

# Sorghum INSECT MANAGEMENT 2016



## How to Use This Guide

This publication was prepared to help producers manage insect populations with the best available methods proven practical under Kansas conditions. It is revised annually and intended for use during this calendar year. Users should be aware that pesticide label directions and restrictions are subject to change, and some may have changed since this publication was written. The economics of control should be considered in any pest management decision. Because costs vary greatly over time and are influenced by factors beyond the scope of this publication, product cost in general is not considered a reason for including or omitting specific insecticide products in these recommendations. Always compare product price, safety and availability when making treatment decisions. The user is responsible for proper use and should read the label carefully before making a pesticide application. It is illegal to use a pesticide in a manner inconsistent with the label. The label tells where, how and when the product can be used.

For more information on pests covered in this publication or other crop pests visit [www.entomology.k-state.edu/extension/insect-information/crop-pests](http://www.entomology.k-state.edu/extension/insect-information/crop-pests). Kansas State University entomologists assume no responsibility for product performance, personal injury, property damage, or other types of loss resulting from the handling or use of the pesticides listed.

## Using Insecticides Safely

Injury or death can result from swallowing, inhaling, or prolonged skin contact with insecticides. The risk of injury from ingestion is greatest among pets, livestock, and young children. Skin absorption, and sometimes inhalation, pose the greatest risk to users. Handle pesticides with care and use only when needed. Avoid spilling concentrates on the skin or clothing.

If a spill occurs, remove contaminated clothing immediately, and wash with soap and water. If in the eyes, flush with water for 15 minutes and seek prompt medical attention. If exposed and in need of medical treatment, take the pesticide label

Perennial	Winter/Spring	Summer	Fall/Winter
Wireworms		Pg. 1	
Corn Leaf Aphid			Pg. 2
Chinch Bug		Pg. 4	
Corn Earworm		Pg. 5	
Fall Armyworm		Pg. 6	
Occasional	Winter/Spring	Summer	Fall/Winter
False Wireworm		Pg. 1	
Greenbug			Pg. 2
Sugar Cane Aphid			Pg. 1
False Chinch Bug			Pg. 4
Cutworm		Pg. 4	
Grasshopper		Pg. 6	
Sorghum Webworm			Pg. 6
Spider Mites		Pg. 6	
	Jan Feb Mar Apr	May Jun Jul Aug Sep Oct Nov Dec	

with you. For poison control information contact the Mid-America Poison Control Center at 800-222-1222.

Wear protective equipment (respirators, clothing) as specified on the label. Bathe and change clothing frequently. Launder contaminated clothing separately. Protect fish, wildlife, and other nontarget organisms. Do not dispose of unused pesticides where the runoff may contaminate streams, lakes, or drinking water supplies, nor apply in a manner that could pollute such sites.

Consider the presence of honeybees before applying insecticides. Avoid drift to beehives or adjacent blooming crops. Notify the bee owner before applications are made in the general vicinity. Applying treatment late in the day when bees are not foraging may help to reduce the risk.

## Belowground Pests

### Wireworms and Other Seed-Attacking Pests

Most insects that attack sorghum seeds and seedling plants before emergence can be controlled with seed treatments that contain clothianidin (Poncho), imidacloprid (numerous products), or thiamethoxam (Cruiser).

## Aboveground Pests

### Aphids

#### Sugarcane Aphid, *Melanaphis sacchari*

#### A New Pest of Sorghum in Kansas

These pale yellow aphids have short, dark 'tailpipes' (cornicles) with dark feet and produce copious amounts of honeydew. Capable of very high rates of reproduction, they were discovered attacking grain sorghum in Lubbock, Texas, in 2013 and caused serious economic losses in Texas and other southern states in 2014. Sugarcane aphids were detected in 2014 at non-treatable levels late in the season. However, in 2015 many fields across Kansas exceeded thresholds and were treated with insecticides. Kansas may be at risk of serious infestation again this year as migrant aphids disperse from a much wider region to the south.

Producers should be vigilant and report suspected infestations to their local extension agent or entomologist. The aphid is not expected to overwinter much further north than south Texas, but large numbers of migrants are expected to move north during the growing season.

The sugarcane aphid produces a copious amount of honeydew and has an extremely high reproductive rate on susceptible sorghums, with a potential population doubling time of 1.5 days at 73°C. Feeding by sugarcane aphid eventually causes leaf chlorosis in the form of reddish spots that gradually coalesce into large lesions, somewhat similar to greenbug damage.

### Timing of Infestation

Plants are potentially vulnerable at any growth stage, but Kansas sorghum will be most at risk from boot stage onward. The ability of sugarcane aphid to colonize and overwinter on Johnsongrass and re-sprouting sorghum stubble will be challenges to the management of this pest in more southerly regions.

In 2016, sugarcane aphid overwintered just north of Lubbock, Texas, as asexual females on Johnsongrass rhizomes. No egg-laying females have been observed and infestations of Kansas sorghum will be initiated annually by winged aphids carried from southern latitudes; the timing, extent and exact regions affected will be difficult to predict and largely a function of wind direction during periods of aphid flight in Texas and Oklahoma. The biology of the aphid is such that the daughters of winged aphids lack wings and have a much higher rate of reproduction, but as colonies become large and crowded, winged forms begin to develop until the final generation is exclusively winged once again. Thus, the trend will be for Kansas to receive sugarcane aphid only after infestations to the south mature and produce winged migrants, so growers are advised to plant sorghum early to obtain as much plant growth and maturity as possible before aphids arrive. An insecticidal seed treatment may be advisable for later-planted sorghum, at least this year. In 2015, large flights of sugarcane aphid did not arrive in Kansas until relatively late in the growing season, which minimized economic impact in most areas, but given suitable weather, infestations could easily occur much earlier, in which case they could cause much more damage. Ripening grain remains susceptible to damage through soft dough stages, and the challenge in Kansas will be to determine which infestations have occurred late enough that they need not be sprayed, despite surpassing current treatment thresholds. One important factor will be the onset of low overnight temperatures that will arrest aphid feeding and reproduction; even though aphids may survive for some time in cold weather, they

may do little further damage to the crop. Forage sorghums grown for silage are also at risk, as sugarcane aphid feeding can result in significant loss of biomass, and significantly reduced rates of forage consumption by cattle. It is also very hard to obtain good control of sugarcane aphid in forage sorghums because of the difficulty of getting good spray coverage within these high-density plantings.

### Resistant Hybrids

Many greenbug-resistant sorghum hybrids show good levels of resistance to sugarcane aphid, especially lines expressing the resistance source PI 550610. Hybrids with other types of greenbug resistance are also being screened, but not all of them are demonstrating efficacy against sugarcane aphid. Nonetheless, locally adapted hybrids rated for greenbug resistance would probably be a wise planting choice, if available. Resistant hybrids will slow sugarcane aphid population growth and will assist the evolution of natural biological control by our indigenous complex of aphid predators and parasitoids.

Producers and consultants should scout fields often and report suspected infestations to their local extension agent or entomologist. Before monitoring sorghum for aphids, download the scouting guide for sugarcane aphid in Kansas: [www.myfields.info/sca](http://www.myfields.info/sca). This guide will assist with identification of the aphid and determining the need to spray. Remember, it is just as important to spray immediately once the economic threshold is surpassed as it is to not spray earlier, otherwise infestations will mature and export winged aphids, which could infest nearby fields. Two insecticides are approved for use against sugarcane aphid in Kansas sorghum:

- Transform\* (sulfoxaflor),  
Dow Agrosciences, @ 1.0 oz/acre  
(EPA Section 18); and
- Sivanto (flupyradifurone),  
Bayer Crop Science, @ 4.0 oz/acre.

### Management Considerations

Field trials show good efficacy of the above materials against the sugarcane aphid; both have the ability to penetrate leaves through translaminar movement and kill aphids feeding on the undersides, provided they are applied in a large volume of water, preferably 20 gal / acre or GPA (minimum 10 GPA) by ground applicators or a minimum of 5 GPA using aerial application methods. Laboratory trials indicate that sulfoxaflor, and to a lesser extent flupyradifurone, are relatively safe for important aphid predators such as lady

beetles and lacewings and thus can be considered IPM-compatible. Both these materials have annual application limits and growers are advised to rotate them if follow-up applications are required. Note also that preharvest intervals will be a factor to consider when treating late-season infestations, so applicators should read labels carefully and keep a log of all treatments for each field. Because sulfoxaflor and flupyradifurone are absorbed by leaves and eventually metabolized by the plant, their residual efficacy is limited and reinfestation can occur quite quickly if large numbers of winged aphids continue to settle in the field. When inspecting fields for treatment efficacy, note whether any live aphids are winged or wingless, as the former are more likely to indicate continued immigration rather than control failure. We DO NOT recommend attempts to control sugarcane aphid with contact insecticides that have broad-spectrum activity, which includes all pyrethroid and organophosphate materials. Repeated field trials indicate these materials are not effective, harm beneficial species, and often result in higher aphid numbers than unsprayed control plots. Insecticidal seed treatments are useful for protecting seedlings from sugarcane aphid infestation in southern regions where the pest is active year-round, but are not recommended for this purpose in Kansas where infestation during seedling stages is unlikely.

### Corn Leaf Aphid

These aphids are about 1/16-inch long and dark-green or bluish and found in the whorl of plants in the vegetative growth stage. Plants can tolerate relatively large populations of these aphids without measurable yield loss, and populations usually decline rapidly after the head begins to emerge. Control is rarely necessary and should only be considered if infestations persist after heads have emerged. Otherwise, their presence is generally considered to be beneficial because they attract and support populations of aphid natural enemies that later contribute to greenbug and sugarcane aphid control.

### Greenbug

Greenbugs are small, lime-green aphids that form colonies on undersides of leaves. They have a dark green line down the middle of the back and antennae as long as or longer than their body. Reproductive capacity is high; all individuals are females that mature within five to seven days in warm weather and produce several offspring per day for up to two weeks.

While feeding, greenbugs inject toxic saliva, destroying chlorophyll in the leaves and turning them red or rusty brown. As plants deteriorate, winged forms develop that are capable of dispersal over great distances. Greenbug damage to Kansas sorghum has declined in recent years but could resurge at any time. The widespread use of seed treatments has greatly reduced problems with seedling infestation, but infestations may occur in later stages of plant development if there is significant migration of winged forms from more

southern latitudes. When cool summer weather delays insect activity, migration may continue after panicle emergence. In this case, greenbugs will then feed within the heads causing flower sterility.

Refer to the Greenbug Treatment Guide below for threshold values at various growth stages. For example, an infestation of 10 to 25 greenbugs per plant (based on counts from 25 plants or more) is considered threatening at the one-leaf stage. The infestation may increase or de-

cline depending on the presence of natural enemies such as lady beetles, lacewings and parasitic wasps. Monitor and treat fields if populations increase. An infestation at the one-leaf stage that averages 25 to 50 greenbugs per plant poses a higher risk with serious stand loss likely. Prompt control would be recommended. As plants develop, beneficial insects become increasingly important as agents of greenbug control, and their relative abundance should temper treatment decisions.

### Sugar Cane Aphid Management Options

Insecticide	Rate
Flupyradifurone (Sivanto)	0.02 to 0.025 lb. a.i./acre (3.2 to 3.9 fl. oz./acre)
Sulfoxaflor (Transform)	0.375 - 0.75 oz a.i./acre (0.75 - 1.5 oz / acre)

### Corn Leaf Aphid Management Options

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	0.02 to 0.025 lb. a.i./acre (3.2 to 3.9 fl. oz./acre)
Chlorpyrifos (numerous products)	Check label, but generally 0.5 to 1 pint/acre.
Chlorpyrifos plus gamma-cyhalothrin (Cobalt Advanced)	6.0 to 13.0 fl. oz./acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	9.25 to 11.75 fl. oz./acre

### Greenbug Management Options

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	0.02 to 0.025 lb. a.i./acre (3.2 to 3.9 fl. oz./acre)
Chlorpyrifos (numerous products)	Check label, but generally 0.5 to 2 pints/acre
Chlorpyrifos plus gamma-cyhalothrin (Cobalt Advanced)	11.0 to 38.0 fl. oz./acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	9.25 to 11.75 fl. oz./acre
Dimethoate (Dimethoate or Dimate)	0.25 to 0.5 lb. a.i./acre
Malathion 57	1.5 pints/acre
Methidathion (Supracide 2E)	Section 24(C), 2 pints/acre

### Greenbug Treatment Guide (Susceptible Hybrids)<sup>1</sup>

Plant growth stage <sup>2</sup>	Based on average number of greenbugs per plant		Based on visual rating <sup>3</sup>
	Threatening level	Treatment level <sup>3</sup>	
0- to 1-leaf stage	10 – 25	25 – 50	Colonies or numerous winged adults present on majority of plants. May be risky to wait until visible damage is obvious.
3-leaf stage	25	50 – 100	As above, before general signs of stress are visible. Light to threatening levels often decline naturally.
5-leaf stage	50	150 – 300	When majority of plants are infested with rapidly increasing colonies of greenbugs and initial signs of reddening start to appear.
Mid-whorl stage, about one month after emergence	200	300 – 600	When majority of plants are infested with rapidly increasing colonies, but before leaves begin to die. Damaging levels uncommon at this stage, but beginning infestations are often starting to appear.
Late whorl through soft dough stages	700	1,000	Some lower leaves beginning to become wet and sticky with honeydew. Some leaves yellowing and reddening with occasional leaves drying. Small to large colonies present and increasing on the majority of plants.

<sup>1</sup>Some upward adjustment in numbers and damage is usually indicated to justify treatment on resistant hybrids particularly in early growth stages.

<sup>2</sup>One leaf stage means collar of first leaf visible, same system for third and fifth leaf stages.

<sup>3</sup>Assumes minimal beneficial activity. Remember frequent field visits are usually necessary to make wise decisions.

**Resistant hybrids** can be a useful way of reducing greenbug damage. Currently, hybrids with resistance to biotypes I and K offer the best protection. While resistant hybrids are not a perfect or complete solution, they delay greenbug development and reproduction, allowing natural enemies more time to respond, and should be considered for a portion of the acreage in areas prone to greenbug infestations. Check with local seed suppliers for greenbug resistant hybrids adapted to your area.

**Seed treatments** are justified if damaging populations of seed-destroying insects are known to be present in the field, or if there is a known risk of chinch bug migration from an adjacent wheat field. The use of seed treatments for the sole purpose of preventing aphid infestations is not justified in Kansas sorghum. Whorl stage infestations by corn leaf aphids serve to draw aphid predators into the crop and thus help protect against more damaging aphid species that arrive later.

**Soil treatments** applied at planting time are useful for early-season protection when there are significant flights of greenbugs during planting. Treatments are particularly useful in eastern regions of the state where protection from chinch bugs is also desirable. Terbufos is labeled only for band or knifed-in application because it can be phytotoxic. Soil treatments may

not be effective where insecticide-resistant greenbugs are present.

#### *Terbufos (Counter 15G)*

Band application for use in Lock 'n' Load systems: Apply 1 lb. a.i./acre once a year. Follow label directions and select rate based on formulation and row width. Place granules in a 5- to 7-inch band directly behind the planter shoe in front of the press wheel. Incorporate lightly with drag chains or tines. Apply 1 to 2 lb. a.i./acre if knifed in. See label for rate based on formulation and row width. Drill granules 1 to 4 inches directly below the seed or 1 to 4 inches below and up to 5 inches to the side. PHI is 50 days for forage and 100 days for fodder or grain.

### Bugs

#### Chinch Bug

Adults are small, black bugs about 1/8 inch long with white wings folded over the back. Two small, dark, triangular markings appear near the mid-portion of the wings. Immatures are bright red after hatching, then darken as they approach maturity. A white band on the upper side of the first abdominal segment is visible until wing buds grow to cover it.

Overwintered adults emerge in early spring and fly to small grains where they mate and produce the first generation. Most problems in sorghum occur when large

groups of immature, wingless nymphs migrate from maturing wheat fields and invade adjacent sorghum fields where they complete development. Because nymphs are flightless, various barrier treatments and trap crops historically have been used to protect the margins of emerging sorghum fields. Occasionally, adults fly into sorghum either directly from overwintering grasses, late-maturing wheat or from other sorghum fields.

Problems with this insect are generally confined to eastern and central Kansas, with damage beginning in May or June. The risk of damage is greater where sorghum is planted next to thin stands of wheat. Seedling sorghum is most vulnerable, and seven to 10 bugs per plant will cause stunting, poor root development and stand reduction. Larger plants can tolerate more bugs, but severe infestations can cause stunting, lodging, and yield loss.

Using **seed treatments**: clothianidin (Poncho), imidacloprid (numerous products) and thiamethoxam (Cruiser) at planting can decrease chinch bug damage. These treatments work well initially, but wear off in a few weeks. Growers should be aware of this problem and use follow-up sprays on border rows if protection wears off before the end of chinch bug migration. See MF3107, *Chinch Bug* ([www.ksre.ksu.edu/bookstore/pubs/MF3107.pdf](http://www.ksre.ksu.edu/bookstore/pubs/MF3107.pdf)).

### Chinch Bug Management Options (Foliar Treatments)

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	3.2 to 3.9 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.019 to 0.022 lbs. a.i./acre (2.0 to 2.8 fl. oz.)
Carbaryl (Sevin)	1.5 to 2 lb. a.i./acre
Chlorpyrifos (Numerous products)	Check label, but generally 1 to 2 pints/acre.
Chlorpyrifos (Saurus)	8 oz./1,000 row ft. - T-band at planting
Chlorpyrifos plus gamma-cyhalothrin (Cobalt Advanced)	11.0 to 38.0 fl. oz. of product/acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	9.25 to 11.75 fl. oz./acre
Deltamethrin (Delta Gold)	0.015 to 0.022 lb. a.i./acre (1.3 to 1.9 fl. oz.)
Esfenvalerate (Asana XL 0.66)	0.03 to 0.05 lb. a.i./acre (5.8 to 9.6 fl. oz.)
Gamma-cyhalothrin (Proaxis)	0.015 lb. a.i./acre (3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.03 lb. of a.i./acre
Zeta-cypermethrin (Mustang MAXX, Respect EC, etc.)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

### False Chinch Bug Management Options

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	3.2 to 3.9 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lbs. a.i./acre (1.3 to 2.8 fl. oz.)
Chlorpyrifos plus zeta-cypermethrin (Stallion)	9.25 to 11.75 fl. oz./acre
Zeta-cypermethrin (Mustang MAXX, Respect EC)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

## False Chinch Bug

Similar to chinch bugs in size and appearance, false chinch bug nymphs are grayish to brown, and may be tinged with yellow rather than bright orange. Adults are gray to brown with transparent wings, whereas chinch bug adults are black with white wings with a black triangle.

False chinch bugs occasionally become abundant when conditions favor survival on various weed hosts, particularly wild mustards. They have a wide host range and as many as four generations per year. Fields planted no-till into wheat stubble where weed control was delayed until just before planting, and fields bordering weedy areas are most at risk.

False chinch bugs spend little time on sorghum plants but abundant populations can reduce stands. Adults can swarm into sorghum fields later in the season. Infestations averaging 140 bugs per panicle during milk stage are considered damaging. But swarms of adults usually are spotty. Unless several spots are present, it is usually hard to justify field-wide treatment.

See MF3047, *False Chinch Bug* ([www.ksre.ksu.edu/bookstore/pubs/MF3047.pdf](http://www.ksre.ksu.edu/bookstore/pubs/MF3047.pdf)).

## Caterpillars

### Cutworms

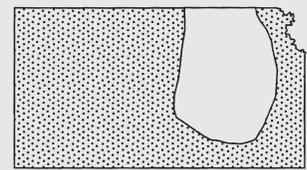
Cutworm damage to sorghum is infrequent, but growers should be alert when early season cutworm damage has occurred in neighboring cornfields. The crop is at risk in the two weeks after planting, so scout fields during and shortly after emergence.

Rescue treatments should be considered if a majority of larvae are less than ½-inch long. Worms of this size can destroy four to six plants each before completing development. Older larvae are

## 2016 Chinch Bug Outlook

Overall, statewide numbers have been relatively low since the wet year of 1993. But locally damaging infestations have developed every year, particularly in parts of north and south central Kansas. Growers should continue to monitor for chinch bug activity each spring, especially when moisture is limited during April, May, and June and nearby wheat is thin and lacking in vigor.

In 2014 and again in 2015, chinch bug infestations continued into mid-October and consisted of both adults and nymphs, especially on later planted (double cropped) sorghum. These late season populations may lead to significant spring populations in sorghum. High chinch bug densities in early spring, coupled with dry conditions, may result in damaged wheat stands.



□ – Area where chinch bugs usually are of greatest concern.

harder to kill and less is gained by controlling them because they have already caused most of their damage.

Consider the amount of stand reduction that can be tolerated before deciding to treat. If the minimum stand density recommended for a particular hybrid under your management program is 40,000 plants per acre and you have 50,000, then you can tolerate a stand reduction of 20 percent before treatment becomes economically justified, assuming losses will be even across the field. If cutworm damage is localized in certain areas, spot treatments applied to affected areas will be more cost effective than treating the whole field.

Other factors that affect the decision to treat include the length of the areas where plants are missing in a row and the planting date of the sorghum. Skips of less than 2 feet may be partially compensated for by plant tillering, but longer areas are of more concern. Sorghum planted earlier than mid-June tillers more than sorghum planted later, making later plantings less

able to compensate for cutworm stand reduction. If a decision is made to replant, ensure that cutworms have all pupated.

### Corn Earworm

Although larvae of this moth prefer corn, they often infest sorghum heads. The head capsule is light brown, and the body color varies from pink to green to brown with light and dark stripes along the length of the body. Larvae can be 1½ inches long at maturity.

Infestations are more common in southern Kansas, and sorghum is vulnerable to infestation from bloom through milk stages. One to two larvae per head can result in approximately 5 to 10 percent yield loss. The average size of larvae at detection is a key consideration, because less will be gained by treating older, larger larvae. The decision to treat should balance the expected yield and crop value against treatment cost and the amount of damage that can be prevented.

## Cutworm Management Options

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	1.3 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.008 to 0.010 lbs. a.i./acre (1.0 to 1.3 fl. oz.)
Chlorpyrifos (numerous products)	Check label, but generally 1 to 2 pints/acre.
Chlorpyrifos (Saurus)	8oz./1,000 row ft. - T-band at planting
Chlorpyrifos plus gamma-cyhalothrin (Cobalt Advanced)	11 to 38 fl. oz. of product/acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	3.75 to 11.75 fl. oz./acre
Deltamethrin (Delta Gold)	0.012 to 0.018 lb. a.i./acre (1 to 1.5 fl. oz.)
Esfenvalerate (Asana XL 0.66)	0.03 to 0.05 lb. a.i./acre (5.8 to 9.6 fl. oz.)
Flubendiamide (Belt)	2.0 to 4.0 fl. oz/acre
Gamma-cyhalothrin (Proaxis)	0.0075 to 0.01 lb. a.i./acre (1.92 to 2.56 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.015 to 0.02 lb. of a.i./acre
Zeta-cypermethrin (Mustang MAXX, Respect EC, etc.)	0.008 to 0.025 lb. a.i./acre (1.28 to 4.0 fl. oz.)

## Fall Armyworm

This moth is an annual pest from southern states. It arrives in Kansas in July and lays eggs on corn, sorghum and other summer crops. Damage to sorghum may occur from July to the first frost. Feeding during the whorl stages causes large, irregular perforations in the foliage that are evident as leaves unfold, making the plant appear ragged. Late-planted fields may suffer more damage if attacked while plants are small.

Leaf damage has little effect on yield, and larvae feeding within the whorl are protected from exposure to insecticides, making control difficult at this stage. Do not consider treatment unless 75 percent of plants show fresh damage and there are one or two live larvae per plant. Head infestations by fall armyworm and mixed infestations with corn earworm can be assessed the same as for corn earworm.

## Sorghum Webworm

This problem is usually confined to southeast Kansas. Damage is caused by

small, fuzzy, striped worms that feed in developing heads. There are several overlapping generations, and damage tends to be more severe in late-planted fields and in varieties with compact heads. Larvae are active from August to October. Infestations do not injure mature seed. Hot, dry weather contributes to natural mortality. Control or mow Johnsongrass because it serves as a reservoir for this pest. Destroying stubble can reduce populations of overwintering larvae. Kansas growers should begin scouting fields by mid-August and consider treatment where infestations average five or more worms per head during the early post-bloom period.

## Miscellaneous Pests

### Grasshoppers

Fields and border areas should be scouted in early summer while grasshoppers are small. Field borders may need treatment if grasshopper nymphs are abundant (15 to 20 per square yard) to prevent migration into the sorghum.

In the field, populations of five to eight nymphs per square yard justify treatment.

## Spider Mites

Spider mite problems are most common in southwestern Kansas. Infestations develop on the undersides of lower leaves and may expand rapidly to upper portions of the plant. This occurs as the plant enters the reproductive stages, especially during periods of hot, dry weather that stresses plants and favors mite growth and reproduction.

Effective mite management requires several elements: frequent inspection of fields, prudent use of insecticides and miticides, careful timing of applications, and thorough coverage with sprays. Treatment is recommended when a majority of plants are infested with expanding colonies on lower leaves and some mites can be seen migrating up into the midsection of the plant. Do not delay treatment. Infestations that become established throughout the canopy are difficult to control.

## Corn Earworm Management Options

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	1.8 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lbs. a.i./acre (1.3 to 2.8 fl. oz.)
Chlorantraniliprole (Prevathon)	14.0 to 20.0 fl. oz./acre
Chlorpyrifos (numerous products)	Check label, but generally 2 pints/acre.
Chlorpyrifos plus gamma-cyhalothrin (Cobalt Advanced)	19 to 38 fl. oz. of product/acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	5.0 to 11.75 fl. oz./acre
Deltamethrin (Delta Gold)	0.012 to 0.018 lb. a.i./acre (1 to 1.5 fl. oz.)
Esfenvalerate (Asana XL 0.66)	0.03 to 0.05 lb. a.i./acre (5.8 to 9.6 fl. oz.)
Flubendiamide (Belt)	2.0 to 4.0 fl. oz./acre
Gamma-cyhalothrin (Proaxis)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.02 to 0.03 lb. of a.i./acre
Methomyl (Lannate)	0.225 to 0.45 lb a.i./acre
Spinosad (Blackhawk)	0.038-0.075 lb. a.i./acre (1.7 to 3.3 fl. oz.)
Zeta-cypermethrin (Mustang MAXX, Respect EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

### Fall Armyworm Management Options

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	1.8 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lbs. a.i./acre (1.3 to 2.8 fl. oz.)
Chlorantraniliprole (Prevathon)	14.0 to 20.0 fl. oz./acre
Chlorpyrifos (numerous products)	Check label, but generally 1 to 2 pints/acre.
Chlorpyrifos plus gamma-cyhalothrin (Cobalt Advanced)	11 to 38 fl. oz. of product/acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	9.25 to 11.75 fl. oz./acre
Deltamethrin (Delta Gold)	0.015 to 0.022 lb. a.i./acre (1.3 to 1.9 fl. oz.)
Flubendiamide (Belt)	2.0 to 4.0 fl. oz./acre
Gamma-cyhalothrin (Proaxis)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.02 to 0.03 lb. of a.i./acre
Methomyl (Lannate)	0.225 to 0.45 lb a.i./acre
Spinosad (Blackhawk)	0.038-0.075 lb. a.i./acre (1.7 to 3.3 fl. oz.)
Zeta-cypermethrin (Mustang MAXX, Respect EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

### Sorghum Webworm Management Options

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	1.8 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lbs. a.i./acre (1.3 to 2.8 fl. oz.)
Carbaryl (Sevin 80S)	1.25 to 2.5 lb./acre
Chlorantraniliprole (Prevathon)	14.0 to 20.0 fl. oz./acre
Chlorpyrifos (Lorsban-4E)	Check label, but generally 1 pint/acre
Chlorpyrifos plus gamma-cyhalothrin (Cobalt Advanced)	16.0 to 38.0 fl. oz./acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	5.0 to 11.75 fl. oz./acre
Deltamethrin (Decis 1.5 EC)	0.012 to 0.018 lb. a.i./acre (1 to 1.5 fl. oz.)
Flubendiamide (Belt)	2.0 to 4.0 fl. oz./acre
Gamma-cyhalothrin (Proaxis)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.02 to 0.03 lb. of a.i./acre
Methomyl (Lannate LV)	1.5 pints/acre
Spinosad (Blackhawk)	0.038 to 0.075 lb. a.i./acre (1.7 to 3.3 fl. oz.)
Zeta-cypermethrin (Mustang MAXX, Respect EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

Most eggs survive chemical sprays, so a second treatment usually is required for large numbers of eggs, regardless of the kill rate achieved on adults and nymphs. Examine infested leaves on several plants under a hand lens every few days after treatment to determine when most eggs have hatched. If active life stages appear to have survived the initial treatment, consider changing to a different miticide and altering application techniques to achieve better coverage. The goal should be to maintain functional leaves in the upper 2/3 of the canopy until the hard dough stage.

### Label Terminology

The waiting or preharvest interval (PHI) refers to the time that must elapse between application and harvest. The interval usually is different for forage use as compared to grain harvest, but when not specified, the interval usually is the same regardless of use of the treated product. The waiting interval does not signify how

long an insecticide will provide control following application. The restricted entry interval (REI) specifies the time that must elapse before workers can safely return to work in treated fields without the use of protective clothing and/or equipment.

Some pesticides are classified for Restricted Use. This classification means that individuals (private or commercial) must be certified by the Kansas Department of Agriculture before purchasing or using these products. Some pesticide use may be permitted by means of State of Kansas Special Local Needs (SLN) labels. The law requires possession of this label when using a product for an SLN purpose.

### Endangered Species

EPA's Endangered Species Protection Program (ESPP) helps promote the recovery of endangered species. If limitations on pesticide use are necessary to protect listed species in a certain geographic area, the in-

formation is relayed through Endangered Species Protection bulletins. Pesticide labels may direct you to the local Extension office. Information is also available online from the EPA at [www.epa.gov/espp/bulletins.htm](http://www.epa.gov/espp/bulletins.htm).

### The Worker Protection Standard

The Worker Protection Standard (WPS) is a series of federal regulations pertaining to pesticides used in agricultural plant production on farms, forests, nurseries and greenhouses. You must comply with these regulations if you are an agricultural pesticide user and/or an employer of agricultural workers or pesticide handlers. For more complete information, consult the U.S. Environmental Protection Agency publication *The Worker Protection Standard for Agricultural Pesticides — How to Comply, What Employers Need to Know*. This publication is available at your local K-State Research and Extension office.

#### Spider Mite Management Options

Insecticide	Rate
Dimethoate (Dimethoate or Dimate)	0.5 lb. a.i./acre
Methidathion (Supracide 2E)	0.5 lb. a.i./acre
Propargite (Comite II)	1.64 lb. a.i./acre

#### Grasshopper Management Options

Field Sprays	
Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	3.2 to 3.9 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.019 to 0.022 lb. a.i./acre (2.0 to 2.8 fl. oz.)
Chlorantraniliprole (Prevathon)	8.0 to 20.0 fl oz/acre
Chlorpyrifos (numerous products)	Check label, but generally 0.5 to 1 pint/acre
Chlorpyrifos plus gamma-cyhalothrin (Cobalt Advanced)	6 to 13 fl. oz. of product/acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	9.25 to 11.75 fl. oz./acre
Deltamethrin (Delta Gold)	0.012 to 0.018 lb. a.i./acre (1.0 to 1.5 fl. oz.)
Dimethoate (Dimethoate or Dimate)	0.5 lb. a.i./acre
Gamma-cyhalothrin (Proaxis)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.02 to 0.03 lb. a.i./acre
Zeta-cypermethrin (Mustang MAXX, etc.)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

## Grasshopper Management Options

### Noncrop Area Treatments

Insecticide	Rate	Special Instructions
Acephate (Bracket 90 Orthene 75S)	0.28 lb./acre (4oz) (Bracket 90), ½ lb./acre (Orthene 75S)	Apply in 10 to 20 gallons by ground, or in 1 to 5 gallons by air. Use as a treatment on ditch banks, roadsides, and field borders. Do not feed or graze treated forage.
Beta-cyfluthrin (Baythroid XL)	2.6 to 2.8 fl. oz./acre	Labeled for use in pastures, rangeland, grass for hay, grass for seed. PHI is 0 days.
Diflubenzuron (Dimilin 2L)	2 fl.oz./acre	Apply to manage grasshoppers in breeding areas before they move into crop land. Treat early instars (majority in the second to third nymphal stages). For use on field border, fence rows, roadsides, farmsteads, ditchbanks, wasteland, and CRP land. REI is 12 hours.
Esfenvalerate (Asana XL)	0.015 to 0.03 lb. a.i./acre (2.9 to 5.8 fl.oz./acre of Asana XL)	This label is for noncrop use on land adjacent to tilled area to control migrating insects. Repeat as needed, but do not exceed 0.5 lb. a.i./acre per year. Do not feed the treated vegetation. Do not spray ditch banks or areas adjacent to water.
Gamma-cyhalothrin (Proaxis)	0.0075 to 0.015 lb ai/acre, 1.92 to 3.84 fl. oz./acre	Spray non-cropland adjacent to agricultural areas to control migratory insects that may threaten crops. Use highest labeled rates for dense/tall foliage, high insect populations and/or larger insects. Do not graze livestock in treated area. REI is 24 hours.
Lambda-cyhalothrin (Grizzly Z)	0.02 to 0.03 lb a.i. / acre or 2.56 to 3.84 fl. oz.	Spray non-cropland adjacent to agricultural areas to control migratory insects that may threaten crops. Use highest labeled rates for dense/tall foliage, high insect populations and/or larger insects. Do not graze livestock in treated area. REI is 24 hours.
Zeta-cypermethrin (Mustang Maxx)	0.0175 to 0.025 lb. a.i./acre or 2.8 to 4.0 fl.oz./acre	Labeled for use on grass forage, fodder, pasture, and rangeland with a 12 hour REI and a 0-day harvest restriction on forage. Thus, this material may be used to treat these areas when grasshoppers are threatening to move from these areas into neighboring crop fields.

## Sorghum Insecticide Use Instructions

Insecticide	Special Instructions
Alpha-cypermethrin (Fastac EC)	Do not use any products containing cypermethrin and zeta-cypermethrin during a crop season when using Fastac. Do not make applications less than 10 days apart. Do not apply more than 11.4 fl. oz. (0.075 lb a.i.) per acre per season.
Beta-cyfluthrin* (Baythroid XL)	Minimum application volume (water) is 2 gallons for aerial application and 10 gallons by ground. REI is 12 hours. PHI is 14 days.
Carbaryl (Sevin)	Do not use within 14 days of harvest or grazing for forage use. PHI is 21 days. REI is 12 hours.
Chlorantraniliprole (Prevathon)	Do not make more than 4 applications per acre per crop. Minimum interval between treatments is 7 days. Do not apply more than 60 fl. oz. or 0.2 lb a.i. of chlorantraniliprole per acre per year. REI is 4 hours. PHI is 0 days.
Chlorpyrifos* (Chlorpyrifos, Eraser, Govern, Lorsban, Nufos, Pilot, Warhawk, Whirlwind, Yuma)	The treated crop is not to be used for forage, fodder, hay or silage within 30 days after application of 0.5 lb. a.i./acre, or within 60 days at rates above 0.5 lb./acre. Do not apply to drought-stressed sorghum within three days after irrigation or rain. Do not treat sweet varieties of sorghum. Do not apply more than 1.5 lb. a.i./acre per season. REI is 24 hours.
Chlorpyrifos (Saurus)	Apply as a T-band in a 6 to 8 inch band over the open seed furrow and incorporate into the top 0.5 to 1 inch. Granules must be incorporated. One application per season. Suppression only.
Chlorpyrifos plus gamma-cyhalothrin* (Cobalt Advanced)	Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn. To minimize the potential for chemical injury, do not apply Cobalt to drought stressed grain sorghum within 3 days following irrigation or rain except where the product is applied in irrigation water. Do not harvest for grain, forage, fodder, hay, or silage within 30 days after application of 26 fl. oz. of Cobalt per acre or within 60 days after application of rates above 26 fl. oz. per acre. Do not apply more than 77 fl. oz. of Cobalt per acre per season. Do not make more than 3 applications of Cobalt or other products containing chlorpyrifos per use season. Do not make a second application of Cobalt or other product containing chlorpyrifos within 10 days of the first application.
Chlorpyrifos plus zeta-cypermethrin (Stallion)	A new product registration that is a combination of chlorpyrifos (2.72 lb./gal.) plus zeta-cypermethrin (0.272 lb./gal.). REI is 24 hrs. PHI is 30 days for grain and stover; 45 days for forage.
Deltamethrin* (Delta Gold)	Minimum application volume (water) is 2 gallons for aerial application and 5 gallons by ground. REI is 12 hours. PHI is 14 days. Do not cut or graze sorghum forage within 14 days of application.
Dimethoate (Dimethoate or Dimate)	Minimum application volume (water) is 2 gallons for aerial application and 5 gallons by ground. REI is 12 hours. PHI is 14 days. Do not cut or graze sorghum forage within 14 days of application. Do not apply after heading. Up to three applications permitted.
Esfenvalerate* (Asana XL 0.66 EC)	Apply by ground or air equipment. Do not exceed 0.15 lb. a.i./acre per season. PHI is 21 days. This use pattern may not appear on the federal label. See Supplemental Labeling EPA Reg. No. 352-515 issued in 1998. REI is 24 hours.
Flubendiamide (Belt)	Apply with ground equipment, or by air or chemigation. Use sufficient water for adequate coverage. PHI is 14 days for grain or 3 days for forage. REI is 12 hours.
Gamma-cyhalothrin* (Proaxis)	Apply with ground or air equipment, using sufficient water and application methods to obtain full coverage of foliage. When applying by air, apply in a minimum of 2 gallons of water per acre. Do not apply more than 0.03 lb. a.i. (0.48 pint) per acre per season after crop emergence and do not apply more than 0.01 lb. a.i. (0.16 pint) per acre once crop is in soft dough stage. PHI is 30 days. REI is 24 hr.
Lambda-cyhalothrin* (numerous products including Warrior II with Zeon Technology, Silencer, Taiga Z, and Lambda T)	Apply by ground or air in sufficient gallonage to obtain full coverage. Use a minimum of 2 gallons of water per acre by air. Do not apply more than 0.02 lb. a.i./acre once crop is in the soft dough stage. Do not graze livestock in treated areas or harvest for fodder, silage or hay. PHI is 30 days. REI is 24 hours.
Malathion	This organophosphate insecticide is available from several suppliers and in various formulations, but only some labels list sorghum as an application site. REI is 12 hours. PHI 7 days. Read labels closely.
Methidathion* (Supracide 2E)	May cause phytotoxicity on some sorghum hybrids. PHI is 30 days. REI is 48 hours. Use for greenbug based on SLN label.
Methomyl* (Lannate)	Apply in a minimum of 10 gallons per acre by ground or 2 gallons by air. PHI is 14 days for grain or grazing. REI is 48 hours.
Spinosad (Blackhawk)	Apply in 2 to 5 gallons of water per acre by air or in a minimum of 5 gallons by ground. Time application to coincide with peak egg hatch. Do not apply more than 12.4 fl. oz./acre per year. PHI 3 days for grain or fodder or within 21 days for forage. REI is 4 hours.
Zeta-cypermethrin* (Mustang MAXX, Respect EC, etc.)	Apply in a minimum of 10 gallons of water by ground or 2 gallons by air. Do not make applications less than 10 days apart. Do not apply more than 0.125 lb. a.i./acre per season. PHI is 14 days for grain and stover, and 45 days for forage. REI is 12 hours.

\* Restricted Use Pesticide



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