 2 – 3 pt.	.375 – 1.0 .5 – .75	10.7 – 4 4 – 2.7	Highly toxic to aquatic invertebrates, wildlife, and bees. Do not apply within 20 days of harvest or grazing. Do not apply more than 2 times per season.
permethrin Ambush 2EC Pounce 3.2EC	6.4 oz. 4 oz.	.1 .1	20 32	Toxic to fish and aquatic organisms. Do not graze or feed soybean forage to livestock. Preharvest interval: 60 days. Maximum AI per acre per season: 0.4 lb
spinosad Tracer 4SC	1 – 2 oz.	.031 – .062	128 – 64	Toxic to bees and mollusks. Do not feed treated forage or hay to beef or dairy cattle. Preharvest treatment interval: 28 days. Maximum AI per acre per season: 0.186 lbs. REI: 4 hours.
thiodicarb Larvin 3.2F	10 – 30 oz.	.25 – .75	12.8 – 4.3	Toxic to fish, aquatic invertebrates, birds, and mammals. Do not feed forage, hay, or straw to livestock. Preharvest interval: 28 days. Maximum AI per acre per season: 3 lbs. REI: 48 hours.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	2.8 – 4 oz. 2.8 – 4 oz.	.0175 – .025 .0175 – .025	45.7 – 32 45.7 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

VELVETBEAN CATERPILLAR larvae vary from light to dull green, with white lines running the length of the body. The lines on the side of the body are usually much broader than those of the green cloverworm or looper. Velvetbean caterpillars have four pairs of abdominal prolegs and are about 1½ inch long when full grown. When disturbed the velvetbean caterpillar becomes very active and wriggles about like the green cloverworm. Velvetbean caterpillars are voracious feeders usually starting at the top of the plant and feeding downward causing complete defoliation if not controlled. Velvetbean caterpillars are migratory insects flying in from Central and South America each year. Velvetbean caterpillars are primarily foliage feeders but will feed on petioles causing pods to drop to the ground after a significant loss of foliage. Velvetbean caterpillars generally are late season pests of soybeans in Mississippi.

THRESHOLD: If plants are not blooming or filling pods and no diseased worms are present, apply insecticide when eight or more worms one-half inch long or longer are present per foot of row or when 35 percent foliage loss has occurred and worms one-half inch long or longer are present. If plants are blooming and filling pods and no diseased worms are present, apply insecticide when four or more worms one-half inch long or longer are present per foot of row or when 20 percent foliage loss has occurred and worms one-half inch long or longer are present. If you use a drop cloth to detect velvetbean caterpillars, threshold is eight caterpillars per foot of row before bloom and four caterpillars per foot of row after bloom. If you use a sweep net, threshold is 75 caterpillars per 25 sweeps before bloom and 38 caterpillars per 25 sweeps after bloom.

Soybean Looper

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
indoxacarb Steward 1.25SC	5.6 11.3 oz.	.055 - .11	22.8 – 11.5	Toxic to fish, birds, and aquatic invertebrates. Do not feed or graze livestock on treated fields. Postharvest interval: 21 days. Maximum AI per acre per season: 0.44 lbs.
methoxyfenozide Intrepid 2F	4 - 8 oz.	.06 - .12	32 - 16	Drift and runoff may be toxic to sensitive aquatic vertebrates. Do not apply by air within 150 feet or by ground within 25 feet of surface water. Preharvest interval: 14 days for seed; 7 days for hay or forage. Maximum AI per acre per season: 1 lb AI (or 4 applications per acre per season). REI: 4 hours.
spinosad Tracer 4SC	1 – 2 oz.	.031 – .062	128 – 64	Toxic to bees and mollusks. Do not feed treated forage or hay to beef or dairy cattle. Preharvest treatment interval: 28 days. Maximum AI per acre per season: 0.186 lbs. REI: 4 hours.
thiodicarb Larvin 3.2F	18 – 30 oz.	.45 – .75	7.1 – 4.3	Toxic to fish, aquatic invertebrates, birds, and mammals. Do not feed forage, hay, or straw to livestock. Preharvest interval: 28 days. Maximum AI per acre per season: 3 lbs. REI: 48 hours.

SOYBEAN LOOPERS are migratory insects that fly in from Central and South America each year and infest soybeans mid- to late-season in Mississippi. Soybean loopers are leaf feeders and can cause extensive defoliation when present in high numbers. Soybean loopers generally start feeding in the middle of the plant canopy and move upward. The larva has a characteristic looping movement when crawling. It is light green, with white lines running the length of the body on the sides and top. The body tapers toward the head, and the larva has two pairs of abdominal prolegs. The soybean looper has developed resistance to some insecticides but is often controlled by disease organisms.

THRESHOLD: If plants are not blooming or filling pods and no diseased worms are present, apply insecticide when eight or more worms one-half inch long or longer are present per foot of row or when 35 percent foliage loss has occurred and worms one-half inch long or longer are present. If plants are blooming and filling pods and no diseased worms are present, apply insecticide when four or more worms one-half inch long or longer are present per foot of row or when 20 percent foliage loss has occurred and worms one-half inch long or longer are present. If you use a drop cloth to detect soybean loopers, threshold is eight loopers per foot of row before bloom and four loopers per foot of row after bloom. If you use a sweep net, threshold is 38 loopers per 25 sweeps before bloom and 19 loopers per 25 sweeps after bloom.

Saltmarsh Caterpillar

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
carbaryl Sevin XLR 4L Sevin 4F	3 pt. 3 pt.	1.5 1.5	2.7 2.7	Toxic to bees and aquatic invertebrates. Preharvest intervals: 21 days for grain, 14 days for grazing. Maximum AI per acre per season: 6 lbs. Toxic to bees. Pre-harvest interval for grazing: 21 days. Maximum AI per acre per season: 6 lbs.
beta-cyfluthrin Baythroid XL 1EC	1.6 – 2.8 oz.	.0125 – .022	80 – 45.5	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08CS	.96 –1.6 oz.	.015 –.025	138 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
esfenvalerate Asana XL 0.6EC	2.9 – 5.8 oz.	.015 – .03	44 – 22	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
gamma-cyhalothrin Prolex 1.25EC	.77 – 1.28 oz.	.0075 – .0125	166.7 – 100	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
methomyl Lannate 2.4LV	1 – 1½ pt.	.3 – .45	8 – 5.3	Toxic to fish, aquatic invertebrates, bees and wildlife. Do not graze forage within 3 days and hay within 12 days of last application. Do not apply within 14 days of harvest. Maximum AI per acre per season: 1.35 lbs. Use .45 lb a.i. of methomyl on heavy populations of saltmarsh caterpillar.
methoxyfenozide Intrepid 2F	4 - 8 oz.	.06 - .12	32 - 16	Drift and runoff may be toxic to sensitive aquatic vertebrates. Do not apply by air within 150 feet or by ground within 25 feet of surface water. Preharvest interval: 14 days for seed; 7 days for hay or forage. Maximum AI per acre per season: 1 lb AI (or 4 applications per acre per season). REI: 4 hours.
permethrin Ambush 2EC Pounce 3.2EC	6.4 oz. 4 oz.	.1 .1	20 32	Toxic to fish and aquatic organisms. Do not graze or feed soybean forage to livestock. Preharvest interval: 60 days. Maximum AI per acre per season: 0.4 lb.
spinosad Tracer 4SC	1.5 – 2 oz.	.047 – .062	85 – 64	Toxic to bees and mollusks. Do not feed treated forage or hay to beef or dairy cattle. Preharvest treatment interval: 28 days. Maximum AI per acre per season: 0.186 lbs. REI: 4 hours.
thiodicarb Larvin 3.2F	18 – 30 oz.	.45 – .75	7.1 – 4.3	Toxic to fish, aquatic invertebrates, birds, and mammals. Do not feed forage, hay, or straw to livestock. Preharvest interval: 28 days. Maximum AI per acre per season: 3 lbs. REI: 48 hours.
zeta-cypermethrin Mustang Max 0.8E Respect 0.8EC	1.8 – 4 oz. 1.8 – 4 oz.	.008 – .025 .008 – .025	100 – 32 100 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

SALTMARSH CATERPILLARS (often called "woolly worms") feed in the larval stage on soybean foliage. Eggs are laid in masses on the soybean leaves. Infestations often start around field borders. You can easily recognize this caterpillar by the thick hair that covers the body. Color may be black, rust, or yellowish-orange. This pest seldom reaches treatable levels, but large numbers can cause extensive defoliation if left untreated.

THRESHOLD: If plants are not blooming or filling pods and no diseased worms are present, apply insecticide when eight or more worms one-half inch long or longer are present per foot of row or when 35 percent foliage loss has occurred and worms one-half inch long or longer are present. If plants are blooming and filling pods and no diseased worms are present, apply insecticide when four or more worms one-half inch long or longer are present per foot of row or when 20 percent foliage loss has occurred and worms one-half inch long or longer are present.

Bollworm (Corn Earworm or "Podworm")

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
carbaryl Sevin XLR 4L Sevin 4F	1 – 3 pt. 1 – 3 pt.	.5 – 1.5 .5 – 1.5	8 – 2.7 8 – 2.7	Toxic to bees and aquatic invertebrates. Preharvest intervals: 21 days for grain, 14 days for grazing. Maximum AI per acre per season: 6 lbs. Toxic to bees. Pre-harvest interval for grazing: 21 days. Maximum AI per acre per season: 6 lbs.
beta-cyfluthrin Baythroid XL 1EC	1.6 – 2.8 oz.	.0125 – .022	80 – 45.5	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08CS	.96 –1.6 oz.	.015 –.025	138 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
esfenvalerate Asana XL 0.66EC	5.8 – 9.6 oz.	.03 – .05	22 – 13	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
gamma-cyhalothrin Prolex 1.25EC	.77 – 1.28 oz.	.0075 – .0125	166.7 – 100	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
indoxacarb Steward 1.25SC	5.6 – 11.3 oz.	.055 – .11	22.8 – 11.5	Toxic to fish, birds, and aquatic invertebrates. Do not feed or graze livestock on treated fields. Postharvest interval: 21 days. Maximum AI per acre per season: 0.44 lbs.
methomyl Lannate 2.4LV	¾ – 1½ pt.	.225 – .45	10.6 – 5.3	Toxic to fish, aquatic invertebrates, bees and wildlife. Do not graze forage within 3 days and hay within 12 days of last application. Do not apply within 14 days of harvest. Maximum AI per acre per season: 1.35 lbs. Use .45 lb a.i. of methomyl for high populations of corn earworm.
permethrin Ambush 2EC Pounce 3.2EC	6.4 – 12.8 oz. 4 – 8 oz.	.1 – .2 .1 – .2	20 – 10 32 – 16	Toxic to fish and aquatic organisms. Do not graze or feed soybean forage to livestock. Preharvest interval: 60 days. Maximum AI per acre per season: 0.4 lb.
spinosad Tracer 4SC	1.5 – 2 oz.	.047 – .062	85– 64	Toxic to bees and mollusks. Do not feed treated forage or hay to beef or dairy cattle. Preharvest treatment interval: 28 days. Maximum AI per acre per season: 0.186 lbs. REI: 4 hours.
thiodicarb Larvin 3.2F	10 – 30 oz.	.25 – .75	12.8 – 4.3	Toxic to fish, aquatic invertebrates, birds, and mammals. Do not feed forage, hay, or straw to livestock. Preharvest interval: 28 days. Maximum AI per acre per season: 3 lbs. REI: 48 hours.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	2.8 – 4 oz. 2.8 – 4 oz.	.0175 – .025 .0175 – .025	45.7 – 32 45.7 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

The **BOLLWORM OR CORN EARWORM**, found on cotton and corn, is commonly referred to as the "podworm" in soybeans. It varies in color from light green to pink, dark brown, or rust, with pale lines running the length of the body. It has four pairs of abdominal prolegs and is about 1¼ inches long when fully grown. The worm usually curls up when knocked to the ground. Infestations occur most often during the reproductive stages of the soybean plant. In high numbers, this insect can cause significant yield loss.

THRESHOLD: Before bloom, treat on 35 percent defoliation level. If you use a drop cloth to detect bollworms, threshold is four worms per foot of row after bloom. With a sweep net, threshold is 15 worms per 25 sweeps after bloom.
***Bollworms or podworms are difficult to sample with the sweep net. Sweep deeper into the canopy, using extra force; supplement with visual check for pod or bloom feeding.**

Beet Armyworm

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
spinosad Tracer 4SC	1.5 – 2 oz.	.047 – .062	85– 64	Toxic to bees and mollusks. Do not feed treated forage or hay to beef or dairy cattle. Preharvest treatment interval: 28 days. Maximum AI per acre per season: 0.186 lbs. REI: 4 hours.
indoxacarb Steward 1.25SC	5.6 – 11.3 oz.	.055 – .11	22.8 – 11.5	Toxic to fish, birds, and aquatic invertebrates. Do not feed or graze livestock on treated fields. Postharvest interval: 21 days. Maximum AI per acre per season: 0.44 lbs.
methoxyfenozide Intrepid 2F	5.6 11.3 oz.	.055 - .11	22.8 – 11.5	Drift and runoff may be toxic to sensitive aquatic vertebrates. Do not apply by air within 150 feet or by ground within 25 feet of surface water. Preharvest interval: 14 days for seed; 7 days for hay or forage. Maximum AI per acre per season: 1 lb AI (or 4 applications per acre per season). REI: 4 hours.
thiodicarb Larvin 3.2F	10 – 30 oz.	.25 – .75	12.8 – 4.3	Toxic to fish, aquatic invertebrates, birds, and mammals. Do not feed forage, hay, or straw to livestock. Preharvest interval: 28 days. Maximum AI per acre per season: 3 lbs. REI: 48 hours.

The **BEET ARMYWORM** prefers to feed on foliage of seedling soybean plants. However, if they are present during fruiting, they will feed on bloom buds, blooms, and small pods. The larva has a small black spot on each side of the second body segment. This small black spot is directly above the second pair of true legs behind the head. The beet armyworm has four pairs of abdominal prolegs and a smooth body. The larvae are about 1¼ inch long when fully grown. They generally curl up when knocked to the ground. Color may vary from grayish-green to near black with pale lines running the length of the body. Beneficial insects and diseases usually control this pest. Beet armyworms are migratory insects that generally attack soybeans in Mississippi mid- to late-season.

THRESHOLD: If plants are not blooming or filling pods and larvae are present, apply insecticide if defoliation reaches 35 percent. If plants are blooming and filling pods and larvae are present apply insecticide if defoliation reaches 20 percent.

Fall Armyworm

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1Gallon or 1.0 lb. Dry Will Treat	Comments
acephate Orthene 90S	.83 – 1.1 lb.	.75 – 1.0	1.2 – .9	Do not harvest for hay or forage. Do not apply within 14 days of harvest. Apply by air at 5-10 GPA and by ground at 10-50 GOA. Maximum AI per acre per season: 1.5 lb.
carbaryl Sevin XLR 4L Sevin 4F	1 – 3 pt. 1 – 3 pt.	1 – 1.5 1 – 1.5	4 – 2.7 4 – 2.7	Toxic to bees and aquatic invertebrates. Preharvest intervals: 21 days for grain, 14 days for grazing. Maximum AI per acre per season: 6 lbs. Toxic to bees. Pre-harvest interval for grazing: 21 days. Maximum AI per acre per season: 6 lbs.
beta-cyfluthrin Baythroid XL 1EC	1.6 – 2.8 oz.	.0125 – .022	80 – 45	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08CS	1.6 – 1.92 oz.	.025 – .03	83 – 69	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
gamma-cyhalothrin Prolex 1.25EC	1.28 – 1.54 oz.	.0125 – .015	100 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
methoxyfenozide Intrepid 2F	5.6 11.3 oz.	.055 - .11	22.8 – 11.5	Drift and runoff may be toxic to sensitive aquatic vertebrates. Do not apply by air within 150 feet or by ground within 25 feet of surface water. Preharvest interval: 14 days for seed; 7 days for hay or forage. Maximum AI per acre per season: 1 lb AI (or 4 applications per acre per season). REI: 4 hours.
indoxacarb Steward 1.25SC	5.6 – 11.3 oz.	.055 – .11	22.8 – 11.5	Toxic to fish, birds, and aquatic invertebrates. Do not feed or graze livestock on treated fields. Postharvest interval: 21 days. Maximum AI per acre per season: 0.44 lbs. First and second instars only.
thiodicarb Larvin 3.2F	10 – 30 oz.	.25 – .75	12.8 – 4.3	Toxic to fish, aquatic invertebrates, birds, and mammals. Do not feed forage, hay, or straw to livestock. Preharvest interval: 28 days. Maximum AI per acre per season: 3 lbs. REI: 48 hours.
spinosad Tracer 4SC	1.5 – 2 oz.	.047 – .062	85 – 64	Toxic to bees and mollusks. Do not feed treated forage or hay to beef or dairy cattle. Preharvest treatment interval: 28 days. Maximum AI per acre per season: 0.186 lbs. REI: 4 hours.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	3.2 – 4 oz. 3.2 – 4 oz.	.02 – .025 .02 – .025	40 – 32 40 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

FALL ARMYWORMS are occasional pests of soybeans but can be extremely damaging if present in high numbers. Fall armyworms will damage all stages of soybeans. In the early stages, they can act similar to cutworms by cutting seedlings off at ground level. Later stages will feed primarily on foliage and pods. The larva has a characteristic inverted "Y" on the head capsule and is brown to dark green.Eggs are laid in masses and are covered with grey scales from the female moth.

THRESHOLD: Treat young soybeans when plant stand is being reduced below the recommended plant population. See Table 1 on page 41. If plants are not blooming or filling pods and larvae are present, apply insecticide if defoliation reaches 35 percent. If plants are blooming and filling pods and larvae are present, apply insecticide if defoliation reaches 20 percent.

Stink Bugs

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
acephate Orthene 90S	.56 – 1.1 lb.	.5 – 1.0	1.6 – .9	Do not harvest for hay or forage. Do not apply within 14 days of harvest. Apply by air at 5-10 GPA and by ground at 10-50 GOA. Maximum AI per acre per season: 1.5 lb.
beta-cyfluthrin Baythroid XL 1EC	1.6 – 2.8 oz.	.0125 – .022	80 – 45.5	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin Karate Z 2.08CS	1.6 – 1.92 oz.	.025 – .03	83 – 69	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
gamma-cyhalothrin Prolex 1.25EC	1.28 – 1.54 oz.	.0125 – .015	100 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
esfenvalerate Asana XL 0.66EC	5.8 –9.6 oz.	.03 – .05	22 – 13	Do not feed or graze livestock on treated plants. Do not apply within 21 days of harvest. Maximum AI per acre per season: 0.2 lb. REI: 12 hours.
methyl parathion Methyl 4EC Penncap-M 2EC	¾ – 2 pt. 1 – 3 pt.	.375 – 1.0 .25 – .75	10.7 – 4 8 – 2.7	Highly toxic to aquatic invertebrates, wildlife, and bees. Do not apply within 20 days of harvest or grazing. Do not apply more than 2 times per season.
zeta-cypermethrin Mustang Max 0.8EC Respect 0.8EC	3.2 – 4 oz. 3.2 – 4 oz.	.02 – .025 .02 – .025	40 – 32 40 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.

In Mississippi three species of **STINK BUG** are commonly found in soybeans: southern green, green, and brown. Adult stink bugs are about one-half inch long. During spring and early summer, they feed and reproduce on a variety of weeds and in home gardens. Stink bugs damage soybeans by piercing the pod hulls and sucking juices from the developing seeds. This type of feeding can result in unfilled pods, severely shrunken seeds, or discolored seed around the puncture sites. Punctured seed can cause lower grades and lower germination. Stink bugs lay barrel-shaped eggs in masses on the leaf surface. Emerging nymphs complete five life stages before becoming adults. All stages feed on soybeans, but the fourth and fifth instar nymphs can cause as much damage as the adult stage.

THRESHOLD: If you use a drop cloth, threshold is .33 stink bugs per foot of row from bloom to mid-pod. Threshold is 1 bug per foot of row from mid-pod to maturity. If you use a sweep net, threshold is 3 bugs per 25 sweeps from bloom to mid-pod and 9 bugs per 25 sweeps from mid-pod to maturity. Brown stink bugs are more difficult to control with pyrethroids.

Blister Beetle

Insecticide	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Acres 1 Gallon or 1.0 lb. Dry Will Treat	Comments
carbaryl				
Sevin XLR 4L	1 – 2 pt.	.5 – 1.0	8 – 4	Toxic to bees and aquatic invertebrates. Preharvest intervals: 21 days for grain, 14 days for grazing. Maximum AI per acre per season: 6 lbs.
Sevin 4F	1 – 2 pt.	.5 – 1.0	8 – 4	Toxic to bees. Pre-harvest interval for grazing: 21 days. Maximum AI per acre per season: 6 lbs.
beta-cyfluthrin				
Baythroid XL 1EC	1.6 – 2.8 oz.	.0125 – .022	80 – 45.5	Extremely toxic to fish and aquatic invertebrates. Do not feed green forage within 15 days of harvest. Preharvest interval: 45 days. Maximum AI per acre per season: 0.0875 lb. REI: 12 hours.
lambda-cyhalothrin				
Karate Z 2.08CS	1.6 – 1.92 oz.	.025 – .03	83 – 69	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.06 lb.
gamma-cyhalothrin				
Prolex 1.25EC	1.28 – 1.54 oz.	.0125 – .015	100 – 83	Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 45 days of harvest. Maximum AI per acre per season: 0.03 lb.
methyl parathion				
Methyl 4EC	¾– 2 pt.	.375 – 1.0	10.7 – 4	Highly toxic to aquatic invertebrates, wildlife, and bees. Do not apply within 20 days of harvest or grazing. Do not apply more than 2 times per season.
zeta-cypermethrin				
Mustang Max 0.8EC	2.8 – 4 oz.	.0175 – .025	45.7 – 32	Toxic to aquatic invertebrates. Postharvest interval is 21 days. Maximum AI per acre per season: 0.125 AI.
Respect 0.8EC	2.8 – 4 oz.	.0175 – .025	45.7 – 32	

BLISTER BEETLES feed mainly on the leaves of soybean plants. Blister beetles may be grayish, black, or orange with stripes and are about three-fourths inch long. They are rarely a problem in soybeans, but large numbers can cause extensive defoliation. Some species will congregate in very large numbers within the soybean field, but damage is usually isolated to small patch-like areas. The larvae of the blister beetle can be considered a beneficial insect. First instar larvae are very mobile and search out and feed on grasshopper eggs.

THRESHOLD: If plants are not blooming or filling pods and beetles are present, apply insecticide if defoliation reaches 35 percent. If plants are blooming and filling pods and beetles are present, apply insecticide if defoliation reaches 20 percent.

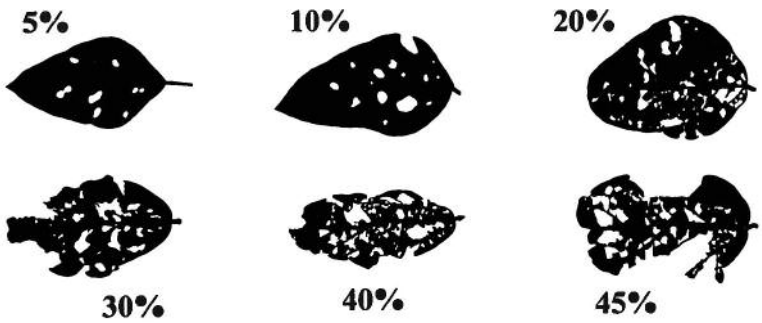
Table 1.
Suggested Plant Populations for Soybeans Planted in Mississippi

Row Width in Inches	Feet of Row per Acre	Plants per Foot of Row	Plants per Acre
40	13,068	8.00	104,544
38	13,756	7.50	103,455
36	14,520	7.00	101,640
30	17,424	6.00	104,544
20	26,136	4.00	104,544
14	37,337	3.50	130,680
12	43,560	3.00	130,680
10	52,272	2.75	143,748
7	74,674	2.25	168,016
6	87,120	2.00	174,240

Table 2.
Growth Stages of Soybeans (from Fehr & Caviness 1977)

VE – Emergence
VC – Cotyledon + unfolding unifoliate
V1 – First-node trifoliate
V2 – Second node
V3 – Third node
V4 – Fourth node
V (n) – Nth-node
R1 – Beginning bloom
R2 – Full bloom
R3 – Beginning pod
R4 – Full pod
R5 – Beginning seed
R6 – Full seed
R7 – Beginning maturity
R8 – Full maturity

Estimating Foliage Loss



Effectively estimating whole plant foliage loss is important in determining economic thresholds. Concise determinations in the field are difficult to make. Following is one procedure that may help in making defoliation estimates more accurate.

1. Study the leaflet photographs that show different foliage losses. Remember the threshold is 35 percent foliage loss for soybeans not blooming or filling pods and 20 percent foliage loss for soybeans blooming or filling pods.
2. Randomly select 10 to 20 leaflets from the middle or upper position of plants within a field.
3. Compare each leaflet with the photographs to the left and score each leaflet collected.
4. Average the scores to find the average foliage loss for the field sampled.
5. Practice this method using several field surveys.

OCCASIONAL PESTS OF SOYBEANS

Grape colaspis larvae occasionally are present early in the season in soybean fields. Feeding injury may result in stand reduction. Although uncommon, even severe infestations are difficult to detect early enough for chemical control, and replanting is often required.

Potato Leafhopper populations are occasionally extremely high in soybean fields. Smooth-leaf varieties are particularly susceptible to potato leafhoppers. Extensive feeding on leaves by this pest may cause leaf discoloration and malformation, often called "hopperburn." Although this is generally insignificant, yields can sometimes be reduced. Approximate thresholds are five to nine per plant before bloom, with smaller plants being more susceptible. Blooming and more mature plants can tolerate larger populations.

Lesser cornstalk borer larvae damage soybeans by boring into the main stem at or just below the soil surface. Seedlings are cut off at the soil surface or may lodge because of extensive tunneling. The larvae are bluish-green and travel on top of the soil in silken tubes. Treatment is usually preventative and based on field history. Preventative treatments of Lorsban 15G applied T-band or in-furrow at planting at 8 oz./1,000 row feet are recommended when the field has a history of this pest. See label for additional details.

Soybean aphids are a new pest to soybeans in Mississippi. Currently soybean aphids have only been found in a few counties in Mississippi. While several species of aphids will feed on soybeans, soybean aphids are the only species that will colonize in very large numbers on soybeans. Soybean aphids, like whiteflies, excrete honeydew while they feed. This honeydew can cover the plant and cause sooty mold. This sooty mold prevents photosynthesis and can cause premature defoliation. Since this is a new pest to Mississippi, there are no current established thresholds. In Midwest states, thresholds are generally 250 aphids per plant. Apparently, there is no value in treating after R6.

Thrips can occur in high populations on soybeans and are most damaging during periods of drought. Although these populations may delay maturity, they generally do not reduce yields.

Tobacco budworm only occasionally develops high populations in soybeans. Heaviest infestations often occur in areas with the highest concentration of cotton acreage. This insect is very similar in appearance and habits to the bollworm, and you should use the same treatment threshold. Budworms have developed resistance to many insecticides and are more difficult to control.

Whiteflies normally do not build damaging populations on soybeans, but in favorable conditions, extremely large populations can occur. Very little direct damage results from whitefly feeding. These insects produce honeydew. A fungus known as sooty mold grows on the honeydew. When this mold covers the leaf surface, it blocks sunlight, which prevents photosynthesis and can cause premature defoliation.

Whitefringed beetles occur in soybeans on the Coastal Plain. Although adults feed on foliage, populations are usually low. Whitefringed beetles are not thought to be of economic importance, but we don't know how much soybean damage they cause.

CORN, COTTON, & SOYBEAN INSECT CONTROL GUIDE COMMITTEE

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