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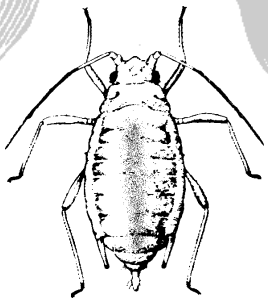
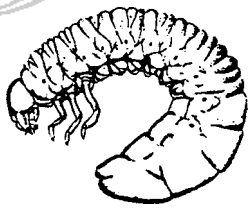
Managing Insect and Mite Pests of Texas Sorghum





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Managing Insect and Mite Pests of Texas Sorghum

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AN INTEGRATED APPROACH TO managing insect and mite pests can help Texas sorghum growers and crop protection specialists:

- Prevent damaging insect pest infestations;
- Diagnose the presence and severity of an insect pest infestation; and
- Control an infestation with insecticides when preventive methods are not fully effective and sampling justifies the need for insecticide.

Sorghum has an advantage over other grain crops because it can withstand relatively harsh, hot, dry climates, but responds well to favorable production conditions and irrigation. The crop adds important agricultural diversity in a production region. Beneficial insects associated with sorghum often help reduce the severity of insect and mites in sorghum and in other crops such as cotton. Sorghum is an important rotation crop with cotton and soybeans, and rotation helps manage some weeds, diseases and insect pests.

Some insect and mite pests can reach damaging levels throughout the growing season. Others can cause damage only at a specific plant growth stage. Figure 1 illustrates the probability of various insect and mite pests occurring at each plant development stage.

Most insect pests of sorghum are occasional pests, meaning they cause economic damage in localized areas or only during certain years. Only one or two key insect pests are usually in any sorghum-growing area in Texas. These insects occur most years and dominate control practices. Examples of key insect pests of sorghum are greenbug and sorghum midge.

Some pests, such as Banks grass mite, are induced. These are present in sorghum fields or surrounding areas, but usually in nondamaging numbers. They increase to economically important levels after changes in cultural practices or crop varieties, or insecticide use for other insect pests.

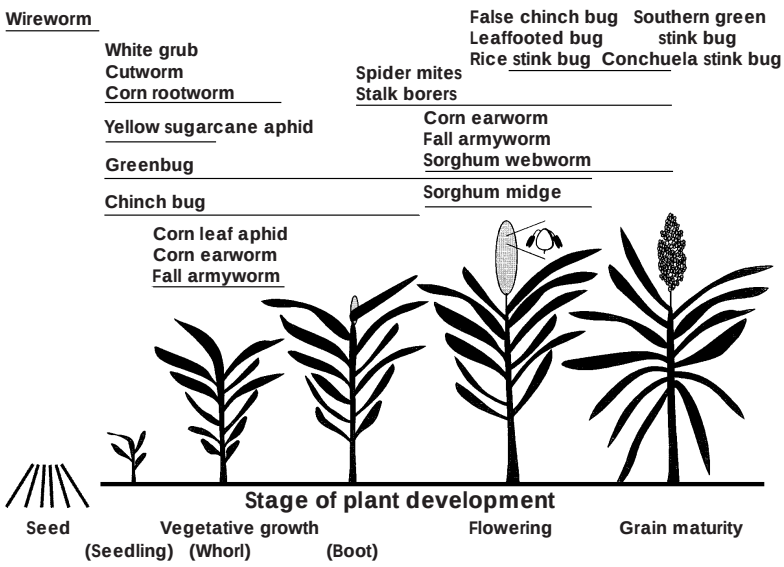

Figure 1. Sorghum insect pest occurrence.

Methods to prevent insect pest infestations

Managing insect and mite pests of sorghum involves actions that prevent pests from increasing to high enough numbers to cause economic damage. These practices help avoid pests, reduce their abundance or slow their rate of increase, delay the time they reach damaging levels and/or increase the plant's tolerance to the insect pest.

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Cultural management methods

Cultural management methods involve using crop production practices to reduce pest abundance or damage.

Crop rotation involves successive use of host and non-host crops. Sorghum benefits most when rotated with a broad-leaf or tap-rooted crop such as cotton or soybeans. Growing sorghum in a field planted to a different crop the previous year significantly reduces the potential for problems from some insect pests, diseases and weeds.

Crop rotation is especially effective against insect pests with a limited host range, long life cycle (one or fewer generations a year) and limited ability to move from one field to another. For example, wireworms, white grubs and some cutworms have only one generation a year, must have a grass-type crop to develop and reproduce, and cannot move during the damaging larval stage from one field to another. Thus, growing a crop such as cotton or soybeans in the field before growing sorghum helps reduce abundance of these soil-inhabiting pests. Sorghum growers should rotate crops regularly.

Destroying the previous crop, volunteer and alternate host plants eliminates breeding and/or overwintering habitats to reduce insect pest abundance and damage. This involves mechanically or chemically destroying sorghum plants soon after harvest to kill or expose insect pests and remove their food supply. This method also includes destroying volunteer crop and alternate host plants within and outside a field.

Where conservation tillage practices are used, herbicides can be applied post-harvest to kill crop, volunteer and alternate host plants. Herbicides stop crop growth effectively and are compatible with cultural management practices to reduce insect pest abundance. Where crop residue must be destroyed mechanically to expose overwintering insect pest life stages, conservation tillage may enable certain species of insect pests to become more abundant.

Destroying previous crop, volunteer and alternate host plants reduces insect pest abundance the following year. This practice is particularly important to reduce the abundance of southern corn rootworm, cutworms, sorghum webworm, sorghum midge and stalk-boring insects. Johnsongrass is a non-cultivated host of many sorghum insect pests, including greenbug, yellow sugarcane aphid and sorghum midge. Destroying this weed is difficult but very helpful in managing insect pests.

Seed selection, seedbed preparation and seed treatment are important in reducing the effects of sorghum insect pests. When deciding on a sorghum hybrid to plant, consider how well the hybrid is adapted to the locale and its susceptibility to insect pests and diseases.

Use sorghum hybrids that tolerate greenbugs. Hybrids resistant to sorghum midge are less available, but are highly advantageous in southern parts of the state. Sorghum hybrids with loose (open) rather than tight (compact) grain heads are less infested with larvae of corn earworm, fall armyworm and sorghum webworm, all of which feed on developing kernels. Also, sorghum with open grain heads is less likely to show the effects of grain deterioration from weather, grain head-infesting bugs and pathogens. Early, uniform hybrids avoid infestation by several insect pests, including sorghum midge, corn earworm and fall armyworm, in addition to avoiding late-season weather problems.

Sorghum hybrids resistant to pathogens and with good standability also reduce the detrimental effects of insect pests. Insect pests add to the stress on sorghum plants during the growing season, and, combined with pathogen infection, increase plant lodging. Some insect pests, such as greenbug and corn leaf aphid, transmit maize dwarf mosaic virus and other sorghum diseases. This problem is best dealt with by using disease-resistant sorghum.

Good seedbed preparation promotes rapid seed germination and seedling growth, which are essential to avoiding damage by wireworms, red imported fire ant and yellow sugarcane aphid. Rapidly growing seedlings are more tolerant of damage.

Fungicide- and insecticide-treated seed protects against some diseases and seed-feeding insects. Seed bought pre-treated with the systemic insecticide imidacloprid (Gaucho®) is protected against seed-feeding insects and those such as aphids and chinch bug that attack sorghum during the seedling stage. However, this systemic insecticide also suppresses corn leaf aphids that attract beneficial arthropods needed for natural control of greenbug and other insect pests.

Planting time should be as early as practical, but not when temperatures are too cool for rapid seed germination and seedling growth. In dryland areas of the state, early planting usually takes advantage of seasonal rainfall patterns.

Early planting avoids infestation and damage by some sorghum insect pests because plants grow beyond a vulnerable stage before these insect pests are present. Also, young plants can reach a more tolerant stage before insect pests are present, be susceptible for a shorter period of time or mature before an insect pest becomes abundant enough to cause serious damage. Early-planted sorghum generally avoids damaging numbers of sorghum midge, corn earworm, fall armyworm, sorghum webworm, stalk borers and grain head-infesting bugs.

Fertilizer and irrigation applied to sorghum can both help and harm efforts against insect pests. Using too much fertilizer and irrigation can cause sorghum plants to be succulent and attractive to sorghum insect pests and extend the time to maturity. On the other hand, healthy, vigorously growing plants better tolerate insect pest infestation and other plant stresses. In areas with alkaline soils where iron-deficiency is a problem, applying iron is important for production of healthy sorghum.

Chinch bugs and spider mites favor hot, dry conditions and stressed plants. Dense stands of vigorously growing sorghum are less susceptible to chinch bugs. Rainfall tends to reduce greenbug and spider mite numbers. Yield potential reductions by most leaf-feeding insect pests partially depend on plant condition.

Biological management methods

Biological management methods reduce insect pest abundance by using natural enemies — predators, parasites and pathogens that kill insect pests. Natural enemies can be used in three ways:

- Conservation, or enhancing numbers of already existing natural enemies. Conserving natural enemies is the most applicable biological management method to suppress the abundance of sorghum insect pests.
- Augmentation, the mass culturing and periodic release of a natural enemy.
- Importation, the introduction of non-native natural enemies.

Conservation of natural enemies involves protecting existing natural enemies so they are abundant enough to suppress the insect pests they attack. Sorghum hosts an abundance of natural enemies, primarily because of aphid infestations. The corn leaf aphid, usually non-injurious to sorghum, often becomes very abundant. Corn leaf aphids attract many different natural enemies that attack aphid and caterpillar pests.

Natural enemies allowed to increase can hold some insect and mite pests below damaging levels. Insecticides often destroy natural enemies, because most insecticides used in sorghum are broad spectrum, killing insect pests as well as natural enemies. The fact that insecticides kill natural enemies is a primary reason for making sure insecticides are needed before applying them. Once natural enemies have been destroyed, there is no natural (biological) protection against insect pests. This results in resurgence of the treated insect pest or allows a secondary pest such as corn earworm or spider mites to increase.

Sorghum pests most affected by natural enemies are greenbug, corn earworm, fall armyworm, sorghum webworm and spider mites. Important natural enemies include ladybird beetles, lacewing fly larvae, syrphid fly larvae, minute pirate bug, insidious flower bug, damsel bug, big-eyed bug and parasitic wasps. Predators affect abundance and rate of increase of greenbugs, often preventing them from causing damage.

This is particularly true when greenbug-resistant hybrids are used. Parasites often terminate a greenbug infestation. Predators are important in suppressing abundance of corn earworms and fall armyworms that infest sorghum grain heads. Although several parasites attack sorghum midge, their effect is minimal. Several pathogens, mostly fungi, infect some aphids, chinch bug and caterpillars.

Augmentation is the purchase and periodic release of natural enemies not normally occurring in sufficient numbers to control pests. Commercially available natural enemies sold for pest control in sorghum include convergent lady beetles, lacewing flies and the greenbug parasite *Lysiphlebus testaceipes*.

Naturally occurring convergent lady beetles help control greenbug infestations in sorghum. However, the convergent lady beetles available to buy are collected from natural hibernating sites and stored in refrigerators. When released in the field, they quickly fly away or feed at low and ineffective rates without reproducing.

The effectiveness of augmenting other natural enemies for control of sorghum pests is unknown. Because definitive information on augmentation (when to apply, how many to apply, etc.) is lacking, entomologists with the Texas Agricultural Extension Service cannot provide guidelines for augmentation as a management tool in sorghum.

Importation is the identification, collection and release of natural enemies in areas where they do not occur naturally. This method has been effective where an exotic pest has entered Texas without the natural enemies that help control the pest in its native country. Certain species of parasitic wasps and lady beetles that feed on the greenbug have been imported and released in Texas.

Methods to diagnose insect pest infestations

Sampling

Sampling insects and mites in sorghum is critical to determining the severity of an infestation and need for insecticide application. Insect pest numbers in sorghum fields can change rapidly. Inspect sorghum at least once a week, especially during critical times when insect pests are likely to be present, to determine the pests present, their abundance and damage. Growers may need to inspect flowering sorghum daily when assessing abundance of sorghum midge. Record the information collected during each field inspection for future reference to determine changes in insect abundance and plant damage.

The number of samples needed depends on the size of the sorghum field, uniformity, plant growth stage and severity of the insect infestation. Seldom are insect pests distributed evenly in a sorghum field. Examine plants from all parts of a field. Avoid examining only field borders. Take at least two samples per acre in the sorghum field.

Growers can estimate the abundance of most insects in sorghum by visually inspecting the plants and plant parts. Some insects, especially those infesting sorghum grain heads, are effectively sampled by using the "beat-bucket" method. Insect pests that live in the soil are hard to detect and most need to be sampled before the crop is planted.

Soil-dwelling insects, such as white grubs and cutworms, can be found by searching through the soil. Wireworms are difficult to detect in soil. A grain-baited trap can be used to attract them (See wireworm section on page 7 for details.)

For visual examination, randomly select and carefully inspect plants to detect insects and associated damage. During inspection, consider other factors such as predators, parasitized aphids, plant growth stage and condition. Visual examination is used most often to sample aphids, chinch bug, spider mites and sorghum midge.

The beat-bucket technique is the best way to estimate the number of corn earworm, fall armyworm, sorghum webworm and bugs in sorghum grain heads. Shake sorghum grain heads vigorously into a 5-gallon plastic bucket. Then count the caterpillars and bugs in the bucket. Because adult bugs can fly, take care to count those flying from the bucket or sampled plant.

Economic threshold level

The economic threshold level is the abundance of an insect pest or amount of plant damage that justifies applying insecticide. Although economic treatment levels provided in this publication are based on research, consider them only guidelines, because environmental and crop conditions vary from year to year and region to region.

Economic treatment levels for most insect pests are provided in tables that consider differences in insecticide and application costs and per-acre value of the sorghum crop. To determine if the abundance of insect pests justifies applying insecticide, first estimate the per-acre value of the crop. Then determine the per-acre cost of control including the insecticide and application. Read across the columns for cost of control and down the table columns for the market value of the crop. The abundance of the insect pest at that point in the table warrants the cost of control.

Chemical management methods

Insecticides are chemicals that kill insects. They are powerful tools and have several advantages. The major advantage is they are often the only practical control for insect pests at or near damaging levels. The key disadvantages of insecticides are cost and broad toxicity. They can harm nontarget organisms in the crop and nearby areas. From a sorghum insect management standpoint, cost of insecticide and killing natural enemies are of most concern.

Use an insecticide in the proper amount and only when necessary to prevent economic loss. The cost of achieving full crop potential can exceed potential benefits. Apply insecticides only when insect pests are becoming more abundant and economic crop loss is expected. When deciding whether to apply an insecticide, consider the cost of insecticide applications, prevailing market conditions, expected yield, insect pest abundance, insect age and duration of attack, and stage and condition of the plants attacked.

Indiscriminate insecticide use can lead to pest resistance, resurgence of the treated pest and outbreaks of secondary pests. Selective insecticide use by application method, choice of product or dosage can greatly reduce occurrence of these problems. Treating insect pests in sorghum can affect the abundance of beneficial and pest insects in adjacent crops.

Seed insecticide treatments

Gaucho®-treated seed can be purchased to control wireworms, fire ant, greenbug, yellow sugarcane aphid and chinch bug. Use of Gaucho®-treated seed is discussed within the sections on these pests. Contact your seed dealer to buy Gaucho®-treated seed.

Lindane can be used in the planter box or as a direct seed treatment. To directly treat seed, add 1 pint of water to each 100 pounds of seed in a cement mixer or commercial or homemade seed treater and mix to fully coat the seed. Add insecticide slowly and in the correct amount, thoroughly mixing until insecticide is distributed evenly on all seeds. Treated seeds should be planted within 20 days of treatment because longer exposure to insecticide may lower seed germination of some sorghum hybrids.

Take care to avoid inhaling the dust when placing and mixing insecticide in a planter box to treat planting seed. Use an old broom handle, stick or similar device to mix insecticide and seed in the planter box.

Lindane used on planting seed can delay and reduce seed germination when soil is cold and wet, or very hot. Lindane should at all times be used according to label instructions. If the 7-day forecast is for a cold, wet period or the soil temperature is marginal for seed germination, it may be best not to use lindane. Despite these precautions, lindane has been an effective, low-cost method of protecting sorghum planting seed from insect attack. **Do not use treated sorghum seed for human consumption or livestock feed.**

Seed sometimes is treated with insecticides such as malathion, methoxychlor or pirimiphos-methyl to control stored-grain pests and do not control seed-feeding insect pests once seed is planted.

Soil insecticide treatments

Insecticides for controlling some soil-inhabiting insect pests must be applied before the crop is planted or at planting time. Granular or liquid formulations may be used. The formulation used usually depends on available equipment and the target insect. Several application techniques are used to treat soil: preplant row treatment, row band at planting and in-furrow at planting.

Preplant row treatment requires special equipment to incorporate insecticide to a depth of 2 to 4 inches. Row treatments must be made after or during bed formation because further cultivation or bed shaping changes the position of insecticide in the row. For best control, treat a band of soil 7 to 10 inches wide and 2 to 4 inches deep, and place seed in the center of the band.

Row band and in-furrow applications may be used to apply insecticide to soil at planting. The technique chosen depends on the pest insect and how a particular insecticide is labeled. Mount the granular applicator spout or spray nozzle just behind the opening plow or disc opener and in front of the covering shovels or press wheel. Adjust spouts or nozzles to make the treatment band 6 to 8 inches wide, treating the seed furrow as well as covering soil. Incorporating insecticide by covering shovels is adequate. Insecticide also can be incorporated with short parallel chains, loop chains, press wheels, finger tines or other suitable devices. Do not apply insecticides directly on seed unless the label clearly describes that use, because doing so usually results in poor seed germination. In-furrow insecticide application for other insect pests does not adequately control white grubs when they are abundant.

Some insecticides (e.g., aldicarb, carbofuran, disulfoton, phorate, terbufos) are systemic and can be applied at planting. Applied to soil, these chemicals are absorbed into the young growing sorghum plant and control or suppress such early-season insect pests as greenbug, corn leaf aphid, yellow sugarcane aphid and chinch bug.

Certain insecticides, besides being systemic, are effective against some soil-inhabiting insect pests, such as wireworms and corn rootworms. Duration of systemic activity varies with insecticide and rate, but generally suppress insect pests for 2 to 6 weeks after application.

Foliar and grain-head insecticide treatments

Aircraft or ground machines may be used to apply insecticides to sorghum foliage and grain heads. Aerial applications work best when insecticide swaths meet or overlap. Insecticide sprays are more effective and hazards minimized when wind velocity is less than 10 miles per hour.

Nozzle size and number, ground speed and pressure influence the rate of insecticide spray output per acre by a ground machine. Calibrate the sprayer carefully to ensure the recommended amount of insecticide is applied. One nozzle per row usually is adequate for young sorghum planted in rows. Two to three nozzles may be needed to adequately cover larger plants and broadcast-planted sorghum. Optimal pump pressure depends on the kind of nozzle used.

Some insecticides discolor foliage of certain sorghum hybrids. Yield losses may occur from extensive leaf damage after these chemicals are used on susceptible hybrids. Review the label carefully before using an insecticide. If you do not know whether the sorghum is susceptible to insecticide, consult the insecticide manufacturer and/or seed company. Carefully follow instructions on the label of an insecticide container to avoid hazards to the applicator, wildlife and the environment.

Endangered Species Act

The Endangered Species Act is designed to protect and recover animals and plants in danger of becoming extinct. Under

provisions of this act, the U.S. Fish and Wildlife Service helps the Environmental Protection Agency and Food and Drug Administration to implement pesticide programs by analyzing the biological effects of pesticides on threatened and endangered species.

Many pesticide labels now list restrictions limiting use of products or application methods in areas designated as biologically sensitive. These restrictions often change. Refer to Environmental Hazards of Endangered Species discussion sections of product labels and/or call your local county Extension agent or fish and wildlife service personnel to determine what restrictions apply in your area. Regardless of the law, pesticide users can be good neighbors by knowing how their actions may affect people and the environment.

Bees and other pollinators

Protect bees and other pollinators from insecticides. Pollination by bees is important in producing such crops as alfalfa, clover, vetch and cucurbits. Sorghum is an important source of pollen for honey bees in many parts of Texas. However, sorghum is wind- or self-pollinated and does not require insect pollinators.

Take care to minimize bee losses by:

- Applying insecticides, if practical, before bees move into fields or adjacent crops. When bees are present in the field or vicinity, make applications during the evening after bees have left the field.
- Where insecticides are needed, using materials least toxic to bees and notifying beekeepers so they can protect bees.
- Preventing insecticide spray from drifting directly onto bee colonies.

Inbred lines for hybrid seed production

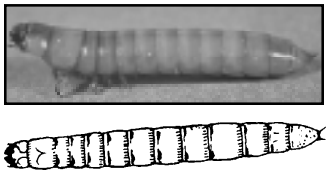
Inbred lines used for sorghum hybrid seed production often are more susceptible than hybrids to insect pest damage and insecticide phytotoxicity. The increased susceptibility to insecticides and higher crop value of sorghum for hybrid seed production generally require lower economic threshold levels for insect pests. Also, insect pests that influence seed quality and germination are more important in hybrid seed production.

Monitor hybrid seed production fields regularly and consider the increased susceptibility to insect pests and insecticide phytotoxicity. Before applying an insecticide, check the insecticide label carefully and consult the manufacturer and seed company about possible phytotoxic effects.

Seed and root insect pests

Wireworms

Elateridae and Tenebrionidae



Wireworm

True and false wireworms are immature stages of click and darkling beetles. Wireworms generally are shiny, slender, cylindrical and hard-bodied. Their color ranges from yellow to brown.

Wireworms feed on planted sorghum seed, preventing germination. To a lesser degree, they feed on seedling plant roots, reducing plant stands and vigor.

Cultural practices that reduce abundance of and damage by wireworms include:

- Preparing good seedbeds and planting when soil moisture and temperature are adequate to promote rapid seed germination;
- Cultivating to reduce non-crop plant material; and
- Planting sorghum in a field where a taprooted crop such as cotton was grown the previous year.

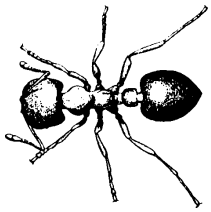
Sample fields before planting to determine the need to use insecticide-treated seed or to apply insecticide at planting. Soil examination and bait traps can be used to sample for the presence of wireworms.

To build a bait trap, place 6 to 12 ounces of nontreated sorghum seed in a 4-inch wide by 6- to 8-inch deep hole in the soil. Cover the hole with soil, and mark the trap with a stake. Covering the trap location with a 4- by 4-foot sheet of black plastic warms the soil and makes trapping more effective. At

least 2 weeks before planting, install one trap for each 10 to 20 acres. Two weeks later, examine the grain in the trap and count the wireworms. Also, growers may thoroughly examine soil samples 1 foot square by 4 inches deep. *If you find one wireworm larva per square foot or two or more larvae per bait trap, treat either seed or soil with insecticide.*

Lindane applied as a seed or planter box treatment effectively controls wireworms. Information on seed treatment procedures is contained in the section on seed treatment. Gaucho®-treated seed also is labeled for wireworms. Applying some insecticides in furrow at planting also may control wireworms.

Red imported fire ant
Solenopsis invicta



Red imported fire ant

Under certain conditions in the eastern and southern parts of the state, red imported fire ants feed on planted seed. Worker ants chew through the thin seed coat and remove the embryo (germ). They rarely consume the endosperm (starch) of the seed. They prefer water-soaked or germinating seeds, but also damage dry seeds.

Cultural management practices that reduce damage by wireworms to planted sorghum seed also reduce red imported fire ant. Use seed with good vigor and plant into a well-prepared seedbed when soil temperature and moisture are adequate for rapid seed germination. Firmly pack covering soil to prevent easy access of fire ants to planted seed and thus reduce damage by fire ants. Insecticide-treated seed as described for wireworms is effective against red imported fire ants. Gaucho®-treated seed or in-furrow, at-planting application of insecticide may provide effective control.

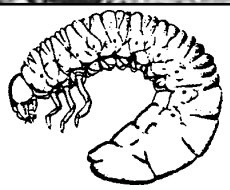
Table 1. Suggested insecticides for seed treatment for wireworms and red imported fire ants.

Lindane formulation	% Lindane	Concentrate
Gammasan®	16.6	3 oz./bu.
Seed Mate Lindane 25®	25	4 oz./cwt.
Sorghum Guard®	16.6	3 oz./bu.

Remark

Seed Mate Lindane 25®. If soil temperature is extremely high (hot weather, mid-summer planting) reduce recommended dosage by one-half.

White grubs
Phyllophaga crinita and others



White grub

White grubs are the larvae of May or June beetles. White grubs are characteristically "C-shaped" with white bodies and tan to brown heads and legs. Because the last abdominal segment is transparent, dark-colored digested material can be seen in the larva. Larvae vary in size according to age and species.

Rarely are white grubs serious pests of sorghum. However, because they can be present in a field at planting and cannot be controlled once sorghum is planted, their presence must be determined before planting. Grubs damage sorghum by feeding on the roots. They may kill small seedlings, resulting in stand loss. Severely pruned roots of larger plants result in plant stunting and lodging and increased susceptibility to drought and stalk rot organisms.

Planting sorghum in a field where a non-grass crop was grown the previous year is the most important cultural management tactic against white grubs.

To determine the abundance of white grubs before planting, examine 1 square foot of soil in each 5 to 10 acres. *If more than two white grubs are found per square foot, severe damage to sorghum could result.* No insecticides for white grubs are currently labeled for broadcast, incorporated application. *If white grubs average one per square foot, growers can adequately suppress them with an in-furrow or row band application of terbufos.*

Table 2. Suggested insecticide for controlling white grubs.

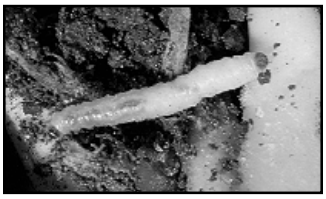
Insecticide		Days from last application to:	
Toxicant per pound	Concentrate / 1,000 ft. of row	Harvest	Grazing
Terbufos		See remark	
(Counter® 15G)	8 oz.		
(Counter® 20CR®)	6 oz.	100	50

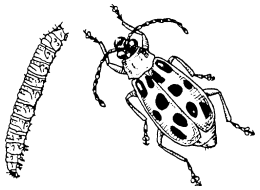
Remark

Terbufos. Apply once per season in a 5- to 7-inch band directly behind the planter shoe in front of the press wheel, and not in direct contact with seed.

Southern corn rootworm

Diabrotica undecimpunctata howardi





Southern corn rootworm

Southern corn rootworms are the larvae of the spotted cucumber beetle. Rootworms are small, brown-headed and creamy white, with wrinkled skin. They burrow into germinating seeds, roots and crowns of sorghum plants.

Symptoms of rootworm damage include reduced stands and plant vigor, and occurrence of "dead heart" in young plants. Later in the season, maturity may be delayed, weeds may increase in abundance because of a nonuniform plant stand, and plants may lodge. Damage by southern corn rootworms is most likely to occur in the area of Texas shaded on the map (Figure 2).

Granular or liquid formulations of several insecticides are labeled for in-furrow or row band application for controlling rootworm. Base the need for insecticide treatment on a field history of previous damage by rootworms. Rotating insecticides decreases the possibility of rootworms developing resistance. Seed treatment with lindane controls light infestations of rootworms present at planting.

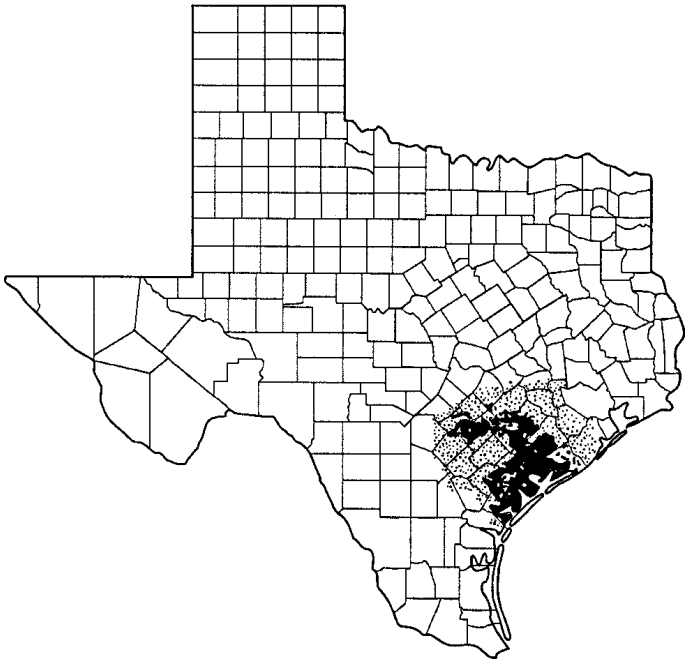


Figure 2. Areas of potentially economically damaging southern corn rootworm infestations in Texas.

Table 3. Suggested insecticides for controlling southern corn rootworm.

Insecticide (listed alphabetically)		Days from last application to:	
Toxicant per gallon or pound	Concentrate per unit area	Harvest	Grazing
Carbofuran		See remarks	
(Furadan® 4F)	24-32 oz./acre	75	75
Chlorpyrifos		See remarks	
(Lorsban® 15G)	4-8 oz./1,000 ft. of row		
Terbufos		See remarks	
(Counter® 15G)	4-8 oz./1,000 ft. of row		
(Counter® 20CR®)	3-6 oz./1,000 ft. of row	100	50

Remarks

Carbofuran. Apply in seed furrow or 7-inch band and incorporate.

Chlorpyrifos. Apply once per season in a 6- to 7-inch band, behind the planter shoe and in front of the press wheel.

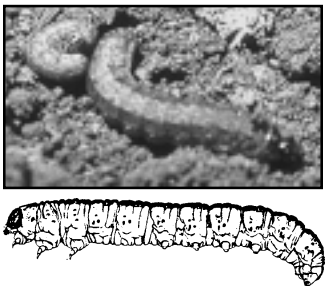
Terbufos. Apply once per season in a 5- to 7-inch band directly behind the planter shoe in front of the press wheel, and not in direct contact with seed.

NOTE: Lower rates of insecticides listed have been shown to provide most favorable economic returns; however, where high infestations consistently occur, use the higher insecticide rate.

Stem and leaf insect pests

Cutworms

Agrotis and *Euxoa spp.*



Cutworm

Cutworms of several species can damage sorghum. Cutworms are immature stages of moths that are active at night. Cutworm moths prefer to lay eggs in grassy and weedy fields. Eggs are laid on stems or leaves of sorghum, grassy weeds or in the soil, and hatch in 2 to 14 days.

The typical cutworm larva attacking sorghum is plump and curls into a "C" shape when disturbed. Larvae vary in color from grayish white to grayish black or brown depending on species. Fully grown larvae are 1 to 2 inches long. Some species pass the winter in the soil as pupae and others as adults; most overwinter as small larvae in cells in the soil, under trash, or in clumps of grass. They start feeding in spring and continue growing until early summer, when they pupate in the soil. Larvae of most species remain underground during the day and feed at night.

The most common cutworms in sorghum (surface-feeding cutworms) cut plants off at, slightly below or above the surface of the soil. Some (climbing or army cutworms) feed on above-ground plant parts; others are subterranean and feed on underground plant parts including roots of seedlings.

Cultural controls for cutworms include plowing under or using herbicides to control vegetation in late summer or early fall, destroying weeds and thoroughly preparing the seedbed at least 3 to 6 weeks before planting. Cutworms are more severe in weedy fields.

Determining the presence of cutworms in sorghum is based on visible damage to plants. For surface-feeding and subterranean cutworms, determine the number of severed or dead and dying plants per foot of row. Base your decision to apply insecticide on the degree to which an adequate stand is threatened. For cutworms that feed on above-ground plant parts, significant losses occur when more than 30 percent of the leaf tissue has been eaten.

Insecticide sprayed as a broadcast treatment on the ground and plants usually protects against cutworms. However, cutworms spend the day hidden in the soil. Late-afternoon applications sometimes are more effective. Insecticidal baits are available and effective against some cutworms, but are expensive. Insecticide applied at planting controls subterranean cutworms. Apply the insecticide in a 6- to 7-inch band and incorporate it into the top 1 to 2 inches of soil.

Aerial or ground application of approved insecticide is effective in controlling cutworms in an established sorghum stand. However, insecticide is more effective on climbing than subterranean cutworms. Refer to Table 4 for insecticides suggested for cutworm control. Also refer to labels of insecticides listed for southern corn rootworm control for labeled use against cutworms.

Table 4. Suggested insecticides for controlling cutworms.

Insecticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per unit area	Days from last application to: Harvest	Grazing
Chlorpyrifos (Lorsban®)		See remarks	
(4E)	16-32 oz./acre	30-60	30-60
(15G)	8 oz./1,000 ft. of row		
Cyfluthrin (Baythroid® 2E)	1.0-1.3 oz./acre	See remarks	14
Cyhalothrin (Karate®1E)	1.92-2.56 oz./acre	See remarks	

Remarks

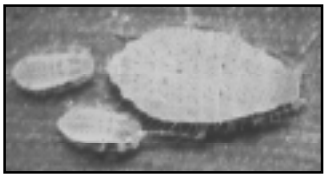
Chlorpyrifos. *4E* - To minimize insecticidal injury, do not apply to drought-stressed plants or within 3 days after irrigation or rain except where insecticide is applied in irrigation water. The waiting period from last application to harvest or grazing is 30 days for the 16-oz. rate and 60 days for the 32-oz. rate.

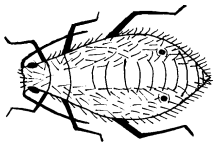
Cyfluthrin. If applied once or twice, green forage may be fed or grazed on the day of treatment. For three applications, allow at least 14 days between last application and grazing.

Cyhalothrin. Do not graze livestock in treated area or harvest for fodder, silage or hay.

Yellow sugarcane aphid

Sipha flava





Yellow sugarcane aphid

Yellow sugarcane aphids usually are lemon-yellow, but under some conditions are pale green, are covered with small spines and have two double rows of dark spots on the back. Both winged and wingless forms live in the colony. This aphid feeds on many different grasses, including johnsongrass and dallisgrass. Females give birth for 28 days to living young, averaging two nymphs a day by each female. Nymphs mature in 13 to 19 days; adults live for 25 to 30 days.

Yellow sugarcane aphids feed on sorghum and inject toxin into leaves of seedlings and older plants. Aphids feeding on seedling plants turn the leaves purple and stunt growth. On more mature plants, leaves turn yellow. By the time discoloration symptoms are visible, plants have been injured significantly. Damage often leads to delayed maturity and plant lodging that may be worsened by associated stalk rots.

The presence of yellow sugarcane aphids must be determined soon after sorghum plants emerge. The presence of purple-colored seedling plants is an indication of a yellow sugarcane aphid infestation. Scout sorghum by inspecting plants beginning the first week of plant emergence and twice weekly until plants have at least five true leaves. As plants grow larger, they become more tolerant of aphid feeding. Very small seedling sorghum plants (one to three true leaves) often are significantly damaged after being infested for a week or less.

Discoloration symptoms may be useful in assessing yield losses, and may be used in a decision to replant. Information in Table 5 describes plant damage and corresponding percentage yield loss associated with levels of damage. Do not consider the first two "seed leaves" when estimating damage.

Economic injury levels presented in Tables 6 to 8 are based on percentage of yellow sugarcane aphid-infested plants at the

Table 5. Estimated yield loss based on damage by yellow sugarcane aphids to three true-leaf stage sorghum plants.

Description	% Loss/plant
No discoloration	0
Localized discoloration	8
Less than one entire leaf discolored	11
One entire leaf discolored	31
More than one leaf discolored	54
More than two leaves discolored	77
Dying/dead plant	100

Table 6. Economic injury levels for yellow sugarcane aphid based on percentage of seedling plants infested at the one true-leaf stage.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Percent infested plants								
6	15	12	10	9	8	7	6	6	5
8	20	16	13	11	10	9	8	8	7
10	25	20	17	14	12	11	10	10	9
12	30	25	21	17	14	13	12	11	10

Table 7. Economic injury levels for yellow sugarcane aphid based on percentage of seedling plants infested at the two true-leaf stage.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Percent infested plants								
6	26	21	18	15	13	12	11	10	10
8	35	28	24	20	17	16	14	13	13
10	43	35	29	25	22	20	17	16	16
12	51	42	35	30	26	23	20	19	18

Table 8. Economic injury levels for yellow sugarcane aphid based on percentage of seedling plants infested at the three true-leaf stage.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Percent infested plants								
6	67	53	44	38	33	30	27	25	24
8	89	71	60	51	44	38	36	33	32
10	*	90	76	64	55	48	44	41	39
12	*	*	92	77	66	57	53	49	44

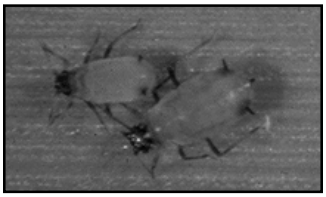
*Do not treat.

1, 2 or 3 true-leaf stage. Do not count the two seed leaves that appear first.

Many predators feed on yellow sugarcane aphid, but the aphid is rarely parasitized. Insecticides are currently the only way to manage yellow sugarcane aphids in sorghum. Gaucho®-treated seed or insecticide applied at planting (carbofuran, disulfoton or phorate) reduces severity of yellow sugarcane aphid infestations (Table 9).

Corn leaf aphid

Rhopalosiphum maidis



Corn leaf aphid

Corn leaf aphids often infest the whorl and underside of leaves of sorghum in great numbers. This dark bluish-green aphid is oval-shaped, with black legs, cornicles and antennae. There are winged and wingless forms.

Corn leaf aphids are found most frequently deep in the whorl of the middle leaf of pre-boot sorghum but also occur on the underside of leaves, on stems or in grain heads. When feeding, corn leaf aphids suck plant juices but do not inject toxin as do greenbug and yellow sugarcane aphid. The most apparent feeding damage is yellow mottling of leaves that unfold from the whorl.

This insect rarely causes economic loss to sorghum. In fact, they can be considered helpful. Beneficial insects such as lady beetles are often attracted to feed on corn leaf aphids. When corn leaf aphid numbers rapidly decline at sorghum heading, the beneficial insects are present to suppress greenbug and other insect pests. These beneficial insects also are believed to move to adjacent crops, such as cotton, and help manage insect pests in those crops.

When abundant, corn leaf aphids are easily seen within the whorl of sorghum plants. The whorl leaf can be pulled from the plant and unrolled to detect aphids when numbers of aphids are low. Occasionally, corn leaf aphids will become so abundant on a few plants in a field that grain head exertion and development are hindered. Moisture-stressed sorghum plants are more likely than non-stressed plants to be damaged by corn leaf aphids. Although very

Table 9. Insecticides for yellow sugarcane aphid.

Insecticide (listed alphabetically)		Days from last application to:	
Toxicant per gallon or pound	Concentrate per acre	Harvest	Grazing
Commercially treated seed			
Imidacloprid (Gaucho®)	Commercially applied		45
Applied at planting			
Carbofuran (Furadan® 4F)	24-32 oz.	See remarks 75	75
Disulfoton (Di-Syston®) (8E) (15G)	16 oz. 5.0-6.7 lb.		
Phorate (20G)	4.9 lb.	See remarks	
Applied post-emergence			
Carbofuran (Furadan® 4F)	8-16 oz.	See remarks 75	75
Dimethoate (4E) (5E)	8-16 oz. 6.4-12.8 oz.	See remarks 28 28	28 28
Disulfoton (Di-Syston®) (8E) (15G)	4-8 oz. 5.0-6.7 lb.	See remarks 7 30	45 45
Parathion (ethyl) (4E) (8E)	16 oz. 8 oz.	See remarks 12 12	12 12
Phorate (20G)	4.9 lb.	See remarks 28	

Remarks

Carbofuran. Applicator must use proper protective equipment when applying this highly toxic insecticide. Do not apply to foliage more than twice per season. Do not apply after heads emerge from the boot.

Dimethoate. Do not apply more than three times per season. Do not apply after heads emerge from the boot.

Disulfoton. 8E - A maximum of three foliar applications may be made, with the last application no later than flowering. Post-harvest interval is 34 days for three foliar applications. ***15G*** - Granular formulation applied post emergence is recommended as whorl application only.

Parathion. Aerial application only. Do not substitute methyl parathion.

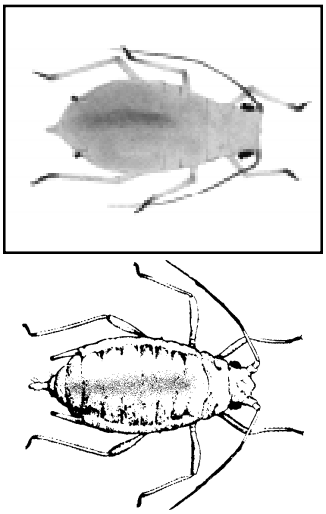
Phorate. Do not place in contact with seed at planting. Apply only once after plant emergence.

rare, infestations on seedling sorghum might cause stand loss, and grain head infestations might cause harvesting problems.

Because corn leaf aphids prefer to live and feed in the whorl of sorghum, aphid numbers normally decline rapidly after the grain head exerts (emerges) from the boot. Sometimes molds grow on the honeydew that corn leaf aphids produce. Honeydew on sorghum grain heads has been associated with harvesting problems. The aphid also transmits maize dwarf mosaic virus.

Although insecticide is rarely justified, corn leaf aphid can be controlled with the insecticides used for greenbug. Gaucho®-treated seed or carbofuran, disulfoton, phorate or terbufos at planting are effective in controlling corn leaf aphids. However, corn leaf aphids do not inject toxin as they feed and very rarely damage sorghum. Because it is rarely a pest, sampling procedures and damage assessment information are unavailable.

Greenbug
Schizaphis graminum



Greenbug

The greenbug is an aphid that sucks plant juices and injects toxin into sorghum plants. The adult greenbug is light green, approximately 1/16 inch long, with a characteristic darker green stripe down the back. Usually, the tips of the cornicles and leg segments farthest from the body are black. Winged and wingless forms may be present in the same colony.

Females produce living young (nymphs) without mating. Under optimum conditions, the life cycle is completed in 7 days. Each female produces about 80 offspring during a 25-day period.

Greenbugs feed in colonies on the underside of leaves and produce much honeydew. The greenbug may be a pest during the seedling stage and in the boot or heading stage. Infestations may be detected by the appearance of reddish leaf spots caused by the toxin greenbugs inject into the plant. The reddened areas enlarge as the number of greenbugs and injury increase. Damaged leaves begin to die, turning yellow then brown. Damage at the seedling stage may result in stand loss.

Larger sorghum plants tolerate more greenbugs. Yield reductions during boot, flowering and grain-development stages depend on greenbug numbers, length of time greenbugs have infested the plants, and general plant health. Many greenbugs on booting and older plants can reduce yields and weaken plants that may later lodge.

Scouting sorghum for greenbugs is easy. Examine a minimum of 40 randomly selected plants per field each week. Greenbugs are seldom distributed evenly in a field, so examine plants from all parts of the field; avoid examining only field borders. In fields larger than 80 acres, or if making a control decision is difficult, examine more than 40 plants.

When deciding whether to control greenbugs, consider the amount of leaf damage, number of greenbugs per plant, percentage of parasitized greenbugs (mummies), numbers of greenbug predators (lady beetles) per plant, moisture conditions, plant size, stage of plant growth and overall condition of the crop. It is important to know from week to week whether greenbug numbers are increasing or decreasing. For example, insecticide treatment would not be justified if the recommended treatment level (based on leaf damage) had been reached but greenbug numbers had declined substantially from previous observations.

In seedling sorghum (less than 6 inches tall), greenbugs may be found on any part of the plant including the whorl or in the soil at the base of the plant. When scouting seedling sorghum, examine the entire plant and the soil around the base of the plant. Note the presence or absence of greenbugs and any damage to plants (yellowing, death of tissue). Refer to Table 10 for economic thresholds for greenbugs on different plant growth stages.

Table 10. Economic threshold levels for greenbug on sorghum at different plant growth stages.

Plant size	When to treat
Emergence to about 6 inches	20% of plants visibly damaged (beginning to yellow), with greenbugs on plants
Larger plant to boot	Greenbug colonies causing red spotting or yellowing of leaves and before any entire leaves on 20% of plants are killed
Boot to heading	At death of one functional leaf on 20% of plants
Heading to hard dough	When greenbug numbers are sufficient to cause death of two normal-sized leaves on 20% of plants

Plants can tolerate about 30 percent leaf loss before yield is reduced. Greenbug infestations after sorghum flowering and before the hard-dough stage should be controlled before they kill more than two normal-sized leaves on 20 percent of the plants. In the Texas Blacklands, insecticide application is suggested when greenbugs are colonizing the upper leaves of booting sorghum and causing red spotting or yellowing of leaves.

These guidelines are based on the assumption that greenbugs are increasing so rapidly that control by beneficial insects is ineffective. However, when more than 20 percent of the greenbugs appear brown and swollen from being parasitized, an insecticide treatment is usually unnecessary. Also, plants showing drought or other stress cannot tolerate as much greenbug damage without suffering reduction in yield.

Greenbug colonies usually begin on the underside of lower leaves and move up the plant. On most sorghum hybrids, only the underside of lower leaves need to be examined, although in some cases greenbug colonies may be found first on the underside of upper leaves. Do not confuse greenbugs with the bluish green corn leaf aphid, often found with greenbugs in the plant whorl.

Greenbugs in a field can increase 20-fold per week, but the seasonal average is 5- to 6-fold increase each week. Rain and predators suppress aphid abundance early in the season, although the increase of natural enemies has a lag time of 1 to 2 weeks. A common parasitoid usually is responsible for a rapid decline in aphid abundance late in the season.

Sorghum hybrids resistant to greenbug are available commercially. However, greenbug biotypes have consistently occurred and new resistant hybrids have had to be developed. Hybrids resistant to greenbug biotypes C, E, I and K have been or are being developed. Using greenbug-resistant hybrids is suggested. Resistance mainly is tolerance, and therefore resistant hybrids will not be free of greenbugs. Damage thresholds for resistant sorghums are the same as for susceptible sorghums because thresholds are based on plant damage.

When deciding on insecticide treatment, consider the previously listed factors and consult the recommended treatment levels in Table 10. When estimating leaf damage, consider any leaf to be dead if more than 75 percent of its surface is red, yellow, or brown. Do not mistake for greenbug damage the natural senescence of the small bottom leaves. Estimate an average leaf damage level for the entire field unless it is feasible to spot treat areas of the field.

The greenbug usually is susceptible to labeled insecticides (Table 11), but resistance to organophosphorous insecticides exists in several counties in the Texas Panhandle. Continued extensive use of certain insecticides could expand the resistance problem. Where resistance exists in an area, apply the initial insecticide at the higher labeled dosage rate and increased application volume to ensure complete coverage.

Chinch bug

Blissus leucopterus leucopterus

Chinch bugs are sporadic pests of sorghum in Texas. Adult chinch bugs are black, with reddish yellow legs and with conspicuous, fully developed white forewings, each of which has a black triangular spot at the middle

Chinch bug

Table 11. Suggested insecticides for controlling greenbug.

Insecticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per unit area	Days from last application to: Harvest	Grazing
Commercially treated seed			
Imidacloprid (Gaucho®)	Commercially applied		45
Applied at planting			
Aldicarb (Temik® 15G)	7 lb./acre	See remarks 90	
Carbofuran (Furadan® 4F)	24-32 oz./acre	See remarks 75	75
Disulfoton (Di-Syston®)			
(8E)	1.2 oz./1,000 ft. of row		
(15G)	6-8 oz./1,000 ft. of row		
Phorate (Thimet®)		See remarks	
(15G)	8 oz./1,000 ft. of row	30	30
(20G)	6 oz./1,000 ft. of row	30	30
Terbufos		See remarks	
(Counter® 15G)	8-16 oz./1,000 ft. of row		
(Counter® 20CR®)	6-12 oz./1,000 ft. of row	100	50

Insecticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per unit area	Days from last application to: Harvest	Grazing
Applied post-emergence			
Carbofuran (Furadan® 4F)	24-32 oz./acre	See remarks 75	75
Chlorpyrifos (Lorsban® 4E)	8-32 oz./acre	See remarks 30-60	30-60
Dimethoate		See remarks	
(4E)	8-16 oz./acre	28	28
(5E)	6.4-12.8 oz./acre	28	28
Disulfoton (Di-Syston®)		See remarks	
(8E)	4-8 oz./acre	7	45
(15G)	5.0-6.7 lb./acre	30	45
Malathion (57EC)	24 oz./acre		
Parathion (ethyl)		See remarks	
(4E)	8-16 oz./acre	12	12
(8E)	4-8 oz./acre	12	12
Phorate (Thimet®)		See remarks	
(15G)	6.7 lb./acre	30	30
(20G)	4.9 lb./acre	30	30

Remarks

Aldicarb. Do not feed green forage to livestock.

Carbofuran. Applicator must use proper protective equipment when applying this highly toxic insecticide. Do not apply after heads emerge from the boot.

Chlorpyrifos. Do not exceed three applications. The waiting period from last application to harvest or grazing is 30 days for the 16-oz. rate and 60 days for more than 16 oz.

Dimethoate. Do not apply more than three times per season. Do not apply after heads emerge from the boot.

Disulfoton. 8E - Do not apply foliar spray or granules more than three times per crop season. Post-harvest interval is 34 days for three foliar applications. ***15G*** - Granular formulation applied post emergence is recommended as whorl application only.

Parathion. Aerial application only. Do not substitute methyl parathion.

Phorate. Do not place in contact with seed. Do not feed foliage before grain harvest.

Terbufos. May be knifed in at bedding, or banded (except in West Texas) or knifed in at planting (see label for dosage differences). Do not place granules in direct contact with seed. For early season control of light to moderate infestations.

of the outer margin. Immature chinch bugs resemble adults in shape but lack wings. Young nymphs are yellowish, later turning reddish with a white or pale yellow band across the front part of the abdomen. Older nymphs are black and gray with a conspicuous white spot on the back between the wing pads.

Eggs are laid behind the lower leaf sheaths of sorghum plants, on roots or in the ground near the host plant. The life cycle is completed in 30 to 40 days, and there are at least two generations a year. Chinch bugs overwinter as adults in bunch grass. They begin moving to sorghum when temperatures reach 70° F.

Adult and immature chinch bugs suck juices from stems, leaves or underground

Table 12. Suggested insecticides for controlling chinch bug.

Insecticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per unit area	Days from last application to: Harvest	Grazing
Commercially treated seed			
Imidacloprid (Gaucho®)	Commercially applied		45
Applied at planting			
Aldicarb (Temik® 15G)	7.5 oz./1,000 ft. of row	See remarks 90	
Chlorpyrifos (Lorsban®15G)	8 oz./1,000 ft. of row		
Terbufos (Counter® 15G)	8 oz./1,000 ft. of row	See remarks	
(Counter® 20CR®)	6 oz./1,000 ft. of row	100	50
Applied post-emergence			
Carbaryl (Sevin®)		See remarks	
(4F)	32-64 oz./acre	21	14
(80S or 80WSP)	1.25-2.5 lb./acre	21	14
(50W)	2-4 lb./acre	21	14
(4XLR+®)	32-64 oz./acre	21	14
Carbofuran (Furadan® 4F)	8-16 oz./acre	See remarks 75	75
Chlorpyrifos (Lorsban® 4E)	16-32 oz./acre	See remarks 30-60	30-60
Cyfluthrin (Baythroid® 2E)	1.3-2.8 oz./acre	See remarks	14
Cyhalothrin (Karate® 1E)	3.84 oz./acre	See remarks	

Remarks

Aldicarb. Apply granules in furrow and cover with soil. Do not feed green forage to livestock.

Carbaryl. Use high-gallonage ground application directed at bases of plants.

Carbofuran. Ground application only. Use 20-30 gallons of water per acre. Do not apply more than twice per season. Do not apply after heads emerge from the boot.

Chlorpyrifos. Apply with enough water to ensure a minimum spray volume of 20-40 gallons per acre. Use ground equipment to direct spray toward bases of plants. The waiting period from last application to harvest or grazing is 30 days for the 16-oz. rate and 60 days for more than 16 oz. Do not apply more than 48 oz. per acre per season. Do not treat sweet sorghum.

Cyfluthrin. If one or two applications are made, green forage may be fed or grazed on the day of treatment. If three applications are made, allow at least 14 days between last application and grazing. Direct applications at the basal portion of the plant.

Cyhalothrin. Do not graze livestock in treated area or harvest for fodder, silage or hay.

Terbufos. Apply in 5- to 7-inch band over the row in front of or behind press wheel and lightly incorporate into soil. Do not place granules in direct contact with seed. For early-season control of light to moderate infestations.

plant parts. Young plants are highly susceptible. Older plants withstand attack better, but they, too, become reddened, weakened and stunted. Chinch bugs are favored by hot, dry weather, and large numbers of immature bugs often migrate from wild bunch grasses or small grains to congregate and feed behind lower leaf sheaths of sorghum plants.

To find chinch bugs, carefully examine plants and surrounding soil. Make at least five random checks per field.

Cultural practices that stimulate dense, vigorous plant stands are recommended because these conditions are less favored by chinch bugs, and injury usually is reduced. Plant sorghum as early as practical.

Apply insecticide when two or more chinch bugs are found on 20 percent of seedling plants less than 6 inches tall. On taller plants, insecticide often is justified when chinch bugs infest 75 percent of the plants. Generally, one chinch bug per seedling sorghum plant reduces grain yield by 2 percent.

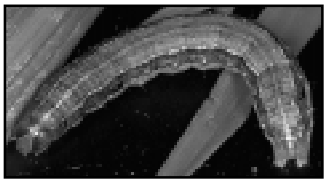
Chinch bugs sometimes are difficult to control with insecticides. In fields with a history of economically damaging infestations of chinch bug, at-planting, soil-incorporated insecticides or Gaucho®-treated seed may be justified. Granular insecticides must receive about one-half inch of rainfall after application to effectively suppress early-season chinch bug infestations.

If infestations reach the economic threshold after plant emergence, apply post-emergence insecticide using at least 20 gallons of water per acre through nozzles directed at the bases of plants. Control is seldom satisfactory on plants in the boot stage or later. Aerial insecticide application is seldom effective and not suggested.

Corn earworm and fall armyworm (whorlworms)

Helicoverpa zea and
Spodoptera frugiperda

Corn earworm



Fall armyworm

Corn earworm and fall armyworm infest the whorls and grain heads of sorghum plants. Larvae hatching from eggs laid on sorghum leaves before grain heads are available migrate to and feed on tender, folded leaves in the whorl.

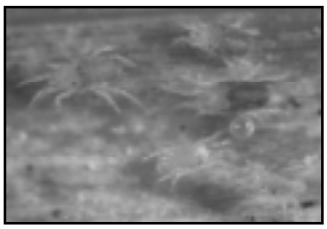
To find larvae in sorghum whorls, pull the whorl leaf from the plant and unfold it. Frass, or larval excrement, is present where larvae feed within the whorl. Damaged leaves unfolding from the whorl are ragged with "shot holes." Although this may look dramatic, leaf damage usually does not reduce yields greatly, and control of larvae during the whorl stage is seldom economically justified. Also, larvae within the whorl are somewhat protected from insecticide.

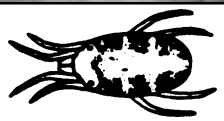
Insecticide application may be justified if larval feeding reduces leaf area by more than 30 percent or is damaging the developing grain head or growing point within the whorl. See the section on Corn earworm and fall armyworm (headworms) for information on these insects as pests of sorghum grain heads.

Banks grass mite

Oligonychus pratensis

Large numbers of Banks grass mites sometimes occur on sorghum, especially in more arid areas of Texas. These mites are very small; females are larger than males. After feeding, mites turn deep green, except for the mouthparts and first two pairs of legs that remain light salmon colored. Eggs (about 50 per female) are laid in webbing on the underside of sorghum leaves. Eggs are pearly white, spherical, one-fourth the size of the adults and hatch in 3 to 4 days. The life cycle requires about 11 days under favorable conditions.





Banks grass mite

Spider mites suck juices from the underside of sorghum leaves. Mite infestations begin along the midrib of the lower leaves. Infested areas become pale yellow initially and later become reddish on the top surface. The entire leaf may turn brown. As spider mites become more abundant on the lower leaves, the infestation spreads upward through the plant. The underside of heavily infested leaves has a dense deposit of fine webbing spun by the spider mites.

Increases in spider mite abundance generally occur after sorghum grain heads emerge. Large numbers of spider mites occurring early in kernel development can reduce the ability of sorghum plants to make and fill grain. After kernels reach hard dough, grain is not affected. However, high spider mite abundance may cause sorghum plants to lodge, resulting in harvest losses.

Inspect the underside of lower leaves carefully. Mites occur in colonies, first along midribs of leaves, but later spread away from the midrib and up the plant to higher leaves. Webbing indicates the presence of mites. Mite infestations commonly begin along field borders, and may spread quickly throughout a field.

Hot, dry weather may favor a rapid increase in mite abundance. Also, mites in sorghum may respond as induced (secondary) pests after an insecticide application for a key insect pest such as greenbug. Rapid increases in spider mite abundance after insecticide application is thought to be caused

by tolerance of mites to some insecticides, destruction of beneficial insects and dispersal of mites from colonies.

Natural enemies do not always control spider mites adequately. Because spider mites increase more rapidly on moisture-stressed plants, irrigation, where available, should be timed to prevent plant stress. Also, spider mites may move from small grains, especially wheat, to sorghum. To avoid direct infestation by mites moving from small grains, plant sorghum away from small grains.

Insecticides produce varying degrees of success. Historically, insecticidal control of mites in sorghum has been erratic. *Insecticide application may be justified when 30 percent of the leaf area of most sorghum plants in a field show some damage symptoms from mite feeding.* Thorough coverage is required; apply at least 3 to 5 gallons of spray mixture per acre. Banks grass mites are often resistant to insecticides.

Table 13. Suggested miticides for controlling Banks grass mite.

Miticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Dimethoate		See remarks	
(4E)	16 oz.	28	28
(5E)	12.8 oz.	28	28
Disulfoton (Di-Syston® 8E)	8 oz.	7	45
Phorate (20G)	4.9 lb.	See remarks 28	
Propargite (Comite® 6.55E)	24-32 oz.	See remarks 30	

Remarks

Dimethoate. Ground application: Apply in 25-40 gallons of water. Do not apply more than three times per season. Do not apply after heads emerge from the boot. Do not use in the Trans-Pecos area.

Phorate. Broadcast into whorl of plant. Do not use in the Trans-Pecos area.

Propargite. Do not apply more than once per season. Slight phytotoxicity may occur on some sorghum hybrids.

Grain head insect pests

Sorghum midge

Stenodiplosis sorghicola

Sorghum midge

The sorghum midge is one of the most damaging insects to sorghum in Texas, especially in the southern half of the state. The adult sorghum midge is a small, fragile-looking, orange-red fly with a yellow head, brown antennae and legs and gray, membranous wings.

During the single day of adult life, each female lays about 50 yellowish white eggs in flowering spikelets of sorghum. Eggs hatch in 2 to 3 days. Larvae are colorless at first, but when fully grown, are dark orange. Larvae complete development in 9 to 11 days and pupate between the spikelet glumes. Shortly before adult emergence, the pupa works its way toward the upper tip of the spikelet. After the adult emerges, the clear or white pupal skin remains at the tip of the spikelet.

A generation is completed in 14 to 16 days under favorable conditions. Sorghum midge numbers increase rapidly because of multiple generations during a season and when sorghum flowering times are extended by a range of planting dates or sorghum maturities.

Sorghum midges overwinter as larvae in cocoons in spikelets of sorghum or johnsongrass. Johnsongrass spikelets containing diapausing larvae fall to the ground and become covered with litter. When sorghum is shredded, spikelets containing larvae fall to the ground and are disked into the soil. Sorghum midges emerging in spring do so before flowering sorghum is available, and these adults infest johnsongrass. Sorghum midges developing in johnsongrass disperse to fields of sorghum when it flowers.

Early-season infestations in sorghum are usually below damaging levels. As the season progresses, sorghum midge abundance

increases, especially when flowering sorghum is available in the area. Numbers often drop late in the season.

Sorghum midge damages sorghum when the larva feeds on a newly fertilized ovary, preventing normal kernel development. Grain loss can be extremely high. Glumes of a sorghum midge-infested spikelet fit tightly together because no kernel develops. Typically, a sorghum grain head infested by sorghum midges has various proportions of normal kernels scattered among non-kernel-bearing spikelets, depending on the degree of damage.

Effective control of sorghum midge requires integration of several practices that reduce sorghum midge abundance and potential to cause crop damage. The most effective cultural management method for avoiding damage is early, uniform planting of sorghum in an area so flowering occurs before sorghum midge reach damaging levels. Planting hybrids of uniform maturity early enough to avoid late flowering of grain heads is extremely important. This practice allows sorghum to complete flowering before sorghum midges increase to damaging levels.

Cultural practices that promote uniform heading and flowering in a field also are important in deciding on treatment and in achieving acceptable levels of insecticidal control. To reduce sorghum midge abundance, use cultivation and/or herbicides to eliminate johnsongrass inside and outside the field. Where practical, disk and deep plow the previous year's sorghum crop to destroy overwintering sorghum midges. Use sorghum midge-resistant hybrids if they are available.

Multiple insecticide applications are used to kill adults before they lay eggs. Sorghum planted and flowering late is especially vulnerable to sorghum midge. To determine whether insecticides are needed, evaluate crop development, yield potential and sorghum midge abundance daily during sorghum flowering. Because sorghum midges lay eggs in flowering sorghum grain heads (yellow anthers exposed on individual spikelets), they can cause damage until the entire

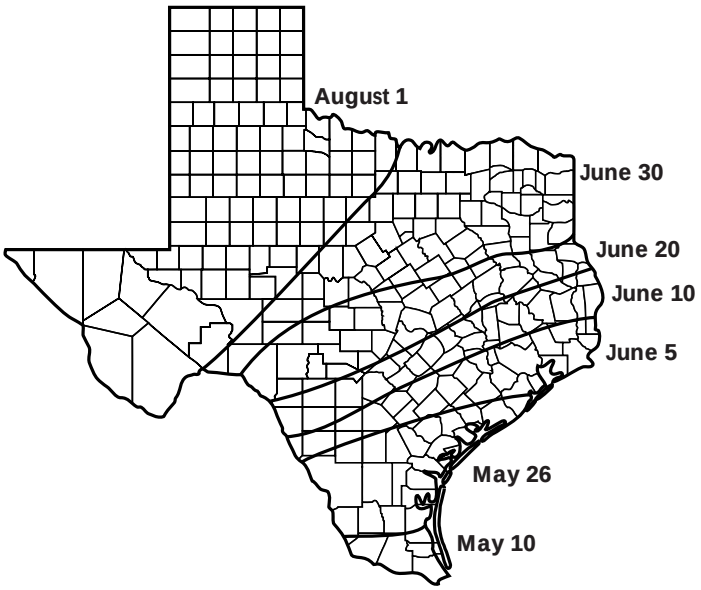


Figure 3. Estimated latest sorghum flowering dates most likely to escape significant damage by sorghum midge.

grain head or field of sorghum has flowered. The period of susceptibility to sorghum midge may last from 7 to 9 days (individual grain head) to 2 to 3 weeks (individual field), depending on uniformity of flowering.

To determine if adult sorghum midges are in a sorghum field, check at mid-morning when the temperature warms to approximately 85° F. Sorghum midge adults are most abundant then on flowering sorghum grain heads. Because adult sorghum midges live less than 1 day, each day a new brood of adults emerges. This fact requires sampling almost daily during the time sorghum grain heads are flowering. Sorghum midge adults can be seen crawling on or flying about flowering sorghum grain heads.

The simplest and most efficient way to detect and count sorghum midges is to inspect carefully and at close range all sides of randomly selected flowering grain heads. Handle grain heads carefully during inspection to avoid disturbing adult sorghum midges. Other sampling methods can be used, such as placing a clear plastic bag or jar over the sorghum grain head as a trapping device for adults.

Because they are relatively weak fliers and rely on wind currents to aid their dispersal, adult sorghum midges usually are most abundant along edges of sorghum

fields. For this reason, inspect plants along field borders first, particularly those downwind of earlier flowering sorghum or johnsongrass. If no or few sorghum midges are found on sorghum grain heads along field edges, there should be little need to sample the entire field.

However, if you find more than one sorghum midge per flowering grain head in border areas of a sorghum field, inspect at least 40 more grain heads from the entire field (avoiding plants within 150 feet of field borders). Calculate the average number of sorghum midge per flowering grain head. Sample at least 20 flowering grain heads for each 20 acres in a field.

Base the need for insecticide treatment on the number of adult sorghum midges per flowering grain head after at least 20 percent of the grain heads in a field are flowering. Tables 14 and 15 present economic injury levels for susceptible or resistant sorghum hybrids. (See page 5 for an explanation of economic threshold tables.)

Insecticide residues should effectively suppress sorghum midges 1 to 2 days after treatment. However, if adults still are present 3 to 5 days after the first application of insecticide, immediately apply a second insecticide treatment. Several insecticide applications at 3-day intervals may be justified if yield potential is high and sorghum midges exceed the economic injury level.

Table 14. Economic injury levels based on number of adult sorghum midges per flowering grain head of a susceptible sorghum hybrid.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Number of sorghum midges								
6	2.4	2.0	1.6	1.3	1.2	1.1	0.9	0.8	0.8
8	3.0	2.5	2.2	1.8	1.6	1.4	1.2	1.1	1.1
10	3.5	3.0	2.6	2.2	1.9	1.7	1.5	1.4	1.3
12	3.9	3.5	3.1	2.7	2.3	2.0	1.8	1.6	1.4

Table 15. Economic injury levels based on number of adult sorghum midges per flowering grain head of a resistant sorghum hybrid.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Number of sorghum midges								
6	12	10	8	7	6	6	5	4	4
8	15	13	11	9	8	7	6	5	5
10	17	15	13	11	10	9	8	7	6
12	19	17	15	13	11	10	9	8	7

Table 16. Suggested insecticides for controlling sorghum midge.

Insecticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Chlorpyrifos (Lorsban® 4E)	8 oz.	30	30
Cyfluthrin (Baythroid® 2E)	1.0-1.3 oz.	See remarks	14
Cyhalothrin (Karate® 1E)	1.92-2.56 oz.	See remarks	
Malathion (Fyfanon® ULV)	8-12 oz.	7	7
Methomyl (Lannate®) (2.4LV)	12-24 oz.	14	14
(90WSP)	4-8 oz.	14	14
Parathion (ethyl)		See remarks	
(4E)	16 oz.	12	12
(8E)	8 oz.	12	12

Remarks

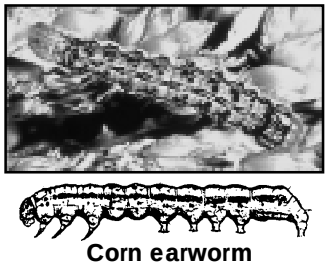
Cyfluthrin. If one or two applications are made, green forage may be fed or grazed on the day of treatment. If three applications are made, allow at least 14 days between last application and grazing.

Cyhalothrin. Do not graze livestock in treated area or harvest for fodder, silage or hay.

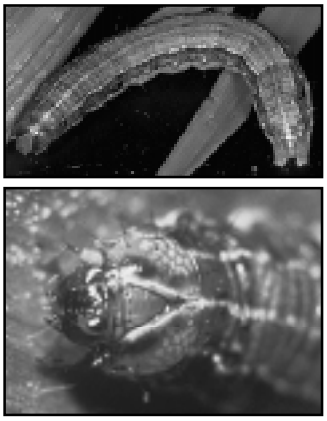
Parathion. Aerial application only. Do not substitute methyl parathion.

Corn earworm and fall armyworm (headworms)

Helicoverpa zea and
Spodoptera frugiperda



Corn earworm



Fall armyworm

Corn earworm and fall armyworm moths lay eggs on leaves or grain heads of sorghum. Newly hatched corn earworm larvae are pale in color and only 1/8 inch long. They grow rapidly and become variously colored, ranging from pink, green or yellow to almost black. Many are conspicuously striped. Down the side is a pale stripe edged above with a dark stripe. Down the middle of the back is a dark stripe divided by a narrow white line that makes the dark stripe appear doubled. Fully grown larvae are robust and 1 1/2 to 2 inches long.

Young fall armyworm larvae are greenish and have black heads. Mature larvae vary from greenish to grayish brown and have a light-colored, inverted, Y-shaped suture on the front of the head and dorsal lines lengthwise on the body.

Corn earworm and fall armyworm larvae feed on developing grain. Small larvae feed on flowering parts of the grain head at first, then hollow out kernels. Larger larvae consume more kernels and cause most damage. The last two larval stages cause about 80 percent of the damage. Frass is common in infested grain heads, on tops of upper leaves and on the ground under plants. Under certain conditions, infested grain heads may have molds.

Natural mortality of small corn earworm and fall armyworm larvae is normally very high. Both corn earworm and fall armyworm moths can lay several hundred eggs on sorghum grain heads before or during flowering, but only a few larvae survive. Natural factors suppressing these insects include predators, parasites, pathogens and cannibalism among larvae.

Infestations usually are less in early- than late-planted sorghum. An important management tactic is to use sorghum hybrids with loose (open) grain heads. Early-planted sorghum and hybrids with open grain heads usually are less infested.

Begin inspecting sorghum grain heads soon after flowering and continue at 5-day intervals until hard dough. To examine grain heads for corn earworms and fall armyworms, shake randomly selected grain heads vigorously into a 5-gallon bucket, where larvae can be seen and counted easily. This "beat-bucket" technique permits detection of even small larvae (less than 1/4 inch) commonly overlooked during visual inspection of the grain head. Inspect at least 30 grain heads from a field to ensure reasonable reliability of sample size. Sample at least one grain head per acre in fields larger than 40 acres.

Because many young headworm larvae die naturally, do not apply insecticide until they are at least 1/2 inch long. The economic injury level is about 1 to 2 larvae per grain head of commercial sorghum (Table 17). (See economic threshold level discussion on page 5.) Fewer larvae per grain head may justify treatment on sorghum grown for seed because of the higher per-acre value. Table 18 lists insecticides suggested to control headworms.

Table 17. Economic injury levels based on number of corn earworm and fall armyworm larvae per sorghum grain head.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Number of headworms								
6	1.5	1.2	1.0	0.9	0.8	0.7	0.6	0.6	0.5
8	2.0	1.6	1.3	1.1	1.0	0.9	0.8	0.8	0.7
10	2.5	2.0	1.6	1.4	1.2	1.1	1.0	1.0	0.9
12	3.0	2.4	1.9	1.7	1.5	1.4	1.3	1.2	1.1

Table 18. Suggested insecticides for controlling corn earworm and fall armyworm in sorghum.

Insecticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl (Sevin®)			
(4F)	32-64 oz.	21	14
(80S or 80WSP)	1.25-1.8 lb.	21	14
(50W)	2-4 lb.	21	14
(4XLR+®)	32-64 oz.	21	14
Cyfluthrin		See remarks	
(Baythroid® 2E)	1.3-2.8 oz.		14
Cyhalothrin		See remarks	
(Karate® 1E)	2.56-3.84 oz.		
Methomyl (Lannate®)			
(2.4LV)	12-24 oz.	14	14
(90WSP)	4-8 oz.	14	14
Parathion (ethyl)		See remarks	
(4E)	12-16 oz.	12	12
(8E)	6-8 oz.	12	12

Remarks

Cyfluthrin. If one or two applications are made, green forage may be fed or grazed on the day of treatment. If three applications are made, allow at least 14 days between last application and grazing.

Cyhalothrin. Do not graze livestock in treated area or harvest for fodder, silage or hay.

Parathion. Aerial application only. Do not substitute methyl parathion.

Sorghum webworm

Nola sorghiella

Sorghum webworm

Sorghum webworms occasionally infest grain heads of sorghum planted 2 to 3 weeks later than normal. This insect occurs primarily in the more humid eastern half of Texas.

Adults are small, white moths active at night. They lay about 100 eggs singly but fastened rather securely to flowering parts or kernels of sorghum. Eggs are round to broadly oval and are flattened from top to bottom.

Webworm larvae are somewhat flattened, yellowish or greenish brown and marked with four lengthwise reddish to black dorsal stripes. When mature, larvae are about 1/2 inch long and covered with many spines and much hair. Pupae within a cocoon are reddish brown, slender and sub-cylindrical. A generation requires 1 month; as many as six generations may develop in a year. The larva overwinters in a cocoon on the host plant.

Many sorghum webworms may be found in grain heads of late-planted sorghum. Young larvae feed on developing flower parts. Older larvae gnaw circular holes in and feed on the starchy contents of maturing kernels, which usually are only partly consumed. Each larva may eat more than 12 kernels in 24 hours. Larvae do not spin webs (as the name might imply) over the sorghum grain head but, when disturbed, young larvae often suspend themselves by spinning a thin silken thread.

Inspect for sorghum webworms when grain heads begin to flower; continue at 5-day intervals until kernels are in the hard-dough stage. To examine grain heads for sorghum webworms, shake grain heads vigorously into a 5-gallon plastic bucket, where

Table 19. Suggested insecticides for controlling sorghum webworm.

Insecticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl (Sevin®)			
(4F)	32-64 oz.	21	14
(80S or 80WSP)	1.25-2.5 lb.	21	14
(50W)	2-4 lb.	21	14
(4XLR+®)	32-64 oz.	21	14
Cyfluthrin		See remarks	
(Baythroid® 2E)	1.3-2.8 oz.		14
Cyhalothrin		See remarks	
(Karate® 1E)	2.56-3.84 oz.		
Methomyl (Lannate®)			
(2.4LV)	24 oz.	14	14
(90WSP)	8 oz.	14	14
Parathion (ethyl)		See remarks	
(4E)	12 oz.	12	12
(8E)	6 oz.	12	12

Remarks

Cyfluthrin. If one or two applications are made, green forage may be fed or grazed on the day of treatment. If three applications are made, allow at least 14 days between last application and grazing.

Cyhalothrin. Do not graze livestock in treated area or harvest for fodder, silage or hay.

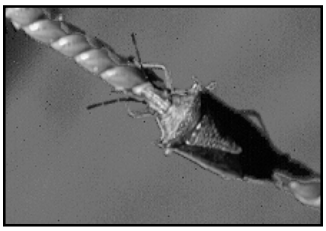
Parathion. Aerial application only. Do not substitute methyl parathion.

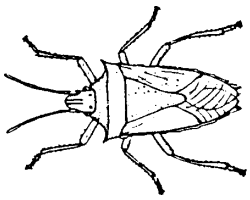
even small larvae can be seen and counted easily. Inspect at least 30 plants from a field to ensure that sample estimates are reasonably reliable. Sample at least one grain head per acre in fields larger than 40 acres.

Insecticide application is economically justified when grain heads are infested with an average of five or more small larvae. Cultural practices to reduce sorghum webworm abundance include plowing sorghum residues after harvest to destroy overwintering pupae, planting as early as practical and using sorghum hybrids with loose (open) grain heads.

Grain head-feeding bugs

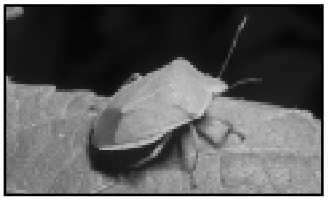
Several species of true bugs, primarily stink bugs, may move in relatively large numbers from alternate host plants into sorghum during kernel development. Bugs infesting sorghum in Texas include rice stink bug, southern green stink bug, conchuela stink bug, brown stink bug (*Euschistus servus*), red-shouldered stink bug (*Thyanta accerra*), leaffooted bug and false chinch bug.

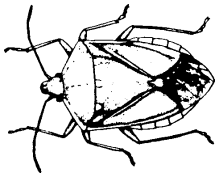




Rice stink bug

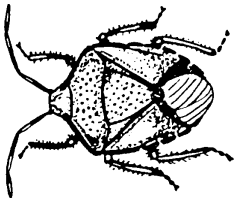
The rice stink bug (*Oebalus pugnax*) is straw-colored, shield-shaped and 1/2 inch long. Females lay about 10 to 47 short, cylindrical, light-green eggs in a cluster of two rows. Eggs hatch after 5 days, and nymphs require 15 to 28 days to become adults.





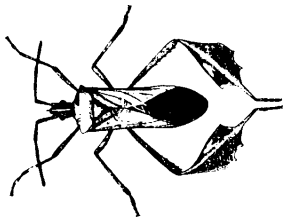
Southern green stink bug

The southern green stink bug (*Nezara viridula*) is about 3/4 inch long, green and somewhat shield-shaped. Females deposit 300 to 500 eggs in clusters of about 30. The eggs hatch in about 7 days, reaching the adult stage in about 6 weeks.



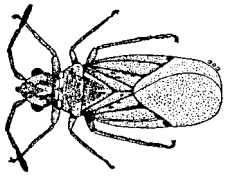
Conchuela stink bug

The conchuela stink bug (*Chlorochroa ligata*) varies in color from dull olive or ash gray to green, purplish pink, or reddish brown. The most characteristic markings are orange-red bands along the lateral margins of the thorax and wings and a spot of the same color on the back at the base of the wings.



Leaffooted bug

The leaffooted bug (*Leptoglossus phyllopus*) is brown, oblong and just longer than 3/4 inch. A white band extends across the front wings. The lower part of each hind leg is dilated or leaf-like. Eggs are laid in rows of 15 to 35. Nymphs are reddish.



False chinch bug

The false chinch bug (*Nysius raphanus*) resembles the chinch bug but with more uniform color, ranging from gray to brown. False chinch bugs are 1/10 inch long. Multitudes of the insect occasionally migrate from wild hosts, such as wild mustard, to sorghum, but these insects usually concentrate in small areas of a field.

Bugs suck juices from developing sorghum kernels and, to a lesser extent, from other grain head parts, and may cause economic damage. The extent of damage depends on number of bugs per grain head,

duration of infestation, and stage of kernel development when infestation occurs. Bugs cause more damage early during kernel development and less as grain develops to the hard-dough stage. Both nymphs and adults can reduce grain weight, size and seed germination. Fungi often infect damaged kernels, causing them to turn black and further deteriorate in quality. Damaged kernels rarely develop fully and may be lost during harvest.

Grain head-feeding bugs tend to congregate on sorghum grain heads and sometimes within areas of a field. Use the beat-bucket technique to estimate abundance. Shake sorghum grain heads vigorously into a 5-gallon bucket, where bugs can be seen and counted more easily. However, adult bugs will fly from the sampled plant or the bucket. Count those that fly from sorghum grain heads or from the bucket and those on plant leaves. Sample at least 30 plants from a field. Take at least one sample per acre in fields larger than 40 acres.

To determine the profitability of controlling an infestation of rice, southern green, or conchuela stink bugs or of leaffooted bugs, consult economic injury Tables 20 through 23. (See economic threshold level discussion on page 5.) The number of bugs per sorghum grain head that will reduce grain yield varies depending on bug species and stage of grain development when infestation occurs. Determine the grain development stage at time of sampling and refer to the appropriate table. If the grain development stage is hard dough and the infestation per grain head is 16 or fewer bugs, an insecticide application likely is unjustified. *The economic threshold level for false chinch bug is 140 bugs per grain head when infestation begins at the milk stage of grain development.*

Not all stink bug species in sorghum are economic pests. Several species, such as the spined soldier bug, prey on harmful insects and thus are beneficial.

For more information on grain head-feeding insects, see B-1421, *Suggested Guide for Controlling Panicle-Feeding Bugs in Texas Sorghum*.

Table 20. Economic injury level based on number of rice stink bugs per sorghum grain head beginning at the milk stage of kernel development.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Number of rice stink bugs								
6	7	6	6	5	5	5	4	4	4
8	8	7	6	6	6	5	5	4	4
10	8	8	7	7	6	6	6	5	5
12	9	8	8	7	7	6	6	5	5

Table 21. Economic injury level based on number of rice stink bugs per sorghum grain head beginning at the soft-dough stage of kernel development.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Number of rice stink bugs								
6	9	8	8	7	7	6	6	6	5
8	10	9	9	8	8	7	7	7	6
10	12	10	10	9	9	8	8	7	7
12	13	12	11	10	10	9	9	8	8

Table 22. Economic injury level based on number of adult southern green stink bugs, conchuela stink bugs and leaffooted bugs beginning at the milk stage of kernel development.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Number of bugs								
6	5	4	4	4	4	3	3	3	2
8	5	5	5	4	4	4	4	3	3
10	6	6	5	5	5	4	4	4	3
12	6	6	6	5	5	5	4	4	4

Table 23. Economic injury level based on number of adult southern green stink bugs, conchuela stink bugs and leaffooted bugs per sorghum grain head beginning at the soft-dough stage of kernel development.

Control cost ($) per acre	Crop market value ($) per acre								
	100	125	150	175	200	225	250	275	300
	Number of bugs								
6	8	7	7	6	6	5	5	4	4
8	9	8	7	7	7	6	6	5	5
10	10	9	8	8	7	7	6	6	5
12	11	10	9	9	8	8	7	7	6

Table 24. Suggested insecticides for controlling grain head-feeding bugs.

Insecticide (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl		See remarks	
(Sevin®)			
(4F)	32-64 oz.	21	14
(80S or 80WSP)	1.25-2.5 lb.	21	14
(50W)	2-4 lb.	21	14
(4XLR+®)	32-64 oz.	21	14
Cyfluthrin		See remarks	
(Baythroid® 2E)	1.3-2.8 oz.		14
Cyhalothrin		See remarks	
(Karate® 1E)	2.56-3.84 oz.		
Parathion (ethyl)		See remarks	
(4E)	12-16 oz.	12	12
(8E)	6-8 oz.	12	12

Remarks

Carbaryl. Direct spray into heads for optimum control.

Cyfluthrin. If one or two applications are made, green forage may be fed or grazed on the day of treatment. If three applications are made, allow at least 14 days between last application and grazing.

Cyhalothrin. Do not graze livestock in treated area or harvest for fodder, silage or hay.

Parathion. Aerial application only. Do not substitute methyl parathion.

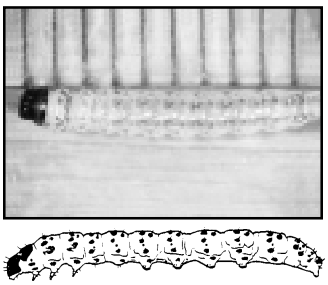
Stem-boring insect pests

Sugarcane borer
Diatraea saccharalis,

Southwestern corn borer
Diatraea grandiosella,

Neotropical borer
Diatraea lineolata **and**

Mexican rice borer
Eoreuma loftini



Sugarcane borer

These closely related insects tunnel in the stalks of sorghum, corn and other crops. The biology of these four species can be generalized: White to buff-colored adult moths lay clusters of elliptical to oval shaped, flattened eggs that overlap like fish scales in shingle-like arrangements on leaves of host plants. Eggs hatch in 3 to 7 days.

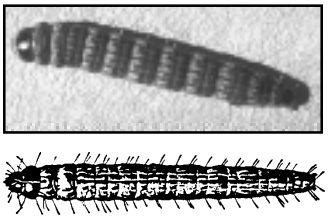
The larval stage lasts about 25 days and the pupal stage about 10. There are two to three generations a year. Larvae are creamy white, about 1 inch long when fully grown, and most body segments have conspicuous round brown or black spots. Spots are lighter colored or absent on mature overwintering larvae. Most stem-boring insects pass the winter as fully grown larvae in cells inside stalks that remain after the crop is harvested.

Young larvae feed for a few days on leaves or the leaf axis. Older larvae tunnel into the sorghum stalks. Larvae bore up and down the pith of the stalk. Borer-infested stalks may be reduced in diameter, and lodging of infested plants can result. Boring by larvae in the stem just below the grain head can cause it to break and the grain head to fall. Injury by borers makes the plant more susceptible to stalk rot diseases.

Planting sorghum early is important because borers typically are more abundant in late-planted sorghum. Shredding stalks very close to the ground or plowing and disking stubble destroys overwintering larvae by exposing them to cold temperatures in more northern regions of Texas. This practice reduces borer abundance the next year. Insecticidal control rarely is justified.

To determine the presence of stem borers, examine the sorghum plants carefully. Small holes near the leaf axis indicate that a larva has entered the stalk. Once larvae have entered the stalk, stalks must be split to see the larvae. Inspect leaves carefully, because eggs are hard to find. Clusters containing 10 to 20 individual eggs may be on the top or underside of leaves, depending on the borer species. Assess the abundance of eggs and small larvae before larvae bore into stalks. Insecticidal control is effective, only if applied before larvae bore into stalks. Karate and Sevin are labeled for controlling southwestern corn borer in sorghum.

Lesser cornstalk borer
Elasmopalpus lignosellus

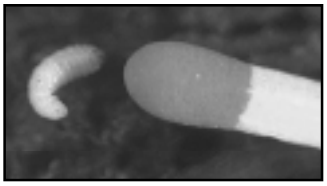


Lesser cornstalk borer

Larvae of the lesser cornstalk borer attack roots and bore into stalks of sorghum plants. Damaging infestations of this insect rarely occur in sorghum. Larvae are light bluish green with prominent transverse reddish-brown bands. They feed in silken tunnels covered with soil particles. Larvae pupate in silken cocoons under crop debris.

Lesser cornstalk borer usually is more severe during dry periods and in sandy soils. Cultural practices that preserve moisture and increase organic matter in the soil discourage the insect. Early planting and rotation with nonhost crops help avoid damage from lesser cornstalk borer. Insecticidal control rarely is justified.

Sugarcane rootstock weevil
Anacentrinus deplanatus



Sugarcane rootstalk weevil larva

The sugarcane rootstock weevil infests sorghum sporadically, especially during dry years and in fields where johnsongrass is abundant.

The adult weevil is dark brown or black, about 1/8 inch long and 1/16 inch wide. The insect overwinters as an adult on ground protected by plant residues. Weevils in early spring infest wild grasses, such as johnsongrass, and later move to sorghum. The female uses her mouthparts to make a small puncture at the base of the plant into which the egg is deposited and concealed. About 16 eggs are laid and hatch in 6 days. Larvae are white, legless grubs about 1/5 inch long when fully grown. A generation is completed in about 40 days.

Adult weevils feed on young sorghum plants and crowns. This damage is noticeable but not as serious as that caused by larvae. Larvae tunnel into the sorghum stalk just below or above the surface of the soil. Tunnels resemble those made by other borers, except they are much smaller and do not extend up the stalk. Larvae often are found at nodes and near the outer surfaces of the stalk. Their feeding often is responsible for a drought-stressed appearance and lodging of sorghum plants. Exit holes and feeding tunnels provide favorable areas where such pathogens as charcoal rot can enter the plant. Historically, control of this insect has not been required.

Policy statement

Information contained in this publication on managing insect and mite pests of sorghum is based on the research and experience of Texas Agricultural Extension Service and Texas Agricultural Experiment Station entomologists. Suggested management strategies are believed to be reliable. However, it is impossible to eliminate all risks associated with managing insect and mite pests in sorghum. Unexpected conditions or circumstances may result in less than satisfactory results when these suggestions are used. The Texas Agricultural Extension Service and The Texas Agricultural Experiment Station do not assume responsibility for ineffective results from using information contained in this publication. The user of the information in this publication assumes all risk.

Insecticides and miticides listed in this publication for use against insect and mite pests of sorghum must be registered and labeled for use by the Environmental Protection Agency and Texas Department of Agriculture. The status of insecticide labels change and may have changed since this publication was printed. Extension entomologists and other appropriate specialists are advised of changes in label status and may be contacted for this information. The USER always is responsible for effects of pesticide residues on livestock and crops, as well as problems that arise from drift or movement of pesticide from the application site to other areas. **Always carefully read and follow the instructions on the pesticide label.**

Original color images courtesy of "Sorghum Insect Photo CD," compiled by Phil Sloderbeck, Kansas State University Department of Entomology, 1995; and Greg Cronholm, Bart Drees, John Jackman and George Teetes, Texas A&M University System.

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