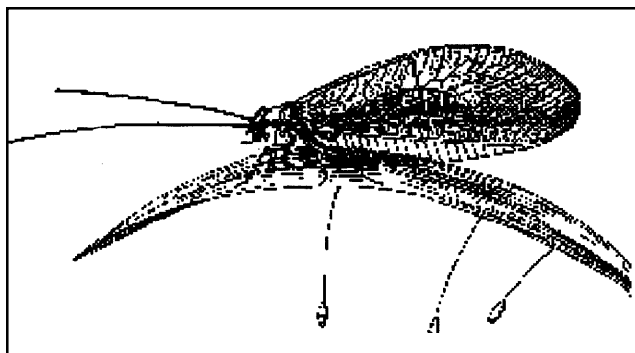


Sorghum Insect Management 2001



The green lacewing, an important aphid predator.

How to Use This Guide

This publication was prepared to help producers manage insect populations with the best methods proven practical under Kansas conditions. It is revised annually and intended for use during the current calendar year only. The mention of commercial products in this publication does not imply endorsement, nor is criticism implied of similar products not mentioned. The suggestions included here are based on experience and observations, and are thought to be reliable under test conditions, but sometimes performance varies in ways that cannot be predicted. The K-State Entomology staff assumes no responsibility for product performance, personnel injury, property damage, or other types of loss resulting from the handling or use of the pesticides listed herein. Pesticide label directions and restrictions are subject to change, and some may have changed since this publication was written. As much as is possible, Extension offices are advised as changes in use occur. Remember, it is illegal to use a pesticide in a manner inconsistent with the label. The user bears responsibility for correct use. Always read and follow label directions carefully. Seek assistance when in doubt.

Additional problem specific information may be available through the local county Extension office. The insecticides listed (except where indicated) are intended for use as foliar sprays. The first name listed refers to the common chemical name of the insecticide product. This is followed in parentheses by the most commonly used trade name(s). The

economics of control should be considered as a factor in any pest management decision. However, since costs vary greatly over time and are influenced by factors that are beyond the scope of this publication, product cost, in general, is not considered a reason for either including or omitting specific insecticide products in these recommendations. We recommend that producers always compare product price, safety and availability when making treatment decisions.

The **waiting interval** 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 **re-entry interval** specifies the time that must elapse before persons can safely return to work in treated fields without the use of protective clothing and/or equipment.

Restricted-Use and SLN Labels

A number of pesticides are classified **Restricted Use**. This means persons (private or commercial) must be certified by the Kansas Department of Agriculture before purchasing or using these products. Some pesticide uses may be permitted by means of **State of Kansas Special Local Needs (SLN) labels**. The law requires possession of this label when using it for an SLN use.

Using Insecticides Safely

Injury or death can result from swallowing, inhaling or prolonged skin contact with insecticides.

The risk of injury due to ingestion is greatest among pets, livestock and young children. Skin absorption and sometimes inhalation usually pose the greatest risk to users. Practice handling 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 call 1-800-332-6633.

Wear protective equipment (respirators, clothing, etc.) as specified on the label. Bathe and change clothing frequently. Launder contaminated clothing separately from other articles in the wash.

Protect fish, wildlife and other non-target organisms. Do not dispose of unused pesticides where the runoff may contaminate streams, lakes, or drinking-water supplies, or apply in a manner that could pollute such sites.

Consider the presence of honeybees before applying insecticides. Application to blooming-stage legumes can usually be avoided. 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 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.

Below-Ground Insects: Seed Attacking Insects

False Wireworms, Kafir Ant, and Seed Corn Beetle

These seed-attacking insects may destroy the planted seed before germination. False wireworms are yellowish-brown, relatively long legged, hard-shelled larvae up to 1½ inches or more in length and about the diameter of a large match stem. Kafir ants are tiny (a sixteenth of an inch) and orange colored. They hollow out the seeds and leave a mealy substance in the vicinity. Seed corn beetles are medium to dark brown with a light colored margin around the wing covers; about ¼ inch in length and often observed on the soil surface or congregating around lights. Adults feed on the planted seed.

Control of these insects is accomplished through use of a planter box insecticidal seed treatment. Use lindane or lindane/diazinon in a formulation labeled for this purpose. Follow label directions on rates, method of application, and safety precautions. Do not feed treated seed.

Wireworms

True wireworms are the immature stages of click beetles. They are generally shiny, slender and hard bodied. Color ranges from yellow to brown. Legs

are present on the first three segments behind the head. They resemble false wireworms but tend to be more slender and cylindrical, and the legs of wireworms tend to be short. Wireworms may feed on the planted seed or cause injury or death to small plants by tunneling into the below-ground portion of plants. Damage is rare in continuous cropped fields, although a few reports are received most years. The likelihood of damage is greater where sorghum follows a sod crop. To detect problems before planting, sample the soil by sifting square-foot samples to a depth of 4 inches through a piece of hardware cloth of about a quarter-inch mesh. Repeat at least five to 10 places in the field. Anticipate damage if two or more wireworms are found per square foot. Watch for wireworms or other soil insects when conducting tillage operations prior to planting. If numerous insects are observed, identify the problem, consider the need for treatment, and options available. Remember, there are no effective rescue treatments for most seed and soil insects, other than cutworms, after the seed is planted.

Seed Treatment

Treat the seed before planting with lindane or lindane/diazinon in a formulation labeled for this purpose. Follow label directions for rates, method of application, and safety precautions. Do not feed treated seed. Seed treatments do not always give satisfactory control. If wireworms are numerous, use a soil treatment.

Imidacloprid (Gaucho)

Use seed commercially treated with 8 oz. of Gaucho 480, or its equivalent, per hundred weight of seed treated as a slurry prior to planting. Do not graze or feed livestock on treated areas for 45 days after planting. Follow any listed rotational restrictions on the seed tag. Treated seed must not be used for food or feed.

Thiamethoxam (Adage)

Use seed commercially treated with 5.1 fl. oz. of Adage 5FS per hundredweight of seed (treated as a water-based slurry in standard slurry seed treatment equipment which provides uniform seed coverage). Follow label precautions and directions for use. Do not use treated seed for feed, food, or oil purposes.

Soil Treatment

Use of a soil insecticide is more expensive than using a seed treatment, but a soil insecticide may be

necessary in a replant situation where wireworms have destroyed an existing stand. Wireworms are commonly controlled either by a band application over the planted row or by in-furrow treatment. A band treatment may perform well, but in-furrow treatment tends to be more reliable in cases where wireworms are concentrated in the seed furrow and destroying the seeds prior to germination. Carbofuran as a liquid is commonly used against wireworms in corn as was the granular product on both corn and sorghum before the label was cancelled. In contrast, the sorghum liquid 24-C label for in-furrow application (KS-880002) makes no mention of wireworms, noting only the control of greenbugs and chinch bugs. Phorate and terbufos, labeled against wireworms on corn, are not generally used as in-furrow treatments in sorghum because of phytotoxicity problems. Aldicarb and disulfoton have labels for sucking pests in sorghum, but generally have not provided wireworm protection and likewise, make no mention of wireworms.

Terbufos (Counter 15G or 20CR)

Restricted Use

Band application. Apply 1 lb. a.i./a based on 40-inch rows, 8.7 lb./a of 15 G on 30-in. rows or 8 oz. per 1,000 ft. of row for any row spacing above 19 inches, or 6.5 lb./a of 20 CR on 30-inch rows 6 oz. per 1,000 ft. of row for any row spacing above 19 inches. Place granules in a 5- to 7-inch band directly behind the planter shoe in front of the press wheel. Use only one application per year.

Cutworms

Damage to sorghum is usually less frequent than for corn, but be especially alert when cutworms have caused injury earlier in the neighboring corn fields. Damage is most likely during the first two weeks following planting. Scout the fields closely during and shortly after emergence. A rescue treatment might be considered if the majority of the worms are ½ inch or less in length when the damage is detected, since each worm is likely to destroy four to six additional plants before it reaches the end of its feeding period. In addition, one must also consider the amount of stand reduction that can be tolerated.

You should probably begin by determining the minimum plant population that is recommended for the hybrid being grown under your management program. Compare this with the population actually present in your field. For example, if the minimum recommended population is 40,000 plants per acre,

and you presently have a population of 50,000 plants, then, in theory, you might be able to tolerate a reduction of 20 percent in the stand assuming the loss was evenly distributed across the field. However, cutworm damage is usually spotty in its distribution across the field, being heavy in certain spots, minimal in others. Quite frequently, therefore, a rescue treatment may be needed on one portion of the field but not on the entire field.

From a practical standpoint, it may be more important to look at the number and length of the skips in the row that are the result of cutworm injury. Plants may be able to compensate for short skips by producing additional tillers, but they begin to lose this ability to compensate as skips longer than about 2 feet appear. Also important is the fact that sorghums planted prior to mid-June tend to tiller more than those planted later. Thus, with other things being equal, damage from cutworms becomes more serious the later the date of planting.

Rescue Treatment

*Chlorpyrifos (Lorsban 4E)**

Restricted Use

Apply 1 lb. a.i./a (2 pints). Mix specified dosage in enough water to ensure thorough coverage and apply in a broadcast application using suitable aerial or ground spray equipment. It is preferable to apply where soil is moist and worms are near the surface of the soil. Do not apply to drought-stressed grain sorghum within three days following irrigation or rain. Do not use for forage, fodder, hay, or silage within 60 days of application at rates above 1 pint per acre. Do not treat sweet varieties of sorghum. Do not apply more than 3 pints of 4E per season.

Lambda-cyhalothrin (Warrior T 1 lb EC)

Restricted Use

Apply 0.015 to 0.02 lb. a.i./a (1.92 to 2.56 fl. oz. of 1 lb./gal. EC). Apply by ground or air in sufficient gallonage to obtain full coverage of target location. Use a minimum of 2 gallons of water per acre by air. Do not graze livestock in treated areas or harvest for fodder, silage or hay. Do not apply within 30 days of harvest.

Cyfluthrin (Baythroid 2 EC)

Restricted Use

Apply 0.015 to 0.02 lb. a.i./a (1.0 to 1.3 fl. oz. of 2 lb./gal. EC). Apply by air or ground equipment in sufficient water for thorough coverage. At this rate (up to 5.6 fl. oz./a) green forage may be fed or grazed on the day of treatment. Allow 14 days between application and harvest of grain or dry forage.

*See additional notes on page 13.

Esfenvalerate (Asana XL 0.66 EC) *Restricted Use*

Apply 0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz. of Asana XL/a). Apply by ground or air equipment. Do not exceed 0.15 lb a.i./acre/season. Do not apply within 21 days of harvest. This use pattern may not appear on the federal label. See Supplemental Labeling EPA Reg. No. 353-515 issued in 1998.

Above-Ground Insects

Chinch Bug

Chinch bug adults are small, black bugs about an eighth of an inch long with white wings folded over the back. When viewed from above, two small blackish triangular markings are visible near the mid-portion of the wings. Immature bugs are bright red when first hatched and gradually become darker as they approach maturity. A white band on upper side of the first abdominal segment is visible until it is covered by the wing pads on the larger nymphs.

Chinch bug problems are generally confined to eastern areas of Kansas. Infestation in western Kansas is rare, but not unheard of. Damage begins in May or June. As small grains start to mature, immature wingless bugs crawl from small grains to nearby sorghums, and occasionally adults will fly into sorghum either directly from overwintering grasses or in a redistribution pattern from either wheat or other sorghums. Risk of damage is greater where sorghum is planted next to thin wheat. Seedling sorghum is extremely vulnerable. As few as seven to 10 bugs per plant will cause stunting, inhibition of secondary root development and stand loss of seedling sorghums. Larger plants can tolerate more bugs, but heavy infestations cause stunting, lodging and yield reduction.

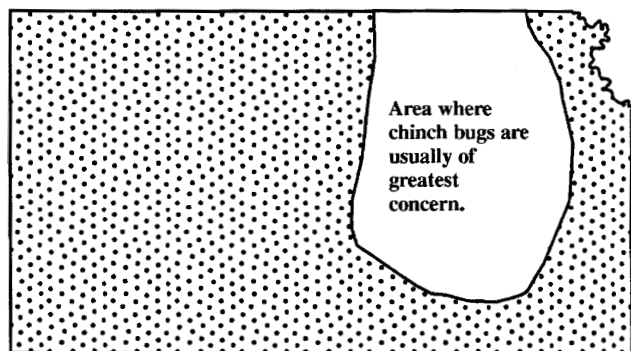
Chinch Bug Outlook for 2001

Chinch bugs usually increase in dry periods and decline during wetter years. Outbreaks tend to occur in roughly 7-to 10-year cycles. Overall, on a statewide basis, numbers have been relatively low since the wet

year of 1993. But locally damaging infestations have been developing each year, most commonly where sorghum is planted adjacent to thin wheat. This pattern is expected to continue in early 2001. Those experiencing problems in recent years should continue to watch for developing populations of chinch bugs in wheat or barley in early June.

Management During Periods of Moderate to Severe Chinch Bug Infestation

1. Wherever possible, avoid planting sorghum next to wheat, especially thin wheat.
2. Consider a trap crop. Plant or drill a 50-foot barrier strip of sorghum or sudan between the wheat and the sorghum field. Plant the barrier as early as possible before the normal date of sorghum planting. This strip will temporarily reduce the amount of migration into the regularly planted field. Concentrate on spraying this barrier and outer portion of the regularly planted sorghum during the period of migration.
3. Planting a strip of soybeans between wheat and sorghum may not produce the desired results. Migrating bugs may move up to a quarter-mile or more on foot through the soybeans in search of a suitable host.
4. Choose hybrids carefully. Some sorghums tolerate damage better and may respond to treatment better than others, though none have a high degree of resistance. Results of a limited study of selected hybrids are available upon request.
5. Chinch bugs thrive under conditions of poor stands, drought stress and lack of vegetative cover. Gear planting practices and fertility programs to encourage good early vegetative growth.
6. Consider the value of planting-time insecticides carefully. Sorghums planted within about three weeks of small grain maturity are benefited the most by this practice. The optional approach of relying entirely on foliar sprays during the seedling period can prove unsatisfactory. In one study, a delay of only two days in spraying 3-inch sorghums resulted in an 80 to 90 percent stand loss where moderate numbers of chinch bugs were present.
7. Examine nearby wheat or small grains during May or June. Infestations of at least one adult overwintered bug or four to five new nymphs per linear



foot in the margin of small grains may be enough to cause damage to the border rows of adjacently planted sorghums. Larger numbers of bugs in small grains would signal a greater degree of potential risk, and could indicate the need for planting-time insecticides for stand establishment.

8. As soon as bugs begin to migrate from small grains, use follow-up sprays with drop nozzles as necessary. Spray border rows of sorghum fields where infestations average five to six bugs per plant or more on seedling plants. Larger plants can tolerate more bugs, but watch plant growth and root development and look for differences between infested and non-infested areas. Often fields will have spots where bugs are numerous enough to cause injury. Unless spot treatment can be used, the size of the area infested must be compared to the cost of treating the entire field. Consider using field-wide treatment with ground-applied sprays for midsummer infestations in fields where infested spots (averaging about 50 bugs/plant where plant size is from about 1 foot in height through the flowering stages) are equivalent to about 1 acre infested in each 7 acres of field size.
9. Perhaps most important, is the need to combine practices using an integrated approach. Research studies have shown that the greatest protection against chinch bug damage can be obtained where a combination of carefully selected varieties that contain chinch bug tolerance are used along with an adequate chemical program (especially at planting time).

Early Season Protection Treatments

Sorghum is most vulnerable during the period when chinch bugs are migrating on foot out of maturing wheat fields. Planting-time soil treatments of carbofuran or aldicarb or commercially applied seed treatments with Gaucho or Adage may be used to obtain early season protection against chinch bug attack. These treatments work well initially, but wear off within a few weeks. *They offer the best protection where sorghum is planted within about three weeks of wheat maturity.*

Seed Treatment

Imidacloprid (Gaucho)

Use seed commercially treated with 8 oz. of Gaucho 480 (or its equivalent) per hundredweight of seed (treated as a slurry prior to planting). Do not graze or feed livestock or treated areas for 45 days after planting. Follow any listed rotational restrictions on the seed tag. Treated seed must not be used for food or feed.

Thiamethoxam (Adage)

Use seed commercially treated with 5.1 fl. oz. of Adage 5FS per hundredweight of seed (treated as a water-based slurry in standard slurry seed treatment equipment which provides uniform seed coverage). Follow label precautions and directions for use. Do not use treated seed for feed, food, or oil purposes.

Planting Time Treatment

Carbofuran (Furadon 4F)

Restricted Use

Apply 2 $\frac{2}{3}$ pts. (2.5 oz. per 1,000 ft. of row) of 4F in 7 to 20 gal. of water per acre on 30-in. rows. Less water is used in CDS microtube injector systems. Do not graze or harvest forage or silage within 75 days of planting. See Kansas 24-C label no. KS-880002. Continual use of carbofuran in the same field may lead to enhanced breakdown.

Aldicarb (Temik 15G)

Restricted Use

In furrow application. For early season control. Standard rate is 7.0 lb. of Temik 15G per acre. Experimental data indicate promise of early season control at lower rates—from 3.5 to 5.25 lb. of 15G/acre. Rates lower than 7 lb. a.i./a do not appear on the federal Temik 15G label, but this pattern is covered in Rhone-Poulenc supplemental labeling dated 4/92. Apply granules in the seed furrow and cover with soil. Do not make more than one application per year. Do not harvest within 90 days of application. Do not allow livestock to graze in treated areas before harvest.

Note: Aldicarb is a member of the same chemical class as carbofuran. Its susceptibility to premature breakdown following repeated use or following carbofuran use is currently unclear. Some evidence suggests less immediate concern.

Refer to additional notes on planting-time treatments under the greenbug section.

Infested Field Sprays

Control by spray is difficult unless drop nozzles are used and the spray is directed to the base of plants. Use 20 to 30 gallons of spray per acre. Bugs must be hit directly with the spray. Sprays will not give residual protection against continued migration from nearby unsprayed areas, so repeat sprays of border areas may be needed every 2 to 3 days during the period of migration — usually 10 days or two weeks.

Carbaryl (Sevin)

Apply 1½ to 2 lb. a.i./a. No preharvest waiting interval is required for forage use. Do not use within 21 days of grain harvest.

Carbofuran (Furadan 4F) *Restricted Use*

Apply ½ lb. a.i. in 20 to 30 gallons of water per acre. Ground application only. A second application may be applied as needed. Do not make more than two applications per season. Do not apply after heads emerge from the boot. Do not graze treated fields or cut silage or forage within 30 days following treatment. Applicators must use proper protective equipment when applying this chemical. SLN label no. KS-880001.

*Chlorpyrifos (Lorsban 4E)** *Restricted Use*

Apply ½ to 1 lb. a.i./a (1 to 2 pints). The treated crop is not to be used for forage, fodder, hay or silage within 30 days after application of ½ lb. a.i./a, or within 60 days at rates above ½ lb./a. Do not apply to drought-stressed sorghum within three days following irrigation or rain. Do not treat sweet varieties of sorghum. Do not apply more than 1½ lb. a.i./a per season.

Lambda-cyhalothrin (Warrior T 1 lb EC) *Restricted Use*

Apply 0.03 lb. a.i./a (3.84 fl.oz. of 1 lb./gallon EC). Apply by ground or air in sufficient gallonage to obtain full coverage of target location. Use a minimum of 2 gallons of water per acre by air. Do not graze livestock in treated areas or harvest for fodder, silage or hay. Do not apply within 30 days of harvest. Note: Do not apply more than 0.02 lb.a.i./a once crop is in the soft dough stage.

Cyfluthrin (Baythroid 2 EC) *Restricted Use*

Apply 0.02 to 0.044 lb. a.i./a (1.3 to 2.8 fl. oz. of 2 lb./gal. EC). Apply by air or ground equipment in sufficient water for thorough coverage. At this rate (up to 5.6 fl. oz./acre) green forage may be fed or grazed on the day of treatment. Allow 14 days between application and harvest.

*See additional notes on page 13.

Esfenvalerate (Asana XL 0.66 EC) *Restricted Use*

Apply 0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz. of Asana XL per acre). Apply by ground or air equipment. Do not exceed 0.15 lb a.i./a per season. Do not apply within 21 days of harvest. This use pattern may not appear on the federal label. See Supplemental Labeling EPA Reg. No. 353-515 issued in 1998.

Corn Earworm

These worms occasionally feed in heads of sorghum. The head capsule is light brown in color, body color of the larvae varies from pink to green to brownish with light and dark stripes running lengthwise of the body. Larvae are about 1½ inches at maturity. Sorghum is most vulnerable to injury during the bloom period and through the milk stages. Infestations are more common in southern areas of the state. During the entire period of larval feeding, an average of one larva per head will cause about a 5 percent decrease in yield, two larvae per head will cause about 9 to 10 percent reduction in yield. Control decisions must be based on expected yield, price and cost of application, and the amount of feeding that can be prevented by the use of control measures.

Methomyl (Lannate) *Restricted Use*

Apply 0.45 lb. a.i./a. Do not use within 14 days of harvest or grazing. Certain formulations are restricted. One day REI.

Cyfluthrin (Baythroid 2 EC) *Restricted Use*

Apply 0.02 to 0.044 lb. a.i./a (1.3 to 2.8 fl. oz. of 2 lb./gal. EC). Apply by air or ground equipment in sufficient water for thorough coverage. At this rate (up to 5.6 fl. oz./a) green forage may be fed or grazed on the day of treatment. Allow 14 days between application and harvest of grain or dry forage.

Lambda-cyhalothrin (Warrior T 1 lb EC) *Restricted Use*

Apply .02 to .03 lb. a.i./a (2.56 to 3.84 fl.oz. of 1 lb./gal. EC). Apply by ground or air in sufficient gallonage to obtain full coverage of target location. Use a minimum of 2 gallons of water per acre by air. Do not graze livestock in treated areas or harvest for fodder, silage or hay. Do not apply more than 0.02 lb. a.i./a once crop is in the soft dough stage.

*Chlorpyrifos (Lorsban 4E)** *Restricted Use*

Apply 1 lb. a.i./a (2 pints). Rates at less than 1.0 lb./a may be ineffective for this purpose. The treated crop is not to be used for forage, fodder, hay or silage within 30 days after application of ½ lb. a.i./a, or within 60 days at rates above ½ lb. a.i./a. Do not apply to drought-stressed sorghum within three days following irrigation or rain except where the product is applied in irrigation water. Do not treat sweet varieties of sorghum. Do not apply more than 1½ lb. a.i./a per season.

Esfenvalerate (Asana XL 0.66 EC) *Restricted Use*

Apply 0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz. of Asana XL per acre). Apply by ground or air equipment. Do not exceed 0.15 lb a.i./a per season. Do not apply within 21 days of harvest. This use pattern may not appear on the federal label. See Supplemental Labeling EPA Reg. No. 353-515 issued in 1998.

Spinosad (Tracer)

Apply 1.5 to 3 fl.oz. (0.047 to 0.094 lbs.a.i./a) in 2-5 gallons of water per acre by air or in a minimum of 5 gallons by ground application. Time application to coincide with peak egg hatch. Do not apply more than 14.4 fl. oz. of product per acre per year. Do not apply within seven days of grain or fodder harvest or within 14 days of forage harvest.

Corn Leaf Aphid

Medium to dark green aphids usually found in the whorls. Infestation may occur anytime during the growing season. Plants generally tolerate large numbers in the whorl without measurable yield losses. Typically, aphids decline rapidly after the boot stage. Although rare, control may be profitable if infestation persists and/or develops and increases in the emerging heads.

*Chlorpyrifos (Lorsban 4E)** *Restricted Use*

Apply ½ to 1 lb. a.i./a (1 to 2 pints). The treated crop is not to be used for forage, fodder, hay or silage within 30 days after application of ½ lb. a.i./a, or within 60 days at rates above ½ lb. a.i./a. Do not apply to drought stressed sorghum within three days following irrigation or rain except where the product is applied in irrigation water. Do not treat sweet varieties of sorghum. Do not apply more than 1½ lb. a.i./a per season.

*Parathion** *Restricted Use*

Apply ½ lb. a.i./a. Do not use within 12 days of harvest. New restrictions include: Apply in at least 3 gallons of water per acre and when winds are not more than 10 mph. Do not apply within 100 feet of buildings, public roads or bodies of water, and not within 100 feet of adjacent property without prior written consent of neighboring landowner. By aerial (commercial applicator) application only.

Disulfoton (DiSyston 8) *Restricted Use*

Apply ¼ to ½ lb. a.i./a. A maximum of three foliar sprays may be made at rates of ½ lb./a.i./a (½ pint) or less. Harvest restrictions are as follows: For soil plus any foliar application wait 34 days for grain harvest and 45 days for forage use. Where three foliar applications are made the interval is 34 days for grain and 60 days for forage. Where less than three foliar applications are made wait seven days for grain harvest and 45 days for forage use.

Fall Armyworm

Damage caused by the larvae may occur from July through frost. Whorl feeding is most common, resulting in a typical “ragworm” type injury. Feeding at this stage generally does not damage the unemerged heads. Worms deep within the whorl are difficult to reach with insecticides. Control is generally discouraged unless more than 75 percent of the plants show fresh injury with at least one live worm per infested plant. Expect more damage on small plants (later planted fields). Head infestation composed of some fall armyworms mixed with corn earworms is not unusual. Assess head infestations as you would for corn earworms.

*Chlorpyrifos (Lorsban 4E)** *Restricted Use*

Apply ½ to 1 lb. a.i./a (1 to 2 pints). The treated crop is not to be used for forage, fodder, hay or silage within 30 days after application of ½ lb. a.i./a, or within 60 days at rates above ½ lb. a.i./a. Do not apply to drought stressed sorghum within three days following irrigation or rain except where the product is applied in irrigation water. Do not treat sweet varieties of sorghum. Do not apply more than 1½ lb. a.i./a per season.

Methomyl (Lannate) *Restricted Use*

Application at 0.45 lb. a.i./a. has shown promise in research trials. Do not use within 14 days of harvest or grazing. Certain formulations are Restricted. 1 day REI.

*See additional notes on page 13.

Lambda-cyhalothrin (Warrior T 1 lb EC)

Restricted Use

Apply .02 to .03 lb. a.i./a (2.56 to 3.84 fl.oz. of 1 lb./gal. EC). Apply by ground or air in sufficient gallonage to obtain full coverage of target location. Use a minimum of 2 gallons of water per acre by air. Do not graze livestock in treated areas or harvest for fodder, silage or hay. Do not apply within 30 days of harvest. Note: Do not apply more than 0.02 lb.a.i./acre once crop is in the soft dough stage.

Cyfluthrin (Baythroid 2 EC)

Restricted Use

Apply 0.02 to 0.044 lb. a.i./a (1.3 to 2.8 fl. oz. of 2 lb./gal. EC). May not control larger larvae. Apply by air or ground equipment in sufficient water for thorough coverage. At this rate (up to 5.6 fl.oz./a) green forage may be fed or grazed on the day of treatment. Allow 14 days between application and harvest.

Spinosad (Tracer)

Apply 1.5 to 3 fl.oz. (0.047 to 0.094 lbs.a.i./a) in 2-5 gallons of water per acre by air or in a minimum of 5 gallons by ground application. Time application to coincide with peak egg hatch. Do not apply more than 14.4 fl. oz. of product per acre per year. Do not apply within seven days of grain or fodder harvest or within 14 days of forage harvest.

False Chinch Bugs

These bugs are often mistaken for chinch bugs. Size and general appearance are similar. Nymphs of false chinch bugs usually are a grayish color to brown, sometimes tinged with yellow. Chinch bug nymphs are bright orange with the young gradually becoming black near maturity, a white band is present in the upper body, near the hind pair of legs. Chinch bug adults are black in color (never gray or brown) wings whitish marked by a dark triangle near outer margins. False chinch bugs are grayish to brown with entirely transparent wings.

False chinch bugs develop on weeds, mustard in particular. Damage is not often observed, but occasionally some border treatment may be indicated where large numbers are attacking sorghum plants. Watch fields planted no-till into wheat stubble where mustard control was delayed until just prior to planting.

Cyfluthrin (Baythroid 2 EC)

Restricted Use

Apply 0.02 to 0.044 lb. a.i./a (1.3 to 2.8 fl. oz. of 2 lb./gal. EC). Apply by air or ground equipment in

sufficient water for thorough coverage. At this rate (up to 5.6 fl.oz./a) green forage may be fed or grazed on the day of treatment. Allow 14 days between application and harvest of grain or dry forage.

Grasshopper

Scout fields early in summer while grasshoppers are small and before migration begins. Where grasshopper nymphs are plentiful (15 to 20 per square yard) around field borders, treat such sites before infestations move into adjoining sorghum. Asana is a new insecticide labeled for non crop border use. Sprays listed below are intended for in-field spraying of sorghum; check label directions before using on wasteland margins.

Dimethoate (Cygon)

½ lb. a.i./a. do not feed or graze within 28 days of treatment. Do not apply more than three applications per season. Do not apply after heading.

*Chlorpyrifos (Lorsban 4E)**

Restricted Use

Apply ¼ to ½ lb. a.i./a. Do not apply to drought stressed sorghum within three days following irrigation or rain except where the product is applied in irrigation water. Do not use treated crop for forage, fodder, hay or silage within 30 days after application. Do not treat sweet varieties of sorghum. Do not apply more than 1½ lb. a.i./a per season.

Lambda-cyhalothrin (Warrior T 1 lb EC)

Restricted Use

Apply .02 to .03 lb. a.i./a (2.56 to 3.84 fl. oz. of 1 lb./gal. EC). Apply by ground or air in sufficient gallonage to obtain full coverage of target location. Use a minimum of 2 gallons of water per acre by air. Do not graze livestock in treated areas or harvest for fodder, silage or hay. Do not apply within 30 days of harvest.

*Parathion**

Restricted Use

Apply ½ lb. a.i./a. 12-day waiting interval. New restrictions include: Apply in at least 3 gallons of water per acre and when winds are not more than 10 mph. Do not apply within 100 feet of buildings, public roads or bodies of water, and not within 100 feet of adjacent property without prior written consent of neighboring landowner. By aerial (commercial applicator) application only.

*See additional notes on page 13.

Cyfluthrin (Baythroid 2 EC) *Restricted Use*

Apply 0.031 to 0.044 lb. a.i./a (2.0 to 2.8 fl. oz. of 2 lb./gal. EC). Apply by air or ground equipment in sufficient water for thorough coverage. At this rate (up to 5.6 fl.oz./a) green forage may be fed or grazed on the day of treatment. Allow 14 days between application and harvest of grain or dry forage.

Sorghum Greenbug

Infestations occur annually in Kansas although damage varies from year to year. Injury may be caused anytime during the growing season from seedling through soft dough stages. Infestations may consist of either winged or wingless adults, plus their progeny (nymphs). Greenbugs are light yellowish-green aphids that concentrate primarily on the undersides of lower leaves. They have a tremendous reproductive capacity; adult females give birth to living young which reach maturity in five to seven days. All adults are females and they produce progeny at the rate of about two per day over a 10-15 day period in warm weather. Greenbugs possess a toxic substance that makes them more damaging than other species of aphids.

Option 1—Planting Time Treatment

Planting time treatments provide early season protection and are useful when heavy greenbug flights develop during the planting period. Generally, use is greater in eastern areas where chinch bugs are the primary concern (using carbofuran or aldicarb). Where the greenbug is the target pest, growers may choose from the materials listed; however, planting time treatments may not be effective where insecticide resistant greenbugs are present. Phorate and terbufos are recommended only in band application and lightly incorporated. In-furrow application (with carbofuran or aldicarb) may provide faster uptake.

Option 2—Seed Treatment

Seed treated with commercially applied systemic products affords early season protection against all of the greenbug biotypes (plus chinch bugs, wireworms, etc.), and may be used as an alternative to soil treatment (planting time insecticides) for this purpose. This method may have application in areas where greenbug insecticide resistance is a problem, or in fields where greenbug susceptible hybrids are planted (includes all hybrids except those containing I and/or K resistance). Currently, the best use of this practice may be in eastern areas where chinch bugs are a frequent problem.

Insecticides for Planting Time Soil Treatment for 30-in. Rows

Insecticides	Rate Per acre	Harvest	Grazing
<i>For band application</i>			
Terbufos			
(Counter 15G)	8.7 lb.	See remarks	
(Counter 20CR)	6.5 lb.	See remarks	
<i>For band or in-furrow application</i>			
Carbofuran			
(Furadan 4F)	2½ pt.	75	75
Aldicarb			
(Temik 15G)	7.0 lb.*	See remarks	

Remarks

Terbufos: Place granules in a 5–7 inch band directly behind the planter shoe in front or behind the press wheel and lightly incorporate. Also may be knifed in. Do not incorporate deeper than 2 inches.

Carbofuran: Note: Less water (a 1:1 ratio) is used in CDS microtube injector systems using Furadan 4F. See Kansas 24-C label #KS-880002.

Aldicarb: Standard rate is 7 lb. of 15G/acre. See additional rate information under the chinch bug section. Do not make more than one application per year. Do not harvest within 90 days of application. Do not allow livestock to graze in treated areas before harvest.

Continual use of carbofuran or possibly aldicarb year after year in the same field may lead to enhanced breakdown.

Terbufos, carbofuran, and aldicarb are all highly toxic and may cause poisoning or death when swallowed, inhaled or spilled on the skin. Use only by persons able and willing to follow label directions.

Imidacloprid (*Gaucho*)

Use seed commercially treated with 8 oz. of Gaucho 480, or its equivalent, per hundredweight of seed (treated as a slurry prior to planting). Do not graze or feed livestock or treated areas for 45 days after planting. Follow any listed rotational restrictions on the seed tag. Treated seed must not be used for food or feed.

Thiamethoxam (*Adage*)

Use seed commercially treated with 5.1 fl. oz. of Adage 5FS per hundredweight of seed (treated as a water-based slurry in standard slurry seed-treatment equipment that provides uniform seed coverage). Follow label precautions and directions for use. Do not use treated seed for feed, food, or oil purposes.

Option 3—Rescue Treatment

Foliar sprays may be used when infestations develop and are reaching levels likely to cause damage. Decisions should be based on field scouting. The treatment guide provides a means of determining the severity of an infestation based on the

Foliar Sprays for Greenbug Control

Insecticides	Rate to use	Harvest	Grazing
Disulfoton			
Disyston 8(RU)	0.5 lb.	7	45
Carbofuran			
Furadan 4F (RU)	0.5 lb.	30	30
Parathion (RU)	0.5 lb.	12	12
Chlorpyrifos (RU)			
(Lorsban 4E)	1/4 to 1/2 lb.	0	30
Dimethoate	.33 lb.	28	see remarks
Malathion	1 lb.	7	7

(RU) = restricted use

Remarks

Disulfoton: Up to three foliar applications may be made at up to .5 lb. a.i. rates. Waiting intervals change with rates used, also if soil treatment was applied. See label for full restrictions.

Parathion: May not be applied within 100 feet of adjacent property without prior written consent of neighboring land owner. For aerial use only, see other restrictions on product label.

Chlorpyrifos: Do not apply to drought-stressed sorghum within 3 days following irrigation or rain except in irrigation water. Do not apply more than 1 1/2 lb. a.i./a per season.

Dimethoate: Do not feed or graze within 28 days of last application. Do not apply after heading. Up to 3 applications permitted.

Carbofuran: Ground application only, use in 20 to 30 gal. of water per acre. Do not make more than two applications per season. Do not apply after heads emerge from boot. SLN label.

Disulfoton, carbofuran, and aldicarb are all highly toxic and may cause poisoning or death when swallowed, inhaled or spilled on the skin. Use only by experienced persons who are knowledgeable, willing and able to exercise judgment and follow label directions.

number of greenbugs per plant and visual signs of damage for the various stages of plant growth. This is based on the need for control in fields of susceptible hybrids (hybrids with C or E resistance are considered susceptible in Kansas). Some upward adjustment in treatment levels may be justified in fields planted to hybrids with I and/or K resistance. Resistant hybrids usually suffer less damage and tend to have lower infestations; however, heavy infestations may still result in damage to yield.

How to use the Control Guide—See Table 1

The table on page 11 shows that, early in the season, on one-leaf stage plants an infestation of 10 to 25 greenbugs per plant (based on an average count of 25 plants or more) is considered “threatening.” Most plants will have colonies of nymphs and

adults or perhaps mostly winged adults. Depending upon conditions, the infestation may persist and build, or it may decline. In some instances control may be indicated. If the infestation at the one-leaf stage is averaging around 25 to 50 greenbugs per plant, the risk is higher, and serious stand loss is likely. In most instances, prompt control would be recommended. Follow the guide based on the appropriate crop growth stage. As the season advances, beneficial insects often become more numerous, and affect treatment decisions.

Greenbug Resistance to Insecticides

Until recently, greenbugs were relatively easy to control with insecticides. However, a resistant strain that is harder to control is present in the sorghum producing region. This problem has been most pronounced in parts of southwest Kansas, and in the Texas High Plains. In field sampling, we have found that most populations consist of a mixture of resistant and susceptible individuals. The proportion of resistant to susceptible greenbugs appears to increase with more frequent insecticide use. The problem is not spreading as fast as it appeared to be a few years ago. This could be the result of lighter infestations and less spraying than sometimes occurs. Nevertheless, the problem is serious, and its future course is difficult to predict. Don’t confuse insecticide resistance with changes in greenbug biotypes. Insecticide resistance can occur in populations of either biotype E or I greenbugs.

Option 4—Resistant Hybrids

Resistant hybrids are a very useful way of reducing greenbug damage. However, to be effective, the hybrid must be resistant to the predominant strain or biotype of greenbug in the area where it is planted. Recent surveys have found that biotype I is now common throughout Kansas, and has largely replaced biotype E in most areas. There is also a biotype K capable of overcoming resistance to I-resistant hybrids, but it is not thought to be as widespread at present. In selecting hybrids with greenbug resistance for Kansas, choose those with resistance to biotypes I or K. Some do not appear to have as much resistance as might be desired.

Option 5—Supplemental Measures

Often, additional measures can be taken to either decrease the amount of chemical treatment or improve the performance of host plant resistance. For instance, growers are encouraged to utilize

Table 1.**Greenbug Treatment Guide
(Susceptible Hybrids)***

Plant Growth Stage**	Based on Avg. No. of Greenbugs per plant		Based on Visual Rating***
	Threatening level	Treatment level***	
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 starting to appear.
mid-whorl stage, About 1 month at after emergence	200	300–600	When majority of plants are infested with rapidly increasing colonies, but before leaves begin to die. Damaging levels uncommon 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 showing yellowing and reddening with occasional leaves dying. Small to large colonies present and increasing on the majority of plants

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

**One leaf stage means collar of first leaf visible, same system for 3rd and 5th leaf stages.

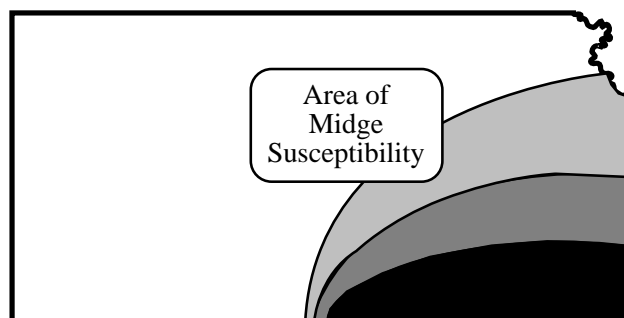
***Assumes minimal beneficial activity. Remember frequent field visits are usually necessary in order to make wise decisions.

natural populations of beneficial insects wherever possible. Lady beetles are important in controlling light or beginning greenbug infestations. Parasitic wasps are usually extremely effective later in the season if they become established before damage becomes serious. The risk of greenbug damage is probably reduced more where beneficial insects can be used in combination with host plant resistance. Growers are sometimes tempted to import and release beneficial insects to augment natural populations. This approach has not met with experimental success at KSU, and is not encouraged.

Ongoing research suggests that use of reduced-till or no-till planting tends to discourage greenbug infestation. Some evidence also suggests that results can be enhanced if reduced tillage can be combined with greenbug-resistant hybrids.

Sorghum Midge

This insect, common to Texas, but rare in Kansas, occurs occasionally, primarily in the southeast area. Midge-damaged heads may be pinkish in color, with some or all seeds undeveloped. For a time, if infested seeds are squeezed, the remains of an orange colored maggot may be forced out. When adults emerge, an empty clear-colored pupal case may remain attached



to the glumes. Diagnosis frequently requires laboratory inspection. When in doubt take a head sample to the K-State Research and Extension office for processing. Where there is concern, consider trying to achieve more uniform, earlier dates of planting to avoid having sorghums blooming during mid- to late August especially south of U.S. 54 from Sumner County eastward. Chemical control is possible but can be achieved only by means of an intensive scouting procedure that is generally not too feasible in view of its infrequent occurrence in Kansas.

Sorghum Webworm

This problem is usually confined to southeast Kansas. It is usually more severe in late maturing fields. Damage occurs from August to October.

Infestations do not injure mature seed. The damage is caused by small fuzzy striped worms that feed within the developing seed. Keeping Johnsongrass mowed and planting early reduces the incidence. Southeast Kansas growers should begin scouting blooming fields by mid August and consider treatment where infestations average five or more worms per head during the early post-bloom period.

Carbaryl (Sevin)

Apply 1 to 2 lb. a.i./a. No preharvest waiting interval is required for forage use. Do not use within 21 days of grain harvest.

*Chlorpyrifos (Lorsban 4E)** *Restricted Use*

Apply ½ to 1 lb. a.i./a (1 to 2 pints). The treated crop is not to be used for forage, fodder, hay or silage within 30 days after application of ½ lb. a.i./a, or within 60 days at rates above ½ lb./a. Do not apply to drought-stressed sorghum within three days following irrigation or rain except where the product is applied in irrigation water. Do not treat sweet varieties of sorghum. Do not apply more than 1½ lb. a.i./a per season.

*Parathion** *Restricted Use*

Apply ¾ lb. a.i./a. Do not use within 12 days of harvest. New restrictions include: Apply in at least 3 gallons of water per acre and when winds are not more than 10 mph. Do not apply within 100 feet of buildings, public roads or bodies of water, and not within 100 feet of adjacent property without prior written consent of neighboring landowner. By aerial (commercial applicator) application only.

Methomyl (Lannate) *Restricted Use*

Apply 0.45 lb. a.i./a. Do not use within 14 days of harvest or grazing. Certain formulations are restricted. One day REI.

Lambda-cyhalothrin (Warrior T 1 lb EC)

Restricted Use

Apply .02 to .03 lb. a.i./a (2.56 to 3.84 fl.oz. of 1 lb./gal. EC). Apply by ground or air in sufficient gallonage to obtain full coverage of target location. Use a minimum of 2 gallons of water per acre by air. Do not graze livestock in treated areas or harvest for fodder, silage or hay. Do not apply within 30 days of harvest. Note: Do not apply more than 0.02 lb.a.i./a once crop is in the soft dough stage.

Cyfluthrin (Baythroid 2 EC) *Restricted Use*

Apply 0.02 to 0.044 lb. a.i./a (1.3 to 2.8 fl. oz. of 2 lb./gal. EC). Apply by air or ground equipment in

sufficient water of thorough coverage. At this rate (up to 5.6 fl.oz./acre) green forage may be fed or grazed on the day of treatment. Allow 14 days between application and harvest of grain or dry.

Spider Mites

Damaging populations are more common in extreme southwestern Kansas. Mite infestations typically develop first on the underside of lower leaves and migrate up the plant. Infestations often increase rapidly as plants enter reproductive development, especially during periods of hot, dry weather.

Suggestions for Mite Control:

1. Good production practices, frequent inspection of fields, careful and judicious use of insecticides and miticides, proper timing of treatments, and thorough coverage with sprays are important elements of a mite management program; but even then, control efforts are not always successful.
2. In general, mite control is advisable when the majority of plants are infested with large, expanding colonies of mites on the bottom leaves, and where some mites are beginning to migrate up into the mid-section of most plants. Complete control is usually neither practical nor possible. On the other hand, avoid waiting too long before initiating treatment. Rapidly expanding infestations that have become established throughout the canopy are usually extremely difficult to bring under control.
3. Strive, where practical, to maintain a degree of control that will keep the leaves in the upper ⅔ of the canopy functional until the hard dough stage is reached.
4. Mark randomly selected plants and count the mites present before treating the field. Where re-entry intervals permit, reinspect treated fields as promptly as possible after treatment—recounting the mites on the marked plants 2 to 3 days after treatment is advisable.
5. Fields with high egg populations prior to treatment are likely to need retreating shortly after the majority of the eggs have hatched. Prompt retreatment also may be needed where the initial application failed to give satisfactory control of nymphs and adults. Evaluate application techniques and consider changing miticides.

*See page 13 for additional notes.

6. The chemicals listed below generally provide fair to good results, but performance from field to field may vary. Performance is influenced by the conditions at time of treatment, the year, history of prior infestations in the community, and the species make-up of the mite populations.

Dimethoate (Cygon)

Apply ½ lb. a.i./a. Do not feed or graze within 28 days of last application. Up to three applications per season permitted. Do not apply after heading.

Propargite (Comite II)

Apply 1.64 lb. a.i./a. Do not use within 30 days of grain harvest, or 60 days of silage use. Do not plant rotational crops within six months of last treatment on grain sorghum. One application per season permitted. May cause burning on some hybrids. Apply small test strip before large-scale use. Comite II for use east of the Rockies.

Additional Notes on Insecticide Use

Lorsban 4E manufactured after Dec. 1, 2000, will carry the Restricted Use label. Growers can no longer buy non-Restricted Use Lorsban 4E after Dec. 31, 2001. Product on hand may be used by growers as labeled.

Some insecticides may be applied through overhead sprinkler systems. Current information suggests that Asana, Lorsban, Warrior, Baythroid, Tracer and some carbaryl (Sevin) products may be applied in this manner. Those interested in using this method of application must comply with the requirements as established by the Kansas Chemigation Safety Law as well as all requirements as listed on the product labels.

Restrictions on use of parathion (ethyl parathion) became effective on January 1, 1992. Use on many crops was cancelled, but use on sorghum was retained. These restrictions include:

Use only in closed transfer systems, mechanical harvesting of treated crops, do not apply in winds greater than 10 mph, and use at least 3 gallons per acre. Use is restricted to commercial applicators by aerial application only. Additionally, landowners must be given written notification that treated crops must be mechanically harvested. They also must be informed of the re-entry restrictions and incident reporting requirements as listed on the product label.

Use within 100 feet of buildings, public roads, or bodies of water is prohibited. Use within 100 feet of property lines is prohibited unless the adjacent landowner has given written consent and has been

informed of the timing of the application and the appropriate re-entry requirements.

This product must be mixed and loaded in a closed system as outlined on the product label. An observer must be present during all mixing/loading activities. Persons involved in repair, cleaning of equipment and disposal of product must wear appropriate protective clothing as specified on the label.

Note: Parathion in these recommendations refers to the ethyl formulation of parathion. Some sorghums are very susceptible to “burning.” Methyl parathion frequently causes severe burning on certain hybrids. It should never be used without first making a test application.

What is the Worker Protection Standard?

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

The Endangered Species Law

Under the provisions of the federal Endangered Species Law, the use of some pesticides is restricted in close proximity to the nesting sites of two migratory birds in portions of Meade, Clark, Comanche, Stafford, Reno, Rice and Barton counties. At present the program is voluntary. Compliance details should be available in the Extension offices of affected counties, otherwise contact Plant Health Division, Kansas Dept. of Agriculture, 785 296-0672.

Other Resources

For help identifying insects found on sorghum, refer to the K-State Research and Extension publications, *Identifying Caterpillars in Corn and Sorghum*, S-121, and *Insects in Kansas*, S-131. S-131 is a reference containing more than 900 color photos that can be used to identify many common insects found throughout Kansas.

Notes:

Notes:

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For more information about insect problems in Kansas, click on the Extension Entomology Home Page at:
<http://www.oznet.ksu.edu/entomology/extension/extension.htm>

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