



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 bears the ultimate responsibility for correct pesticide use and should always read label directions carefully before making pesticide applications. Remember, it is illegal to use a pesticide in a manner inconsistent with the label.

More detailed information, along with photographs of pests and damage, can be found on our website at <http://www.entomology.ksu.edu/extension>. 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, usually pose the greatest risk to users. Handle all pesticides with care and use them 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 with you. For poison control information contact the Mid-America Poison Control Center emergency phone number (800)-222-1222.

Wear protective equipment (respirators, clothing, etc.) 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.

Read the label carefully. It is a legal document. It tells where, how and when the product can be used.

Belowground Pests

Wireworms and other pests that attack seeds

Several insects can attack sorghum seeds and seedling plants before emergence. Many of these pests are controlled by using seed treatments containing clothianidin (Poncho), imidacloprid (Attendant, Concur, Dyna Shield Imidacloprid, Gaucho, Imida, Senator, and possibly others), or thiamethoxam (Cruiser).

Aboveground Pests

Aphids

Corn Leaf Aphid

These aphids are about 1/16-inch long and dark-green or bluish in color 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 popula-

tions 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's natural enemies that later contribute to greenbug 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.

The greenbug treatment guide table on page 2 describes threshold values for 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. Depending on conditions, the infestation may increase or decline. The outcome will largely depend on how many natural enemies are present, so take note of lady beetles, lacewings, and mummified aphids. A field should be monitored and treated if populations increase. If the infestation at the one-leaf stage averages 25 to 50 greenbugs per plant, the risk is higher, and serious stand loss is 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.

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 using systemic insecticides (clothianidin (Poncho), imidacloprid (Attendant, Dyna-Shield Imidacloprid,

Gaucho, Imida, Senator and possibly others) and thiamethoxam (Cruiser)) provide good early season protection against greenbugs. Seed treatment is an attractive option for regions where both greenbugs and chinch bugs are a problem. Seed treatments are the most selective form of insecticide treatment and are more compatible with biological control than most broadcast sprays, but protection does not extend beyond the first two weeks of plant growth.

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 only labeled for a band or a 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. Follow label directions for application rate depending 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 and incorporate lightly with drag chains or tines. Use only one application per year. Knifed-in application. Apply 1 to 2 lb. a.i./acre. Follow label directions for application rate depending 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 of the seed. PHI is 50 days for forage and 100 days for fodder or grain.

Corn Leaf Aphid Management Options

Insecticide	Rate
Chlorpyrifos (numerous products)	Check label, but generally 0.5 to 1 pint/acre.
Chlorpyrifos plus gamma-cyhalothrin (Cobalt)	7 to 13 fl. oz. of product/acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	9.25 to 11.75 fl. oz./acre

Greenbug Management Options

Insecticide	Rate
Chlorpyrifos (numerous products)	Check label, but generally 0.5 to 2 pints/acre
Chlorpyrifos plus gamma-cyhalothrin (Cobalt)	13 to 38 fl. oz. of product/acre
Chlorpyrifos plus zeta-cypermethrin (Stallion)	9.25 to 11.75 fl. oz./acre
Dimethoate (Dimetohate or Dimate)	0.25 to 0.5 lb. a.i./acre
Malathion	1 lb. a.i./acre
Methidathion (Supracide 2E)	0.5 lb. a.i./acre

Greenbug Treatment Guide (Susceptible Hybrids)¹

Plant growth stage ²	Based on average number of greenbugs per plant		Based on visual rating ³
	Threatening level	Treatment level ³	
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.

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

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

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

Chinch Bug Management Options (Foliar Treatments)

Insecticide	Rate
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 plus gamma-cyhalothrin (Cobalt)	13 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.)
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 MAX EC)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

False Chinch Bug Management Options

Insecticide	Rate
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 MAX EC)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

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 may 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 (Attendant,

Dyna-Shield Imidacloprid, Gaucho, Imida, Senator and possibly others) 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 the early season protection wears off before the end of chinch bug migration.

False Chinch Bug

These bugs are similar in size and appearance to chinch bugs. However, false chinch bug nymphs are grayish to brown, sometimes 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.

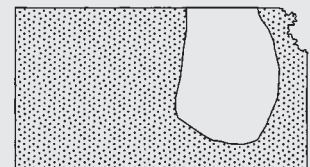
False chinch bugs can occasionally become abundant when conditions favor survival on various weed hosts, particularly wild mustards. They have a wide host range and as many as four generations per year. Fields planted no-till into wheat stubble where weed control was delayed until just before planting,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

False chinch bugs appear to spend little time on sorghum plants, but abun-

2011 Chinch Bug Outlook

Chinch bugs usually increase in dry periods and decline during wetter years. Outbreaks tend to occur in roughly 7- to 10-year cycles. Overall, statewide numbers have been relatively low since the wet year of 1993. But locally damaging infestations have been developing nearly every year, particularly in parts of 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 2009, Chinch bug infestations continued into mid-September, and consisted of both adults and nymphs, especially on later planted (double cropped) sorghum. These significant late season populations did not result in many larger than normal spring populations in 2010. Again, in 2010 many late-planted sorghum fields had considerable chinch bug populations late in the season so the possibility for significant early season populations exists for 2011. Read the label carefully. It is a legal document. It tells what, where, how, and when the product can be used. It is against the law to use a pesticide in a manner inconsistent with the label.



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

dant populations can reduce stands. False chinch bug adults also 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.

Caterpillars

Cutworms

Cutworm damage to sorghum is infrequent, but growers should be alert when early season cutworm damage has occurred in neighboring cornfields. Damage is likely 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 additional plants each before completing development. Older lar-

vae are 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 sometimes 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

Cutworm Management Options

Insecticide	Rate
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 plus gamma-cyhalothrin (Cobalt)	13 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.)
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 MAX EC)	0.008 to 0.025 lb. a.i./acre (1.28 to 4.0 fl. oz.)

Corn Earworm Management Options

Insecticide	Rate
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lbs. a.i./acre (1.3 to 2.8 fl. oz.)
Chlorpyrifos (numerous products)	Check label, but generally 2 pints/acre.
Chlorpyrifos plus gamma-cyhalothrin (Cobalt)	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.)
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)	0.45 lb. a.i./acre
Spinosad (Tracer)	0.047 to 0.094 lb. a.i./acre (1.5 to 3 fl. oz.)
Zeta-cypermethrin (Mustang MAX EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

Fall Armyworm Management Options

Insecticide	Rate
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lbs. a.i./acre (1.3 to 2.8 fl. oz.)
Chlorpyrifos (numerous products)	Check label, but generally 1 to 2 pints/acre.
Chlorpyrifos plus gamma-cyhalothrin (Cobalt)	13 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.)
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)	0.45 lb. a.i./acre
Spinosad (Tracer)	0.047 to 0.094 lb. a.i./acre (1.5 to 3 fl. oz.)
Zeta-cypermethrin (Mustang MAX EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

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.

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. Borders to sorghum fields may need treatment if grasshopper nymphs are abundant (15 to 20 per square yard) to prevent their migration into the sorghum. In the field, populations of five to eight nymphs per square yard justify treatment.

Sorghum Webworm Management Options

Insecticide	Rate
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lbs. a.i./acre (1.3 to 2.8 fl. oz.)
Carbaryl (Sevin)	1.5 to 2 lb. a.i./acre
Chlorpyrifos (numerous products)	Check label, but generally 1 pint/acre
Chlorpyrifos plus gamma-cyhalothrin (Cobalt)	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.)
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)	0.45 lb. a.i./acre
Spinosad (Tracer)	0.047 to 0.094 lb. a.i./acre (1.5 to 3 fl. oz.)
Zeta-cypermethrin (Mustang MAX EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

Grasshopper Management Options

Noncrop Area Treatments		
Insecticide	Rate	Special Instructions
Acephate (Bracket 90 Orthene 75S)	0.25 lb. a.i./acre	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.
Carbaryl (Sevin 4F, 80S, XLR)	0.5 to 1.5 lb. a.i./acre	Apply to noncropland (CRP acreage, set-aside acreage, wasteland, rights-of-way, hedgerows, ditch banks, and roadsides). PHI is 14 days for grazing or harvest of forage for hay. (Label lists control of grasshoppers on multiple sites, which would include noncropland because that site is listed on the label.) Also labeled for use on rangeland at 0.5 to 1.5 a.i./acre where harvesting or grazing is allowed the same day as treatment.
Diflubenzuron (Dimilin 2L)	0.03125 lb. a.i./acre (2 fl. oz. per 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)	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)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz. per 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 (numerous products)	0.02 to 0.03 lb. a.i./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.
Zeta-cypermethrin (Mustang MAX EC)	0.0175 to 0.025 lb. a.i./acre (2.8 to 4.0 fl. oz. per 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.

Grasshopper Management Options

Field Sprays

Insecticide	Rate
Beta-cyfluthrin (Baythroid XL)	0.019 to 0.022 lb. a.i./acre (2.0 to 2.8 fl. oz.)
Chlorpyrifos (numerous products)	Check label, but generally 0.5 to 1 pint/acre
Chlorpyrifos plus gamma-cyhalothrin (Cobalt)	7 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 (Dimetohate 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 MAX EC)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

Spider Mite Management Options

Insecticide	Rate
Dimethoate (Dimetohate 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

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.

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.

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 $\frac{2}{3}$ of the canopy until the hard dough stage.

Other Potential Pests

Information on other potential sorghum pests such as the sorghum midge, sugarcane rootstock weevil and cattail caterpillars can be found on our website <http://www.entomology.ksu.edu/extension> by clicking on Insect Information, Crop Pests and then Sorghum in the menu bar on the left side of the page.

Stored Grain Management

This publication deals with insects during the growing season. For information on insects that attack grain during storage see publication MF-917, *Management of Stored Grain Insects, Part III: Structural Sprays, Pest Strips, Grain Protectants, and Surface Dressings*, or go to the K-State Entomology website www.entomology.ksu.edu/extension and select "Insect Information," then "Stored Grain Management."

Chemigation

Some insecticides may be applied through overhead sprinkler systems. Check labels of insecticides closely to see if chemigation is allowed and for specific application instructions. Those interested in using this method must comply with the requirements established by the Kansas Chemigation Safety Law as well as all requirements listed on product labels.

More Information

For more information about insect problems in Kansas, visit the K-State Research and Extension Entomology home page at <http://www.entomology.ksu.edu/extension>.

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 information is relayed through Endangered Species Protection bulletins. Pesticide labels may direct you to contact your local county Extension office or you

can obtain bulletins directly using EPA's Bulletins Live! at <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.

Sorghum Insecticide Use Instructions

Insecticide	Special Instructions
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.
Chlorpyrifos* (numerous products including Chlorpyrifos, Eraser, Govern, Lorsban, Nufos, Pilot, Warhawk, Whirlwind, and 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 plus gamma-cyhalothrin* (Cobalt)	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 (Dimetohate 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.
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 (Tracer)	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 14.4 fl. oz./acre per year. PHI 7 days for grain or fodder or within 14 days for forage. REI is 4 hours.
Zeta-cypermethrin* (Mustang MAX EC)	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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