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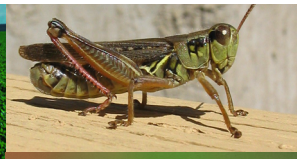
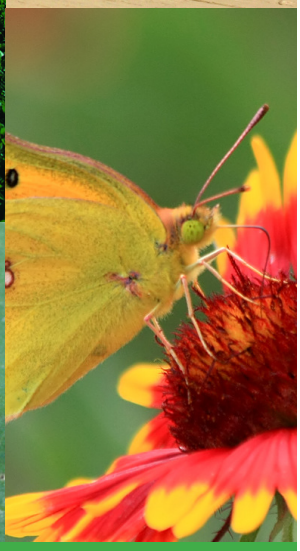
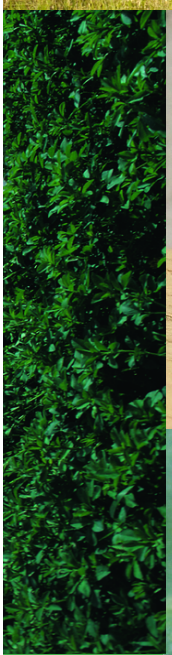




Managing Insect Pests of Texas Forage Crops



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Managing Insect Pests of Texas Forage Crops

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Acknowledgments

Mark Muegge, Extension Entomologist, contributed to this publication, and this revision is dedicated to his memory. Charles Allen, Professor and Extension Entomology Specialist, reviewed this publication.

CONTENTS

Introduction

This publication discusses integrated pest management (IPM) practices for insect pests of Texas forage crops, including bermudagrass hay and pasture, forage sorghum, alfalfa, clover, and vetch.

For information on insect pests of small grains, which sometimes are grown as forage crops, see *Managing Insect and Mite Pests of Small Grains in Texas*, publication E-399, which is available from the county Texas A&M AgriLife Extension office or online at agrilifebookstore.org.

Integrated pest management

IPM is a sustainable pest-management approach that combines biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. IPM combines the most economical and ecologically sound techniques to control insect and mite pests efficiently and effectively.

IPM tactics include:

- **Cultural practices**, such as fertilizing, rotating crops, and planting cultivars with pest resistance
- **Biological control**, which protects the pests' natural enemies
- **Chemical control**, which is the judicious use of selected insecticides and rates to keep pest numbers below economically damaging levels

For example, planting adapted and pest-resistant cultivars can help control some diseases of alfalfa as well as pea aphids, blue alfalfa aphids, and spotted alfalfa aphids.

For ratings of pest resistance of alfalfa varieties, along with their winter hardiness and dormancy characteristics, see *Winter Survival, Fall Dormancy and Pest Resistance Ratings for Alfalfa Varieties*, by the National Alfalfa and Forage Alliance, at http://alfalfa.org/pdf/2011NAFAVariety-Leaflet_small.pdf.

A vital component of IPM is the use of insecticides because they can quickly reduce a pest population to prevent crop loss. Apply insecticides when plant damage or pest populations approach levels that can cause crop losses that are greater than the cost of the insecticide treatment. This pest density or plant damage level is called the *economic threshold* or *action level*.

Another essential is to inspect fields regularly—once or twice a week—to assess crop growth, pest damage, and pest and beneficial insect populations (Fig. 1). This information will enable you to determine whether the pest is at the action level, which is when you may need to use an insecticide or take other management action to prevent economic loss.

Figure 1. Scouting for insects using a sweep net

When using insecticides, always read and follow the directions on the product label. A critical practice is to rotate insecticides that attack pests in different ways. Insecticides are classified according to their modes of action—the ways that they kill insect pests.

For example, some chemicals disrupt the feeding behavior of the insect, which then starves to death. Other pesticides paralyze insects, and still others prevent them from reproducing.

In most pest populations, a few individuals have genes that allow them to survive the pesticide; these insects are termed *resistant* to the pesticide. When pesticides with the same mode of action are used repeatedly, the proportion of resistant individuals increases as they pass on their resistant genes to their offspring.

The selection of insects with resistance occurs more quickly if pesticides with the same mode of action are used repeatedly. To help prevent insecticide resistance, use insecticides only when necessary, and rotate insecticides with those having different modes of action.

To determine an insecticide's mode of action, refer to the product label or access http://www.irac-online.org/documents/moa-classification. Each mode of action is identified numerically by group; some are also identified alphabetically by subgroup (Fig. 2). For example, the classification 1B refers to organophosphates that attack the insect's nervous system; class 7 insecticides disrupt insect growth and development.

GROUP	1B	INSECTICIDE

Figure 2. Example of a product label section indicating an insecticide's mode of action

Rotate insecticides with different mode-of-action numbers. Rotating by brand name may not be effective because the same active ingredient (and the same mode of action) is often sold under different brand names.

Weather, natural enemies, and lack of food often keep pest infestations below economically damaging levels. Common natural enemies in forage crops include damsel bugs, ground beetles, lacewing larvae, lady beetles, pirate bugs, spiders, syrphid fly larvae, and a variety of tiny wasps that parasitize many forage crop pests (Figs. 3 through 13).

Other natural enemies are the bacteria, fungi, and viruses that cause diseases in some pests, including grasshoppers.

When possible, use pesticides that are effective against the pest but less harmful to its enemies.

Figure 3. Damsel bug

Figure 4. Ground beetle

Figure 5. Lacewing

Figure 6. Lady beetle adult

Figure 7. Lady beetle larva

Figure 8. Minute pirate bug

Figure 9. Syrphid fly adult

Figure 10. Syrphid fly larva

Figure 11. Syrphid fly pupa

Figure 12. Spotted alfalfa aphid being attacked by a parasitic wasp

Figure 13. An Aphelinus wasp parasitizing an aphid

Protecting bees and other pollinators
Alfalfa, clover, and vetch in bloom are very attractive to honeybees and other insect pollinators. These pollinators also forage in sorghum fields for pollen and on flowering weeds in and around fields.

When possible, use pesticides that are less toxic to bees. However, most of the insecticides listed in this publication are highly toxic to bees. Exceptions include Sivanto Prime, Intrepid, Dimilin, Prevathon, and insecticides applied as baits for fire ant control.

Bees can be killed on contact with some insecticides and their residues on or in plants. Help prevent bee poisoning by applying insecticides late in the evening or at night when bees are not foraging in the field.

Also, avoid insecticide drift, which can contaminate blooming plants in and around the field. Avoid pesticide drift onto bee colonies. Bees often cluster on the front of hives during hot evenings. Pesticide drift onto clustering bees can result in high mortality. The producer, applicator, and beekeeper should cooperate closely to minimize bee mortality.

For directions and restrictions to protect bees and other insect pollinators, read the "Directions for Use" section of the product label. On new labels, this information is listed in a bee advisory box and noted by the bee icon (Fig. 14).

Figure 14. Icon identifying the bee advisory box on the pesticide label, which details restrictions on pesticide use that protect bees and other pollinators

Phytotoxicity precautions
Some insecticides are poisonous, or phytotoxic, to plants. For example, some pesticides stunt the plants and burn the leaves of certain sorghum hybrids, especially seed sorghums.

Before applying a pesticide, check the label closely for possible phytotoxic effects. This information is also available from the chemical manufacturer and the seed company.

Policy statement on pest management suggestions
The information and suggestions in this publication reflect the opinions of Extension entomologists based on research, field tests, and experience. Because the management suggestions are a product of research, they are believed to be reliable.

However, it is impossible to eliminate all risk. Even when these suggestions are used, unforeseen or unexpected conditions or circumstances may lead to unsatisfactory results. The Texas A&M AgriLife Extension Service assumes no responsibility for risks. Such risks shall be assumed by the user of this publication.

Suggested pesticides must be registered and labeled by the U.S. Environmental Protection Agency and the Texas Department of Agriculture. The status of pesticide label clearances is subject to change and may have changed since this publication was published.

Always read and follow carefully the instructions on the container label. The user is always responsible for the effects of pesticide residues on livestock and crops, as well as for problems that could arise from drift or other movement of the pesticide to others' property.

HAY AND PASTURE INSECTS

Fall armyworm
Two species of armyworms—fall armyworms and true armyworms—can damage improved pastures, temporary winter pastures, permanent pastures, and small grains. Populations of these caterpillars can increase quickly, move in large masses (or *armies*) to fields in search of food, and consume a crop almost overnight.

Although it attacks many other crops, the fall armyworm (Fig. 15) feeds primarily on bermudagrass, ryegrass, sorghum, and wheat. It is a major pest of permanent and improved pastures in most parts of Texas. It is most abundant in mid-summer through early November.

Fall armyworms are green, brown, or black, all having white to yellowish lines running from head to tail. A distinct white line between the eyes forms a characteristic inverted "Y" pattern on the face (Fig 16). Four black spots form a square near the back.

Figure 15. Fall armyworm larva

Figure 16. Distinctive pattern on the fall armyworm face

Figure 17. Fall armyworm adult

At first, armyworms are tiny (⅛ inch) and often go unnoticed because they cause little plant damage. The larvae feed for 2 to 3 weeks; when full grown, they are about 1 to 1½ inches long. Given their immense appetite, great numbers, and marching ability, fall armyworms can damage entire fields or pastures in 2 or 3 days.

Once the armyworm larva completes feeding, it tunnels about an inch into the soil and enters the pupal stage. The moth (Fig. 17) emerges from the pupa in about 10 days and repeats the life cycle.

The fall armyworm moth has a wingspan of about 1½ inches. The front pair of wings is dark gray with an irregular pattern of light and dark areas.

The moths are active at night, when they feed on nectar and deposit egg masses (Fig. 18). A single female can deposit up to 2,000 eggs. There are four to five generations per year.

The fall armyworm apparently does not overwinter in North Texas; it overwinters in the pupal stage in South Texas.

Populations increase in South Texas in early spring, with successive generations moving northward as the year progresses. They may infest pastures from early summer until the first frost in the fall.

Ground beetles, insect viruses, some bird species, and parasitic wasps and flies help suppress armyworm numbers. However, these natural enemies can be overwhelmed when migrating moths move into an area, and the weather conditions favor high survival of eggs and larvae.

Management

The key to managing fall armyworms is to inspect the fields often to detect infestations before they cause economic damage.

Fall armyworm outbreaks in pastures and hayfields often occur after rain, which apparently creates favorable conditions that allow many eggs and small larvae to survive. Especially susceptible to fall armyworm infestations are recently fertilized and irrigated fields that have a dense canopy and vigorous growth.

Also monitor volunteer wheat and weedy grasses in ditches and around fields, which may be a source of armyworms that can move into the nearby crop. Look for the larvae feeding on the grass in late evening and early morning and during cool, cloudy weather.

On hot days, scout for armyworms low in the grass canopy or even on the soil, where they hide under loose soil and fallen leaves. You may need to get on your hands and knees to examine the grass closely.

Another scouting tactic is to roughly run your hands through the grass in a 1- to 2-square-foot area to knock the larvae to the soil and make them easier to see. Then part the grass to look for larvae on the soil.

A sweep net is also effective for sampling hayfields for fall armyworms. When the fields are wet with dew, armyworms can stick to the rubber boots of people walking through the field.

Small larvae chew the green layer from the leaves, creating a clearing or "windowpane" effect, and later feed on the leaf margins. This leaf damage can indicate the need to sample for larvae.

Once the larvae are longer than ¾ inch, they eat dramatically more foliage. During their final 2 or 3 days of feeding, armyworms consume 80 percent of the total foliage consumed during their entire development.

The action level for armyworms depends on the crop's value and growth stage. Seedlings can tolerate fewer armyworms than can older plants. In bermudagrass hay, consider using an insecticide if there are more than two or three armyworms ½ inch or longer per square foot.

If practical, apply the insecticide (Table 1) early in the morning or late in the evening when the larvae are most active and most likely to contact the insecticide spray. If the field is near harvest, an option is to harvest early rather than use insecticide.

True armyworm

The true armyworm is most common during the spring, when it feeds on wheat, rye grass, winter pastures, and seedling corn and sorghum.

The larvae are dark green to nearly black with longitudinal stripes (Fig. 19). The head capsule is yellow-brown with a dark, netlike pattern.

The adult is a night-flying moth (Fig. 20). The wings are pale brown to gray with a single, small white spot near the center of each forewing.

The eggs are laid in rows on the leaves,

Figure 18. Fall armyworm egg mass

Figure 19. True armyworm larva

Figure 20. True armyworm moth

Table 1. Insecticides labeled for fall armyworm and true armyworm in pasture, grasses, and hay. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval for hay (days)	Remarks
beta-cyfluthrin	Baythroid	0	0	Restricted use
carbaryl	Sevin 4F, Carbaryl 4L	14	14	General use
chlorantraniliprole	Prevathon, Coragen	0	0	General use
chlorantraniliprole + lambda-cyhalothrin	Besiege	0	7	Restricted use
cyfluthrin	Tombstone	0	0	Restricted use
diflubenzuron	Dimilin 2L	None listed	1	Restricted use; apply at egg hatch and when larvae are less than ½ inch long
gamma-cyhalothrin	Declare	0	7	Restricted use
lambda-cyhalothrin	Warrior II, Karate, Lambda-cy, generics	0	7 for hay, 0 for forage	Restricted use
malathion	Malathion 57EC	0	0	General use
methoxyfenozide	Intrepid	0	7	General use
spinosad	Tracer, Blackhawk	Allow spray to dry	3	General use; target small larvae or egg hatch
zeta-cypermethrin	Mustang Maxx	Allow spray to dry	0	Restricted use

often between the leaf sheath and blade, and are difficult to find. Egg survival is favored by cool temperatures, which may explain why true armyworm numbers often decline when temperatures rise in early summer.

Like the fall armyworm, true armyworms can reach huge numbers and move en masse to fields for food. True armyworm larvae develop for about 3 to 4 weeks, depending on temperature, and mature larvae are about 1⅓ inch long.

Also like fall armyworms, the small larvae consume little forage. However, when they reach ¾ to 1 inch long, they consume about 80 percent of the total foliage consumption during their entire development. The crop can be lost within days.

The larvae feed mostly on leaves; in wheat, they can feed in the seed head and may cut the head. True armyworms do not readily feed on bermudagrass but may infest pastures that have a mix of bermudagrass, wheat, and ryegrass. In these fields, the worms feed on ryegrass and wheat first, and then bermudagrass if no other cool-season grass is available.

Management

Monitor susceptible crops for true armyworms in the spring. Infestations are often associated with cool, wet weather. The armyworms often feed at night; during the day, they stay on the soil beneath dirt clods and in leaf litter and soil cracks. Look for them in the canopy in the early morning or late evening.

As with fall armyworm, the economic threshold for true armyworm infestations depends on the crop stage and value. Infestations of two to three armyworms per square foot may justify an insecticide application.

If practical, apply insecticides in the early morning or late evening when the larvae are most active and therefore most likely to contact the insecticide spray. Insecticides listed for fall armyworm are also effective against true armyworm (Table 1).

Grasshoppers

Although grasshoppers damage Texas crops locally most years, in some years they become abundant and cause damage regionally. Weather conditions primarily determine grasshopper abundance. Outbreaks often occur after consecutive years of hot, dry summers and warm autumns.

In contrast, cool, wet weather slows the growth of grasshoppers and favors the fungal diseases that kill them. Warm, dry weather in the fall enables grasshoppers more time to feed and lay eggs. Thus, grasshoppers increase during drought conditions.

Cold does not affect grasshoppers because they overwinter as eggs in the soil.

Of the 150 species of grasshoppers in Texas, only five cause most of the crop damage: the differential grasshopper, red-legged grasshopper, migratory grasshopper, two-striped grasshopper, and Packard grasshopper (Figs. 21 through 25). These species' biology, damage, and management

Figure 21. Differential grasshopper

Figure 22. Red-legged grasshopper

Figure 23. Migratory grasshopper

Figure 24. Two-striped grasshopper

Figure 25. Packard grasshopper

are similar.

In the fall, grasshoppers deposit clusters of eggs ½ to 2 inches deep in the soil. They are laid in the undisturbed soil of untilled fields, fencerows, ditches, and hayfields. The eggs hatch in spring and early summer. Because the eggs of different grasshopper species hatch at different times, young grasshoppers can be seen throughout the spring and summer.

As the grasshoppers grow, they shed their old skin (*molt*) and grow a new, larger skin. The periods between molting are called *instars*; grasshoppers complete five or six instars before the final molt to the adult stage.

The adult stage has fully developed wings and can fly. It takes 40 to 60 days for a grasshopper to develop from egg to adult (Fig. 26); most species complete only one generation a year.

As the weeds mature and dry during the summer, grasshoppers fly in search of green plants and can concentrate in crops, orchards, and irrigated landscapes. Grasshoppers are active until late fall, when the adults begin to die or a killing frost occurs.

Management

Control weeds to remove the food needed by young grasshoppers and to discourage the adults from laying eggs in the area.

However, destroying weeds already infested with many grasshoppers can force them to move to nearby crops or landscapes. Control the grasshoppers in the weedy area first with an insecticide or be ready to protect nearby crops if they become infested.

Because female grasshoppers prefer to lay eggs in undisturbed soil, tilling the soil lightly in mid- to late-summer can discourage them from laying eggs.

This insect is susceptible to many insecticides (Table 2). However, some persist for only a few days, allowing the grasshoppers to quickly reinvade the treated area. The period of control depends on the intensity of reinvasion and the insecticide's active ingredient and application rate.

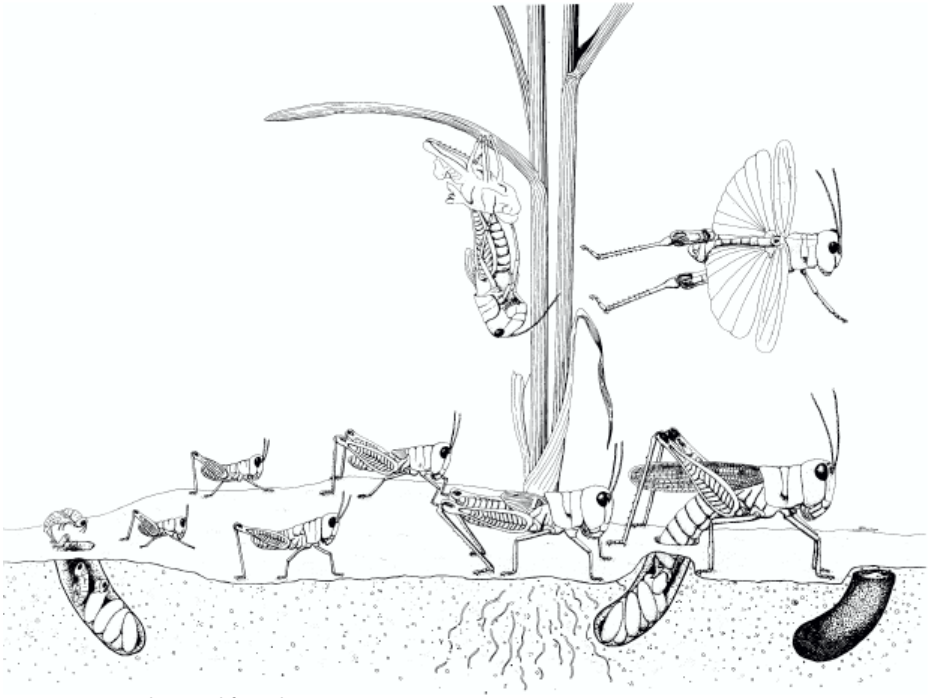

Figure 26. Grasshopper life cycle

Table 2. Insecticides labeled for grasshoppers in pastures, grasses, and hay. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval for hay (days)	Remarks
beta-cyfluthrin	Baythroid	0	0	Restricted use
carbaryl	Sevin 4F, Carbaryl 4L	14	14	General use
chlorantraniliprole	Prevathon, Coragen	0	0	General use
chlorantraniliprole + lambda-cyhalothrin	Besiege	0	7	Restricted use
cyfluthrin	Tombstone	0	0	Restricted use
diflubenzuron	Dimilin 2L	None listed	1	Restricted use: apply at egg hatch and when immature grasshoppers are less than ½ inch long
gamma-cyhalothrin	Declare	0	7	Restricted use
lambda-cyhalothrin	Warrior II, Karate, Lambda-cy, generics	0	7 for hay, 0 for forage	Restricted use
malathion	Malathion	0	0	General use
zeta-cypermethrin	Mustang Maxx	0	0	Restricted use

Controlling grasshoppers over a large area will reduce the number that can reinfest the crop. Monitor grasshopper infestations, and treat them while the insects are still small, before they develop wings and move into crops and landscapes. Small grasshoppers are more susceptible to insecticides, and usually a smaller area will require treatment.

To determine the size of an infestation, estimate the number of grasshoppers per square yard:

1. While walking across the field, estimate the number of adult grasshoppers in an area of 1 square yard. If most of the grasshoppers are less than ½ inch long, divide the number of grasshoppers by three to get the adult equivalent.
2. Walk 15 to 20 paces and again estimate the number in one square yard.
3. Repeat these estimates for at least 18 square yards.
4. Calculate the average number of adults per square yard.

The economic threshold is generally an average of 21 or more adult grasshoppers per square yard along the field margin, or eight or more per square yard in the field. When deciding whether to treat, factor in the crop stage and value as well as the grasshopper feeding damage.

Bermudagrass stem maggot

The bermudagrass stem maggot is a new pest of bermudagrass forage in Texas and the United States. It infests only bermudagrass and stargrass.

Native to South Asia, this stem maggot was first reported in Georgia in 2010. In Texas, it was first found in 2013 in East and South Texas. Since then, it has been reported near San Antonio, Lubbock, and El Paso and is believed to be distributed throughout the state.

The adult stage is a small, yellow fly (Fig. 27) that lays its eggs on the bermudagrass plant. Once the egg hatches, the larva, or maggot, moves to the top node of the stem, burrows into the shoot, and consumes

Figure 27. Bermudagrass stem maggot adult

Figure 28. Bermudagrass stem maggot compared to human thumb

Figure 29. Top dead leaves characteristic of stem maggot damage on bermudagrass

the plant material in the stem. This stem damage results in the death of the top two or three leaves while the rest of the plant remains green.

Fields infested with this pest appear to have frost damage. Cutting open the stem below these dead leaves will reveal the tunnel created by the maggot and possibly the maggot itself. Full-grown, the maggot is yellowish and about ⅛ inch long (Fig. 28).

The maggots are difficult to find because they often complete feeding and leave the stem before the upper leaves turn brown or white and die. Once feeding is complete, the maggot drops to the ground and enters the pupal stage.

The adult fly later emerges from the pupa. The life cycle from egg to adult fly requires about 2 to 3 weeks, and there are several generations a year.

The feeding halts shoot elongation, stunts plant growth, and delays the accumulation of dry matter (Fig. 29). In response, the plant will grow another shoot, which the bermudagrass stem maggot can also attack, further stunting and delaying regrowth.

Damage is more common in fine-stemmed cultivars such as Coastal, Alicia, Russell, and common bermudagrass. Infestations in coarse-stemmed varieties such as Tifton 85 are less common yet can be significant, especially late in the season.

The stem maggot is usually not a pest of grazed pastures because livestock consume the eggs and maggot with the grass, preventing an increase in the fly population.

Figure 30. White grub

Figure 31. May/June beetle adult

Management

Research results in Georgia and Alabama suggest that if you find significant damage, you should harvest the crop as soon as weather allows. Maggots feeding in the stem will die once the crop is cut and dried for harvest.

However, flies will emerge from the pupae already in the soil and reinfest the field. To protect the regrowth from infestation, apply a labeled insecticide (Table 3) about 7 to 10 days after cutting.

This insecticide treatment will kill the adults but not the larvae already feeding in the stems. If the infestation is extensive, consider a second application 5 to 7 days later.

Current research suggests that an insecticide treatment be applied when 20% or more of the stems show evidence of stem maggot feeding (top 2-3 leaves dead or dying).

Once a field is cut, the maggots that are feeding in the stems die as the grass dries. For this reason, bermudagrass maggots are unlikely to be transported in hay. The adult is a strong flier; this is the stage when the pest moves to new fields.

Table 3. Insecticides labeled (2ee label) for control of bermudagrass stem maggot adults.* Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval for hay (days)	Remarks
gamma-cyhalothrin	Declare	0	7	Restricted use
chlorantraniliprole + lambda-cyhalothrin	Besiege	0	7	Restricted use
zeta-cypermethrin	Mustang Maxx	0	0	Restricted use

*Treatment with these insecticides will kill adults only, not the larvae feeding inside the stem (see label).

White grubs and May, June, and green June beetles

The larval stages of May, June, and green June beetles are called *white grubs* (Fig. 30). The larvae are characteristically "C-shaped," with white bodies and tan to brown heads. Their size varies according to age and species. The last abdominal segment is transparent, and the digested material inside the larva is visible.

May and June beetles (Fig. 31) are large, brown, and attracted to outdoor lights at night in spring and early summer. May and June beetles deposit eggs in the soil during the spring and summer.

The grubs feed during the summer and fall and then overwinter. They damage plants by feeding on the roots, which kills the plants, thins stands, and allows weeds to invade the bare soil.

Some species have a 1-year life cycle and emerge as adults the next spring. Other species remain as grubs for a second summer and develop as adults the following spring; they require 2 years to complete a generation.

Green June beetle grubs are very large—up


Figure 32. Green June beetle adult

to 2 inches long—and crawl on their backs. The adult beetle (Fig. 32) is velvety green and ½ to 1 inch long. Females deposit eggs in sandy and sandy loam soils, especially in fields high in organic matter, such as pastures where broiler litter, manure, or other organic matter has been applied.

Although green June beetle grubs feed primarily on organic matter, they occasionally chew on tender grass roots. Most of their damage in pastures and hay results from tunneling near the soil surface which results in the death of grass due to uprooting and desiccation. The green June beetle adult feeds on ripening fruit and can be serious pests of grapes and peaches just before harvest.

Management

No insecticides are labeled to control the white grubs of May or June beetles in pastures and hay. The green June beetle grub comes to the surface of the soil at night to feed, and insecticides, such as carbaryl, applied to the soil surface can effectively control this pest.

For more information on controlling green June beetles, see *Biology and Control of Green June Beetles*, by the Alabama Extension Service, at http://www.aces.edu/pubs/docs/A/ANR-0991/index2.tmpl.

Red imported fire ant

Although red imported fire ants do not feed on grasses, their damage can still warrant management:

- The ants threaten livestock, especially newborn calves.
- Custom cutting and baling operators may charge more for their services where fire ant infestations are severe, and field workers can be stung when handling square bales.
- Because fire ants can infest hay and be transported to uninfested areas, hay shipped out of quarantined areas must be certified as free of fire ants by Texas Department of Agriculture.

Under Texas Administrative Code, Title 4, Chapter 19, Subchapter J, hay from counties infested by red imported fire ants is prohibited from being moved into non-infested counties. An exception is if the hay has been stored on a concrete slab or heavy duty plastic and the site where it was stored has been kept free of red imported fire ants using appropriate bait treatments.

Before moving hay from an infested county to a non-infested county in Texas or to another state, the hay producer or shipper must contact the local Texas Department of Agriculture office to have the hay inspected and to receive a phytosanitary certificate.

Management

The most cost-effective method of controlling fire ants over a large area is to broadcast a bait-formulated product (Table 4) rather than treating individual mounds. These baits are commonly applied at a rate of 1 to 1½ pounds per acre using a held-held applicator or a seeder attached to a truck or ATV and calibrated to apply fire ant bait. Baits can also be applied by airplane.

The bait should be fresh and applied when the ants are actively foraging in late spring, summer, or early fall.

Southern and tawny mole crickets

Two species, the southern and tawny mole

Table 4. Insecticide baits labeled for control of red imported fire ants in grazed pastures and hay. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval (days)	Remarks
hydramethylnon	Amdro Pro	0	7	Maximum control observed in about 3–6 weeks. General use insecticide
methoprene	Extinguish	0	0	Control achieved in about 1–3 months if applied in the spring and 3-6 months if applied in the fall. One application per year is usually sufficient for good suppression. General use insecticide
methoprene + hydramethylnon	Extinguish Plus	0	7	Combines rapid control of Amdro Pro and the longer residual control of Extinguish. General use insecticide
pyriproxyfen	Esteem	0	1	Labeled for use in hay pastures or with livestock used for food or feed production. Control is relatively slow, 1–3 months applied in spring, 3–6 months in fall. General use insecticide

Figure 33. Southern mole cricket

Figure 34. Desert termite adult

Figure 35. Carton tubes built by desert termites

crickets, are pests of improved pastures of bermudagrass and bahiagrass, turf grass, and other crops in Texas.

Mole crickets are brown, cylindrical insects with large, shovel-like front legs modified for digging in the soil. The adults are about 1½ inches long, can run quickly, and fly at night.

Mole crickets deposit eggs in the soil in April and May; the nymphs develop during the summer; and some nymphs mature into adults in the fall. Nymphs and adults overwinter, and there is usually one generation per year.

The southern mole cricket (Fig. 33) is widely distributed east of I-35 from Dallas to Corpus Christi. It tunnels at night just below the soil surface, where it feeds on insects and earthworms.

Tunneling loosens the soil around plant roots, causing the root to dry out and the plants to die. Tunnels dug by the adults are conspicuous on the soil surface; those created by immature mole crickets may be difficult to detect.

The tawny mole cricket was first found in Texas in the Houston area and is expected to expand its range. Unlike the southern mole cricket, the tawny mole cricket feeds on living roots and plants. This feeding, along with tunneling, can cause extensive stand loss.

Both species prefer sandy soil but can also be pests in heavy clay. Crop damage is usually most severe in late summer and fall when the crickets are large and more active.

Management

No insecticides are labeled to control mole crickets in forage crops. However, to determine whether mole crickets and not other insects are responsible for the crop injury:

1. Dissolve 2 tablespoons of liquid dishwashing detergent in 2 gallons of water.
2. Pour the soap solution over an area of about 4 square feet. The solution will drive the crickets to the surface.
3. Observe the area for 4 to 5 minutes and count the number of mole crickets that emerge.

As a point of reference, insecticide treatment is considered in turfgrass if two to four mole crickets come to the soil surface within 3 minutes after applying the soap solution.

Desert termites

Desert termites (Fig. 34) are found in bermudagrass pasture, rangeland, and bunchgrass areas in South and West Texas. They feed primarily on forbs (flowering plants other than grasses), livestock manure, and live and dead grasses.

Signs of their presence include the tubes or sheets of carton (Fig. 35) that they build around the grass stems and plants on which they feed. The carton consists of moist soil particles and termite feces glued together with saliva. The tubes protect the insects from dehydration and predators. Although rain destroys the tubes, the termites quickly rebuild them.

Like earthworms in wetter environments, desert termites help water filter through the soil and break down plant material into nutrients that are available to plants. But during dry periods, the termites can denude patches of grass cover and, in some cases, promote soil erosion. In prolonged droughts, the loss of soil surface cover to feeding by desert termites may impair rainfall infiltration and increase runoff and erosion.

Their carton tubes are more visible in overgrazed pastures or during drought when the plants are less dense, which makes the area appear to have more termites.

Management

Little research has been conducted to determine the economic feasibility of controlling desert termites to reduce the loss of forage production. Also, no insecticides are labeled for desert termite control.

To minimize harm by desert termites, adopt practices that enhance rainfall infiltration and restore rangeland productivity, including ripping, pitting, contour furrowing, managing grazing properly, and controlling weeds and woody plants. For more information, see Texas AgriLife Extension publication E-258, *Desert Termites*, which is available from the county Texas A&M AgriLife Extension office or online at agrilifebookstore.org.

Field skipper

Although the field skipper is a rare pest of bermudagrass hayfields in northeastern Texas, populations of this insect can break out suddenly and damage bermudagrass over a wide area.

The field skipper butterfly, so named for its

Figure 36. Field skipper adult

Figure 37. Field skipper larva

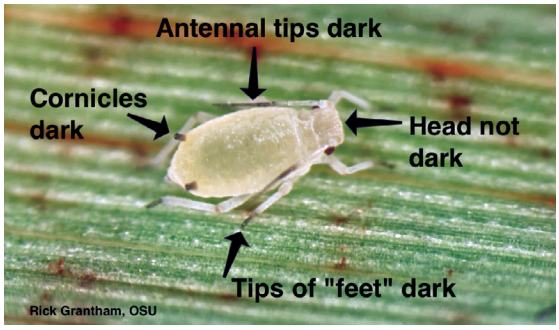

Figure 38. Sugarcane aphid. The black antennae, black feet, and black "tail pipes" are characteristic of the species

direct, very rapid, and often short flights, is orange-brown and has a 1-inch wingspan (Fig. 36).

The larvae are dark olive-green and have a black head (Fig. 37). The body is constricted just behind the neck, making the head appear very large. The body is smooth, tapered to the front and back, and lacks hairs or spines. Full-grown caterpillars have two or three chalky white spots on the underside between the back legs.

The caterpillars consume the leaves of bermudagrass and St. Augustine grass, leaving only the stems. The caterpillars feed in the silken shelters they create by tying grass stems together about midway up the plants. Once they consume the grass, they may crawl in large masses across roads and damage nearby fields or lawns.

Infestations are often first detected when masses of caterpillars crawl up buildings and attack lawns around homes. As with other caterpillars, most of the feeding occurs during the final larval stages, which can quickly defoliate hayfields and lawns as they reach maturity.

Outbreaks have occurred in Texas in late June and July in 1985 and 1989. Although these insects are present every year, the conditions that lead to outbreaks are unknown.

Management

Scout bermudagrass hayfields and meadows for skipper caterpillars from late June through July. Look for bunches of grass stems tied together by silk shelters, in which the larvae feed.

Although harvesting infested fields early will reduce hay loss, many caterpillars may survive after harvest and feed on the regrowth. Insecticide may be needed if early cutting is not an option or if cut fields do not green up normally and caterpillars are alive in the field.

FORAGE SORGHUM INSECTS

Many insect pests of grain sorghum also feed on forage sorghums, sorghum-sudan hybrids, and millets harvested as hay, forage, or silage. However, not all insecticides labeled for grain sorghum are also labeled for forage sorghum. Read the label to determine if the insecticide can be used on sorghums and millet grown for hay, fodder, or silage.

Table 5. Foliar-applied insecticides labeled for chinch bug control in forage sorghum. Follow label directions. See text for seed treatments for control of chinch bugs.

Active ingredient	Insecticide	Pre-grazing interval	Pre-harvest interval	Remarks
carbaryl	Sevin 4L	Do not graze for 14 days after application.	21 days for harvest for grain or fodder, 14 days for grazing or harvest of forage or silage	Use high gallonage ground application at base of plants. Bee caution. Do not apply to crops or weeds in bloom.
chlorpyrifos	Lorsban 4E, Lorsban Advanced	—	Do not harvest for grain, forage, fodder, hay or silage for 30 days at the 1 pint/acre rate; 60 days for rates above 1 pint	Apply in minimum of 15 gallons per acre by ground or 2-5 gpa by air. Apply as a directed spray towards the base of the plant with sufficient water to ensure coverage of an 8- to 12- inch band centered on row. See label for further instructions. Restricted use
beta-cyfluthrin	Baythroid	0	14 days	Restricted use
zeta-cypermethrin	Mustang Max	Allow to dry	0 days for forage	Restricted use

Figure 39. Sugarcane aphids and damage

Chinch bug

Chinch bugs suck plant sap and cause sorghum leaves to turn red and die. Infested plants wilt, their growth is stunted, and the seedlings may die. Sorghum is most susceptible to injury during the seedling stage until the plants are about 18 inches tall. Chinch bugs are common during hot, dry weather.

Adult chinch bugs are black with whitish wings that lie flat across the back. Immature chinch bugs are red with a white band across the back.

Both stages feed on the plant stem just at and below the soil line and behind the leaf sheath of lower leaves. They run when disturbed.

Chinch bugs can move into sorghum fields from nearby wheat fields or from wild bunch grasses.

Management

Scout sorghum for chinch bugs during the seedling stage until plants are about 18 inches tall. Look for chinch bugs around the base of the plant just at or below the soil line. Also, pull back the lower leaf sheaths to look for chinch bugs. Examine plants in at least five places in the field.

Apply an insecticide (Table 5) when you find two or more adult chinch bugs on 20 percent of the plants when seedlings are less than 6 inches tall. On taller plants, the treatment threshold is when you find immature and adult chinch bugs on 75 percent of the plants.

Apply the insecticide as a directed spray toward the base of the plant, where chinch bugs feed. Use sufficient gallons per acre, as directed by the label, to make sure that the lower stem of the plant is covered well.

Sugarcane aphid

The sugarcane aphid (SCA) has recently become one of the most damaging insect pests of grain and forage sorghums in Texas and the southern United States. The aphid is pale yellow, gray, or tan (Fig. 38). The antennae, feet, and "tailpipes" (*cornicles*) are black.

All SCA are females and give birth to live young, which mature into adults in about 5 days. Aphid numbers can increase quickly in the summer.

The SCA feeds by sucking plant sap from the underside of sorghum leaves. Although colonies initially consist of only a few aphids, they can increase quickly to cover much of the lower leaf surface. They feed on grain and forage sorghums (Sudan grass, sorghum/Sudan hybrids) and johnsongrass.

The feeding causes the leaves to turn yellow and finally brown as the leaf tissue dies (Fig. 39). Extensive feeding by SCA can reduce grain and forage yields and increase lodging due to stalk rot. The aphids produce large amounts of honeydew—a shiny, sticky waste product composed primarily of water and plant sugars. It eventually dries to a harmless residue.

Honeydew accumulates on the leaves, making them sticky and shiny. When the humidity is high, a black, sooty mold often grows on the honeydew. The mold blocks the light needed for photosynthesis and may reduce the effectiveness of pesticides.

Honeydew on the leaves and stems can also gum up machinery at harvest.

Management

Scout forage sorghums once a week for sugarcane aphids. Crop damage can occur during the pre-boot stage through grain maturation and often can increase rapidly in hot, dry weather. Look for colonies on the underside of leaves. Check also for honeydew, which can indicate a colony on the leaf above.

In grain sorghum, treatment is suggested when the aphids reach 50 per leaf or more during the pre-boot and boot stage.

Treatment thresholds have not been determined for SCA on forage sorghums. Until they become available, use the thresholds for grain sorghum as a guide for making treatment decisions.

To control SCA with foliar-applied insecticides (Table 6), the insecticide spray must cover the entire plant canopy thoroughly, including the lower leaves.

An alternative to insecticide treatment may be grazing or early harvest. If you are

Table 6. Insecticides labeled for sugarcane aphid control in forage sorghum. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval for hay, forage (days)	Remarks
flupyradifurone	Sivanto Prime	7	7	General use insecticide
sulfoxaflor	Transform WG	7	7	Section 18 registration expires annually. Check current label. General use insecticide

Figure 40. Yellow sugarcane aphid showing the rows of black dots, hairs, and lemon yellow color characteristic of this species

Figure 41. Yellow sugarcane aphid damage

Figure 42. Fall armyworm (top) and corn earworm

planning a second cutting, continue to monitor the infestation weekly because the aphids may reinfest the field.

Yellow sugarcane aphid

The yellow sugarcane aphid is bright lemon yellow and has many long hairs (Fig. 40). Two lines of black dots are usually visible down the back. This aphid feeds on the underside of sorghum leaves but produces little or no honeydew.

While feeding, yellow sugarcane aphids inject a toxic substance into the leaf. The toxin turns the seedling leaves purple and stunts plant growth (Fig. 41). Even a few yellow sugarcane aphids—two or three per leaf—can damage seedling sorghum plants.

Feeding on older plants causes the leaves to turn yellow and die.

Management

Inspect the plants beginning the first week of emergence and twice weekly until the plants have at least five true leaves. Treatment thresholds for yellow sugarcane aphid in forage sorghum have not been determined. Treatment thresholds for grain sorghum range from about 10 percent of the plants with one or more yellow sugarcane aphids per plant at the one-true-leaf stage, and about 40 percent of the plants with one or more yellow sugarcane aphids per plant at the three-true-leaf stage.

For detailed treatment thresholds for grain sorghum plants with one to three true leaves across a range of control costs and crop market values, see Texas A&M AgriLife publication B-1220, *Managing Insect and Mite Pests of Texas Sorghum*, which is available from the county Texas A&M AgriLife Extension office or online at http://www.agrilifebookstore.org/Managing-Insects-and-Mite-Pests-of-Texas-Sorghum-p/eb-1220.htm. See Table 7 for insecticides labeled for aphids.

Chlorpyrifos, zeta-cypermethrin, and beta-cypermethrin do not control the sugarcane aphid, which may increase after these products are applied because of the loss of beneficial insects.

Fall armyworm and corn earworm

The larvae of fall armyworms and corn earworms (Fig. 42) feed on leaves within the whorl of the sorghum plant. When feeding in sorghum whorls, the larvae are called *whorl worms*. As the leaves emerge from the whorl, the feeding damage becomes evident as a series of round or ragged holes across the leaf blade.

Fall armyworms are identified by the white, inverted "Y" pattern on the face. Corn earworms have brown heads, lack the Y pattern, and have short spines along the body (Fig. 58).

To confirm that the culprit is fall armyworms or corn earworms (rather than grasshoppers, etc.), pull the whorl from the plant and unroll the leaves. The larvae and their excrement (*frass*) would be in the tightly rolled leaves.

Although the leaf damage looks dramatic, the forage loss from leaf feeding alone is usually insignificant, and control during the whorl stage is seldom economically justified.

Management

Consider an insecticide treatment (Table 8) if fall armyworms are feeding on the growing point of plants less than 6 inches tall or if infestations threaten to reduce the leaf area by 30 percent or more. Before

Table 7. Insecticides labeled for yellow sugarcane aphid in forage sorghum. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval for hay, silage, forage, or fodder (days)	Remarks
chlorpyrifos*	Lorsban 4E, Chlorpyrifos 4E, Nufos	30 for 1-pint rate, 60 for >1 pint	30 for 1-pint rate, 60 for >1 pint	Do not treat varieties of sweet sorghum. Restricted use insecticide
flupyradifurone	Sivanto Prime	7	7	General use insecticide

*Chlorpyrifos does not control the sugarcane aphid, which may increase after after this product is applied because of the loss of beneficial insects.

Table 8. Insecticides labeled for control of fall armyworms and other caterpillars in forage sorghum. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval for forage (days)	Remarks
chlorantraniliprole	Prevathon, Coragen	—	1	General use insecticide
chlorpyrifos*	Lorsban 4E, Chlorpyrifos 4E, Nufos	30 for 1-pint rate, 60 for >1 pint	30 for 1-pint rate, 60 for >1 pint	For control of armyworms; fall armyworm not listed. Restricted use insecticide
chlorpyrifos + zeta-cypermethrin*	Stallion	—	45	Restricted use insecticide; aids in control of fall armyworm
zeta-cypermethrin*	Mustang Maxx, Respect	Allow to dry	0	For control of armyworms; fall armyworm not listed. Restricted use insecticide

*Sugarcane aphids may increase after this product is applied because it destroys their natural enemies. If sugarcane aphids are present, consider adding Sivanto Prime or Transform to the insecticide mix (see Table 6).

applying an insecticide, confirm that fall armyworms are still present by locating larvae in the whorl.

Controlling fall armyworms with insecticides is difficult because they are somewhat protected in the tightly rolled whorl leaves. Ground applications using 15 to 20 gallons of water per acre with nozzles directed over the top of the row increase penetration of the insecticide deep within the whorl and improve control.

Chemigation of insecticides, if approved on the label, through center pivot systems can improve the chemical's effectiveness.

Because fall armyworm populations increase as the season progresses, late-planted sorghum is at greater risk of infestation than early-planted sorghum.

Grasshoppers in forage sorghum

For information on grasshopper biology, damage, and management, see page 5. Insecticides labeled for control of grasshoppers in forage sorghums are shown in Table 9.

ALFALFA INSECTS

Many types of insects are found in alfalfa and clover. The beneficial insects include pollinators, parasites, and predators. Other insects, which feed on the leaves, stems, crowns, seed pods, and flowers, can cause economic loss when they become abundant.

Some alfalfa cultivars are resistant to certain aphids and diseases. For information on alfalfa varieties with resistance to disease and insect pests, along with other characteristics such as fall dormancy, contact your seed dealer. Also, see *Winter Survival, Fall Dormancy and Pest Resistance Ratings for Alfalfa Varieties*, by the National Alfalfa and Forage Alliance, at http://alfalfa.org/pdf/2011NAFAVariety-Leaflet_small.pdf.

Field scouting: Each week during the growing season, check for insect activity in as much of the field as possible—at least four or five spots in each field. Pest populations can vary across fields, and your results may be inaccurate if you check only a limited area. Sample away from the field edges and avoid sampling when the fields are wet from rain or dew, which makes it difficult to detect insects.

Sweep net sampling: A standard 15-inch-diameter sweep net (Fig. 1) can be used to sample foliage-feeding caterpillars, alfalfa weevil larvae, and plant bugs in

Table 9. Insecticides labeled for control of grasshoppers in forage sorghum. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval for hay (days)	Remarks
beta-cyfluthrin	Baythroid	0	0	Restricted use insecticide
chlorantraniliprole	Prevathon, Coragen	0	1	General use insecticide
chlorpyrifos*	Lorsban 4E, Chlorpyrifos 4E, Nufos	30 for 1-pint rate, 60 for >1 pint	30 for 1-pint rate, 60 for >1 pint	Restricted use insecticide
chlorpyrifos + zeta-cypermethrin	Stallion	—	45	Restricted use insecticide
zeta-cypermethrin	Mustang Maxx	Allow to dry	0	Restricted use insecticide

alfalfa:

1. While walking through the field, take 10 consecutive 180-degree sweeps. Swing the net from side to side with each step. Hold the net so that you draw the lower half of the opening (7 to 8 inches) through the foliage. You should find some foliage and stems in the net; if not, you are not swinging it hard or deep enough.
2. For a good estimate of insect numbers, take five samples (each consisting of 10 sweeps), one from each quadrant of the field and one from near the center. Collect samples 30 to 50 feet or more from the field margin.
3. Calculate the average number of alfalfa weevils, caterpillars, or plant bugs per sweep. Treatment thresholds based on the average number per sweep for each of these pests are presented below.

Beat bucket sampling: To determine the number of alfalfa weevil larvae or aphids per stem using the beat bucket method:

1. Walk across the field and collect a single stem at 30 evenly spaced intervals. Cut each stem carefully at the base to avoid dislodging the larvae, and place the stem inside a small bucket. Collect each stem at random by cutting the first stem that your hand touches.
2. Vigorously beat the 30 stems against the side of the bucket for 20 to 30 seconds to dislodge all of the insects, which will accumulate in the bottom of the bucket. Small alfalfa weevil larvae, which feed between the folded terminal leaves, will not be dislodged. However, because they are small, these larvae do not pose an immediate threat of damage.
3. Remove all of the stems from the bucket, count the stems and the insects, and determine the average number of weevil larvae and aphids per stem.
4. For fields larger than 30 acres, take another 30 stem samples for each additional 30 acres, and average the results for the entire field.

Alfalfa weevil

The alfalfa weevil is primarily a pest of alfalfa but may also attack several species of clover. The larvae damage the plants by feeding on the leaves and buds, stunting plant growth and reducing forage yield and quality.

Figure 1. Scouting for insects using a sweep net

When small, the larvae are light yellow; large larvae are green with a white stripe down the back (Fig. 43). The head is a shiny black. Mature larvae are about ¼ inch long.

The adult alfalfa weevil is a snout beetle about ¼ inch long and brown with a dark brown band down the center of its back (Fig. 44).

Young larvae feed on the leaf buds and between folded leaflets in the plant terminal. Older larvae feed mostly on open leaflets, but they also feed on the terminal buds. The larvae skeletonize the foliage (Fig. 45), which from a distance appears grayish to white.

Mature larvae then drop to the leaf litter and spin silken cocoons. The adult weevils emerge from the cocoons in 1 to 2 weeks.

Females deposit eggs inside of alfalfa stems in the fall, winter, and early spring. The eggs begin to hatch in late winter and early spring when temperatures exceed 50°F. Once larvae are full grown, they pupate and later emerge as adults.

The new adults emerging in late spring feed for a short period and then leave the alfalfa field to go to nearby protected areas for a summer resting period, returning to the fields again in the fall.

The adults also feed on the leaves but cause less damage.

Management

The first cutting is at the greatest risk for alfalfa weevil damage. However, in some

Figure 43. Alfalfa weevil larvae

Figure 44. Alfalfa weevil adult

Figure 45. Alfalfa weevil damage

years, the larvae and adults may threaten the second cutting and require treatment. Begin sampling fields for young larvae as alfalfa terminates dormancy and begins to grow in the spring.

Insecticide treatments may be necessary to protect crop yield if the number of larvae reaches the treatment thresholds (Tables 10 and 11). Sample larvae using a beat bucket or a sweep net as described above.

If the number of larvae is at or above the treatment threshold, and the crop is near harvest, consider harvesting early instead of applying an insecticide. When most of the plants are in the bud stage, cut the first crop as cleanly and closely as possible. Many larvae will die after exposure to the hot soil when the crop is cut. However, during cool, cloudy weather, they may survive under the windrows and damage the regrowth.

Scout for alfalfa weevil damage to regrowth, especially in the strips under the windrows. After cutting or if spring regrowth is short, a good way to sample alfalfa weevil larvae is to count the larvae per square foot.

Table 10. Treatment thresholds for alfalfa weevil larvae

Plant height (inches)	Larvae per terminal/stem	Larvae per square foot	Larvae per sweep
2–6	0.5–1.0	—	—
7–14	1.5	—	20
Near cutting[1]	2.0	—	40–50
Stubble[2] (after cutting)	1	16	—

[1] In alfalfa within 1 to 2 weeks of cutting, it may be advisable to cut early rather than apply an insecticide.
[2] Stubble treatment may be advisable if cloudy conditions and mild temperatures allow many weevils to survive on the stubble under the windrows.

Aphids

Four species of aphids feed on alfalfa in Texas: the pea aphid, cowpea aphid, blue alfalfa aphid, and spotted alfalfa aphid.

Aphids are soft-bodied, slow-moving insects that live in colonies and suck plant sap from stems, leaves, and terminals. Infested plants turn yellow and wilt, and their growth can be stunted. Honeydew can accumulate on the leaves and stems.

Predatory insects and parasites, aphid diseases, and weather conditions often

Table 11. Insecticides labeled for control of alfalfa weevil larvae in alfalfa. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval (days)	Remarks
alpha-cypermethrin	Fastac	—	3	Restricted use
beta-cyfluthrin	Baythroid	—	7	Restricted use
chlorantraniliprole + lambda-cyhalothrin	Besiege	—	7 for hay 1 for forage	Restricted use
chlorpyrifos	Lorsban 4-E, Nufos, etc.	7 for ½ pt/acre, 14 for 1 pt/acre, 21 if more than 1 pt/acre	7 for ½ pt/acre, 14 for 1 pt/acre, 21 if more than 1 pt/acre	Restricted use
chlorpyrifos + gamma-cyhalothrin	Cobalt, Bolton	7–21, see label	7–21, see label	Restricted use
chlorpyrifos + lambda-cyhalothrin	Cobalt Advanced	7–21, see label	7–21, see label	Restricted use
chlorpyrifos + zeta-cypermethrin	Stallion	—	7	Restricted use
cyfluthrin	Tombstone	7	7	Restricted use
gamma-cyhalothrin	Declare, Proaxis	—	7	Restricted use
indoxacarb	Steward	—	7	General use
lambda-cyhalothrin	Warrior II, Karate, Lambda Cy, generics	—	7 for hay, 1 for forage	Restricted use
permethrin	Ambush, Pounce, generics	—	14	Restricted use
phosmet	Imidan 70 WP	7	7	Danger—poison. Do not enter fields for 5 days after treatment. General use
zeta-cypermethrin	Mustang Maxx, Respect	3	3	Restricted use

keep aphid numbers low. However, aphids have a high reproductive rate and can increase very rapidly under favorable conditions.

To sample aphid infestations, estimate the number of aphids per alfalfa stem by looking at the plants or using the beat bucket method as described above (page 15). Aphids dislodged by beating the stems into a beat bucket are easily viewed for estimating the number per stem.

Sample at least 30 stems at random for each 30-acre area within the field. Use the treatment thresholds to determine when an insecticide is justified to avoid crop loss from aphid feeding (Tables 12 and 13).

Table 12. Treatment thresholds for aphid control in fields of established alfalfa

Aphid	Hay height (inches)	Average number of aphids per stem
Pea[1,3,4]	<10	40
	10–20	50–80
	>20	100 or more
Blue alfalfa[1,3] Cowpea[2]	<10	10–12
	10–20	20–40
	>20	50 or more
Spotted alfalfa[2,3]	<10	10
	>10	30

[1] Thresholds from *Blue Alfalfa Aphid* and *Pea Aphid*, University of California, http://ipm.ucanr.edu/PMG/r1300211.html
[2] Thresholds from *Cowpea Aphid*, University of California, http://ipm.ucanr.edu/PMG/r1301511.html
[3] Thresholds from *Spotted Alfalfa Aphid*, University of California. http://ipm.ucanr.edu/PMG/r1300311.html
[4] Thresholds from *Alfalfa Aphids in Oklahoma*, Oklahoma State University. http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2360/EPP-7184web.pdf

Table 13. Insecticides labeled to control aphids in alfalfa (see label for specific aphid species). Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval (days)	Remarks
chlorpyrifos	Lorsban, Nufos, etc.	—	7–21, see label	Restricted use
chlorpyrifos + gamma-cyhalothrin	Cobalt, Bolton	7–21, see label	7–21, see label	Restricted use
chlorpyrifos + lambda-cyhalothrin	Cobalt Advanced	7–21, see label	7–21, see label	Restricted use
dimethoate	Dimethoate 4EC, generics	—	10	General use
flupyradifurone	Sivanto Prime	—	7	General use

Pea aphid

The most common aphid species in Texas alfalfa and clover crops is the pea aphid (Fig. 46). The adults are bright green with long legs. They are about ⅛ inch long, making them the largest aphid species found in alfalfa.

The tip of each antennal segment is black, unlike those of blue alfalfa aphid, which has uniformly dark antennae.

Pea aphids congregate in dense colonies along the stems, terminal shoots, and leaves. Infested plants yellow and wilt. Often, crops are damaged the most in the spring. Honeydew is usually not abundant on infested plants.

Management

Figure 46. Pea aphid showing dark bands on the tips of the antennae

Resistant cultivars are very helpful in reducing pea aphid damage. For varieties with some resistance, see *Winter Survival, Fall Dormancy and Pest Resistance Ratings for Alfalfa Varieties*, by the National Alfalfa and Forage Alliance, at http://alfalfa.org/pdf/2011NAFAVarietyLeaflet_small.pdf.

Use the treatment thresholds to determine when an insecticide is justified in established alfalfa to avoid crop loss (Tables 12 and 13). For seedling plants, the treatment threshold is an average of five pea aphids per plant.

Blue alfalfa aphid

The blue alfalfa aphid (Fig. 47) looks much like the pea aphid but is blue-green and slightly smaller, and the antennae are uniformly dark. The pea aphid is bright green and has a dark band at the tip of each antennal segment.

Blue aphid populations tend to build up in the early spring but decline when temperatures exceed 85°F. Feeding may severely stunt the plants and deform the leaves of new alfalfa regrowth less than 6 inches tall when temperatures are below 75°F. The leaves yellow as the plants die. Infestations often congregate at the top of each stem.

Figure 47. Blue alfalfa aphid (no dark bands on antennae)

Figure 48. Cowpea aphids

Figure 49. Spotted alfalfa aphids

Management

Several alfalfa cultivars are resistant to this pest. For varieties with some resistance, see *Winter Survival, Fall Dormancy and Pest Resistance Ratings for Alfalfa Varieties*, by the National Alfalfa and Forage Alliance, at http://alfalfa.org/pdf/2011NAFAVarietyLeaflet_small.pdf.

Scout for blue alfalfa aphids in dormant alfalfa early in the spring. Use the treatment thresholds to determine when an insecticide is justified in fields of established alfalfa (Tables 12 and 13). For seedling plants, the treatment threshold is an average of one blue aphid per plant.

Cowpea aphid

Cowpea aphids (Fig. 48) are easily distinguished from all other aphids found in alfalfa by their dark blue-black color. The adults are shiny, the nymphs dull. The legs of both stages are off-white with black tips.

This species injects a toxin while feeding that can stunt and kill plants. It also produces large amounts of sticky honeydew.

Cowpea aphids typically increase to damaging numbers in the early spring when the alfalfa is still dormant. When the plants break dormancy, those infested plants fail to grow, and some wilt and die.

Management

Resistant cultivars can help reduce cowpea aphid damage. For varieties with some resistance, see *Winter Survival, Fall Dormancy and Pest Resistance Ratings for Alfalfa Varieties*, by the National Alfalfa and Forage Alliance, at http://alfalfa.org/pdf/2011NAFAVarietyLeaflet_small.pdf.

Scout for cowpea aphids in dormant alfalfa in the spring. Use the treatment thresholds to determine when an insecticide is justified to avoid crop loss (Tables 12 and 13).

Spotted alfalfa aphid

The spotted alfalfa aphid is 1/16 inch long and grayish yellow to yellow-green (Fig. 49). It has four to six rows of raised dark spots on the back.

These aphids are usually found on the undersides of the lower leaves. However, as the population increases, they infest all parts of the plant.

As it feeds, this insect causes a toxic reaction, injuring the plant and even killing seedlings. On established stands, the plants are stunted severely, and yellow (*chlorotic*) areas appear on the leaves. The veins of newly formed leaves often become discolored, a symptom known as *vein banding*.

Spotted alfalfa aphids secrete large amounts of honeydew, which interferes with cutting and baling and degrades hay quality. When disturbed, the aphids fall from the alfalfa plants. The insects can also increase during the fall on seedling alfalfa plants.

Management

Resistant cultivars offer varying degrees of protection from yield and stand losses from the spotted alfalfa aphid. For varieties with resistance, see *Winter Survival, Fall Dormancy and Pest Resistance Ratings for Alfalfa Varieties*, by the National Alfalfa and Forage Alliance, at http://alfalfa.org/pdf/2011NAFAVarietyLeaflet_small.pdf.

Scout for spotted alfalfa aphids on the underside of the leaves, Also look for them near their honeydew, in stunted plants, and near the aphids' characteristic vein banding injury. Use the treatment thresholds to determine when an insecticide is justified in fields of established alfalfa (Tables 12 and 13).

In the fall, look for increases of these aphids on alfalfa seedlings. For seedling plants, the treatment threshold is an average of one to three spotted aphids per plant.

Blister beetles

Although blister beetles do not damage the crop, they contain a chemical, cantharidin, that when consumed is poisonous to livestock, especially horses and chickens. Harvest machinery can pick up live and dead blister beetle adults and incorporate them into hay bales.

Most species of adult blister beetles are narrow, cylindrical, and relatively soft-bodied with long antennae and legs. The head is always distinctly wider than the neck. This feature will easily separate blister beetles from the other beetles commonly found in alfalfa.

The striped blister beetle, *Epicauta* spp., is common in alfalfa. The beetle is yellow and ⅜ to ¾ inch long and has three dark stripes on each wing cover (Fig. 50). It is active on the plant in the morning and late afternoon. On hot days, it may shelter low

Figure 50. Striped blister beetle

Figure 51. Blister beetles

in the canopy.

Other species of blister beetles are black, brown, gray, reddish, and metallic green and blue. (Fig. 51). Photos of many blister beetle species found in Texas are posted at http://texasento.net/TXMeloidae.html

Blister beetles feed primarily on the blooms and tender leaves of alfalfa and many other plants. The immature stage feeds on grasshopper eggs.

Management

Monitor alfalfa fields for blister beetles before cutting hay, especially during June through September, when the beetles usually move into the fields. The risk of blister beetle infestation is generally lower in the first cutting. Blister beetles are best sampled using a sweep net (Figure 1).

Begin field monitoring at least a week before cutting and continue throughout the baling process. Pay close attention to blooming fields, as they are very attractive to blister beetles.

Adult beetles are mobile, and some species are prone to congregate in one or a few small spots within a field. Leave infested areas unharvested or spray them with an insecticide spot treatment (Table 14).

All of the insecticides labeled for blister beetle control are toxic to honeybees and other insect pollinators. Refer to the insecticide label for precautions and restrictions regarding pollinators.

Blister beetles are attractive to blooming fields, where they feed on flowers. Therefore, cutting hay before or at 5 percent bloom can reduce the risk of blister beetle infestations. Striped blister beetles typically congregate into groups or "swarms" of beetles. While cutting, closely watch for swarms and avoid cutting areas of the field where blister beetles are observed.

To reduce the risk of dead beetles being baled into the hay, remove the crimper device, which can crush the beetles into the hay, from the swathers. Cutting without a crimper allows the living beetles to leave the windrow before the hay is baled.

Also, raking the hay before bailing can help dislodge dead beetles from the hay. Because wheel traffic can crush beetles into the hay, avoid driving over standing or freshly cut hay.

Note that some insecticides have a 7- to 21-day waiting period before harvest, which allows time for the beetles to move back into the field. For this reason, inspect the fields again before harvest to determine if the beetles have reinfested treated fields.

Foliage-feeding caterpillars

Larvae of the alfalfa caterpillar, several armyworm species, the corn earworm, and webworms feed on the tender stems and leaves of alfalfa. The sweep net method (page 15) is used to sample most foliage-feeding caterpillars.

Alfalfa caterpillar

The alfalfa caterpillar is the larval stage of a yellow butterfly (Fig. 52) commonly seen in alfalfa fields during late spring and summer. The adult has a 2-inch wingspan and black margins on the wings.

Female alfalfa butterflies lay eggs singly on the underside of alfalfa leaves. The eggs hatch in a few days, and the larvae feed on

Table 14. Insecticides labeled for blister beetles in alfalfa. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval (days)	Remarks
carbaryl	Sevin 4F, Carbaryl 4L	7	7	General use
chlorantraniliprole + lambda-cyhalothrin	Besiege	0	7 for hay 1 for forage	Restricted use
chlorpyrifos + gamma-cyhalothrin	Cobalt, Bolton	7–21, see label	7–21, see label	Restricted use
chlorpyrifos + lambda-cyhalothrin	Cobalt Advanced	7–21, see label	7–21, see label	Restricted use
gamma-cyhalothrin	Declare, Proaxis	—	7	Restricted use
lambda-cyhalothrin	Warrior II, generics	—	7 for hay 1 for forage	Restricted use

Figure 52. Alfalfa caterpillar adult

Figure 53. Alfalfa caterpillar larva

the leaves for 12 to 15 days before pupating.

Mature larvae are about 1½ inches long and dark, velvety green with white stripes along each side (Fig. 53). They have large, rounded heads.

The alfalfa caterpillar is usually most abundant in mid to late summer.

Management

Early cutting is an option for controlling alfalfa caterpillars. Sample using a sweep net (page 15). Consider applying an insecticide (Table 15) if sweep net samples average seven or more foliage-feeding caterpillars per sweep or if defoliation by these caterpillars exceeds 10 percent.

Armyworms

Armyworms are the immature stages of dull-colored moths (Fig. 54). The beet and fall armyworms (Figs. 55 and 56) are commonly found on alfalfa and clover crops; the yellow-striped armyworm is an occasional pest in alfalfa. Armyworm infestations are usually most severe in mid to late summer.

Armyworms lay masses of several hundred eggs each, which hatch in 2 to 3 days. The larvae feed in groups when they are young and disperse as they mature. Full-grown larvae are 1½ inches long. The larvae feed for about 3 weeks before crawling to the soil where they pupate.

Management

Sample using a sweep net (page 15). Consider an insecticide treatment (Table 15) if the samples average seven or more foliage-feeding caterpillars per sweep or

Table 15. Insecticides labeled for alfalfa caterpillars, armyworms, cutworms, and webworms in alfalfa. Some insecticides listed do not control all of these caterpillars. Refer to the product label for specific pests controlled. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval (days)	Remarks
alpha-cypermethrin	Fastac	—	3	Restricted use
beta-cyfluthrin	Baythroid	—	7	Restricted use
carbaryl	Sevin 4F, Carbaryl 4L	—	7	General use
chlorantraniliprole	Prevathon	0	0	General use
chlorantraniliprole + lambda-cyhalothrin	Besiege	—	7 for hay, 1 for forage	Restricted use
chlorpyrifos	Lorsban, Nufos, etc.	—	7–21; see label	Restricted use
chlorpyrifos + gamma-cyhalothrin	Cobalt, Bolton	7–21; see label	7–21; see label	Restricted use
chlorpyrifos + lambda-cyhalothrin	Cobalt Advanced	7–21; see label	7–21; see label	Restricted use
chlorpyrifos + zeta-cypermethrin	Stallion	—	7	Restricted use
cyfluthrin	Tombstone	7	7	Restricted use
gamma-cyhalothrin	Declare, Proaxis	—	7	Restricted use
indoxacarb	Steward	—	7	General use
lambda-cyhalothrin	Warrior II, Karate, Lambda Cy, generics	—	7 for hay, 1 for forage	Restricted use
methoxyfenozide	Intrepid	—	7	General use; not labeled for cutworms
permethrin	Ambush, Pounce generics	—	14	Restricted use
zeta-cypermethrin	Mustang Maxx, Respect	3	3	Restricted use

Figure 54. Beet armyworm adult

Figure 55. Beet armyworm larva

Figure 56. Fall armyworm larva

Figure 57. Corn earworm larva

if defoliation by these caterpillars exceeds 10 percent. Early cutting is an option for controlling armyworm caterpillars.

Corn earworm

Corn earworm larvae are greenish with light brown heads (Fig. 57). Fully developed worms are about 1½ inches long and pale green, pinkish, or brown. Unlike the fall armyworm, these caterpillars do not have an inverted "Y" pattern between their eyes (Fig. 58), and they lay eggs singly. The larvae are usually most abundant from July through September.

The adult or moth stage is yellowish brown with a dark band near the wing margin (Fig. 59).

Management

Consider an insecticide treatment (Table 15) if sweep net samples average seven or more foliage-feeding caterpillars per sweep or if defoliation by these caterpillars exceeds 10 percent. Early cutting is an option for controlling corn earworm caterpillars.

Webworms

The alfalfa webworm and garden webworm (Fig. 60) feed on alfalfa, clover, cowpeas, peas, and similar crops as well as on several weed species, especially pigweed.

Webworm larvae create flimsy webs in the tops of plants and feed within the webs. They completely skeletonize the leaves. Webworms occasionally cause severe damage to alfalfa, primarily in East Texas.

Management

Harvest early if the infested crop is near the cutting stage. The action level for applying an insecticide is when the crop is more than 2 weeks from cutting and 25 to 30 percent of the plant terminals are infested with webworms (Table 15). Insecticides can be less effective when the webs and larvae are large.

Cutworms

Army cutworm

Army cutworm larvae are pale gray and up to 2 inches long (Fig. 61). Female moths (Fig. 62) lay eggs on the soil in the fall, and young larvae hibernate in the soil over the winter.

Army cutworms begin feeding on alfalfa leaves as the weather warms in late winter and early spring. Most damage occurs before the first cutting and to newly planted stands. They feed above the soil surface from late afternoon until daylight the next morning. During bright sunshine, they hide in the soil and under clods, alfalfa crowns, and field debris.

Management

An indication that army cutworms may be damaging alfalfa is the failure of a field to begin growing in the spring. This cutworm can also severely damage newly planted alfalfa. Scout the fields closely for this pest and aphids when the alfalfa shoots start growing in late winter and early spring.

In seedling alfalfa, the threshold for control is two cutworms per square foot. In established alfalfa, it is three or more per square foot when the larvae are ½ inch long or less, and two or three larvae per square foot when they are longer than ½ inch long (Table 15).

Variegated cutworm

The variegated cutworm larva is pale gray to light brown and has four to seven pale

Figure 58. Fall armyworm (left) and corn earworm

Figure 59. Corn earworm adult

Figure 60. Webworm larva

Figure 61. Army cutworm larva

Figure 62. Army cutworm adult

Figure 63. Variegated cutworm larva

Figure 64. Variegated cutworm adult

yellow diamond-shaped spots aligned along the center of its back (Fig. 63). Full-grown larvae are 1½ to 2 inches long. When disturbed, the larvae curl into a C-shape.

These cutworms feed on alfalfa leaves and stems but may also cut plants off at the soil surface. They feed at night and hide beneath loose soil and plant debris during the day.

The forewings of the adults are grayish brown with pale, oval markings near the wing edge; the hind wings are white with brown markings (Fig. 64).

Damaging infestations typically occur during the spring.

Management

Scout the fields closely for this pest and aphids when alfalfa shoots begin growing in early spring. They may also damage regrowth after the first cutting.

Look for larvae beneath loose soil and plant debris during the day. The larvae may also congregate under windrows of cut hay where they feed on the regrowth.

Consider an insecticide treatment (Table 15) if you find an average of two or more larvae per square foot and the larvae are 1½ inches long or less. Larger larvae have almost completed feeding and are less susceptible to insecticides.

Other alfalfa pests

Three-cornered alfalfa hopper

The adult three-cornered alfalfa hopper (Fig. 65) is a green, wedge-shaped insect that is about ¼ long and flies when disturbed. The nymphs (immatures) lack wings and have saw-toothed spines on the back (Fig. 66).

This insect feeds on plant sap by repeatedly puncturing the stem and creating a series of feeding wounds that girdles the stem just above the soil surface. Girdled stems become stunted and weakened and can break over (Fig. 67). The leaves on affected stems turn red underneath and light yellow-green on top. Damaged stems that develop these symptoms usually die. These leaf symptoms can mimic those of boron deficiency.

Most of the feeding damage is caused by the nymphs, the immature stage. Three-cornered alfalfa hoppers also feed on soybeans, peanuts, and other legumes.

Management

Look for girdled stems and examine crowns near the soil surface for nymphs feeding on stems and girdled stems that have not yet fallen over. Consider treatment when 10 percent of the stems are girdled.

Leafhoppers

Adult leafhoppers are wedge-shaped insects that jump, fly quickly when disturbed, and land nearby. Most species are various shades of green or brown; the adults are ⅛ to ⅜ inch long (Fig. 68).

Immature leafhoppers cannot fly; they move quickly to the back of the stems when disturbed. Immatures and adults are easily distinguished from similar insects such as aphids and immature tarnished plant bugs by their curious behavior of quickly moving sideways or backward when disturbed.

Figure 65. Three-cornered alfalfa hopper adult

Figure 66. Three-cornered alfalfa hopper nymph

Figure 67. Damage to peanut plant by three-cornered alfalfa hoppers

Figure 68. Leafhopper

Figure 69. Yellow and red leaf tips and margins on alfalfa caused by potato leafhoppers

Leafhoppers feed by sucking plant juices. When populations are high, feeding may cause stunted growth and leaf yellowing. Leafhopper feeding causes the leaf tips and margins to turn yellow and red (Fig. 69). Of most concern in alfalfa are leafhoppers in the genus *Empoasca*, which includes the potato leafhopper. They are bright green and about ⅛ inch long.

Management

For 3-inch-tall alfalfa, consider treatment (Table 16) if leaf-tip damage is present and you find an average of four leafhoppers in 20 sweeps. If the crop is 6 inches tall, consider treatment if there is an average of 10 leafhoppers per 20 sweeps. If infestations are not detected until plants are yellowed and stunted, take an early harvest to kill leafhopper eggs deposited in the stems, followed by an insecticide application to the regrowth.

Monitor the field margins because leafhopper populations generally increase there first. If the margins have high leafhopper populations, margin or spot treatments may provide adequate control.

Grasshoppers

For grasshopper biology, damage, and management, see pages 5 through 7. Table 17 lists insecticides labeled for controlling grasshoppers in alfalfa.

Figure 70. Clover head weevil adult

Clover insects

Armyworms

For information on the biology, damage, and management of armyworms, see pages 3 through 5.

Table 18 lists insecticide recommendations for controlling these pests on clover.

Clover head weevil and alfalfa weevil

In Texas, the clover head weevil, *Hypera meles*, is primarily a pest of crimson, alsike, and red clover. Full-grown clover head weevil larvae are about ½ inch long and legless, and they have a black head and four light green to dark brown lines running down the back.

The larvae feed on the flowers and developing seeds of most clover species and alfalfa plants. Seed production and natural reseeding are reduced.

Adult weevils (Fig. 70) are about 3/16 inch long and uniformly brown to almost black. The adults lay eggs on clover plants in late March or early April. The eggs are deposited in the leaf stems.

Egg-laying damage to stems can result in lodging of the flowers. Larval populations normally peak during April. The next adult generation leaves the field and remains inactive in leaf litter until the next spring. There is one generation per year.

Management

If you want the clover to reseed naturally, you must control the adult weevils before

Table 16. Insecticides labeled for three-cornered alfalfa hoppers and leafhoppers in alfalfa. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval (days)	Remarks
alpha-cypermethrin	Fastac	—	3	Restricted use
beta-cyfluthrin	Baythroid	—	7	Restricted use
carbaryl	Sevin 4F, Carbaryl 4L	—	7	General use
chlorantraniliprole + lambda-cyhalothrin	Besiege	—	7 for hay, 1 for forage	Restricted use
chlorpyrifos + gamma-cyhalothrin	Cobalt, Bolton	7–21; see label	7–21; see label	Restricted use
chlorpyrifos + lambda-cyhalothrin	Cobalt Advanced	7–21; see label	7–21; see label	Restricted use
chlorpyrifos + zeta-cypermethrin	Stallion	—	7	Restricted use
cyfluthrin	Tombstone	7	7	Restricted use
gamma-cyhalothrin	Declare, Proaxis	—	7	Restricted use
flupyradifurone	Sivanto Prime	—	7	General use
lambda-cyhalothrin	Warrior II, Karate, Lambda Cy, generics	—	7 for hay, 1 for forage	Restricted use
zeta-cypermethrin	Mustang Maxx, Respect	3	3	Restricted use

Table 17. Insecticides labeled for grasshoppers in alfalfa. Follow label directions.

Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval (days)	Remarks
alpha-cypermethrin	Fastac	—	3	Restricted use
beta-cyfluthrin	Baythroid	—	7	Restricted use
chlorantraniliprole	Prevathon	0	0	General use
chlorantraniliprole + lambda-cyhalothrin	Besiege	—	7 for hay, 1 for forage	Restricted use
chlorpyrifos	Lorsban 4-E, Nufos, etc.	7 for ½ pt/acre, 14 for 1 pt/acre, and 21 for >1 pt/acre	7 for ½ pt/acre, 14 for 1 pt/acre, and 21 for >1 pt/acre	Restricted use
chlorpyrifos + gamma cyhalothrin	Cobalt, Bolton	7–21; see label	7–21; see label	Restricted use
chlorpyrifos + lambda-cyhalothrin	Cobalt Advanced	7–21; see label	7–21; see label	Restricted use
chlorpyrifos + zeta-cypermethrin	Stallion	—	7	Restricted use
cyfluthrin	Tombstone	7	7	Restricted use
dimethoate	Dimethoate 4EC, generics	—	10	General use
gamma-cyhalothrin	Declare, Proaxis	—	7	Restricted use
lambda-cyhalothrin	Warrior II, Karate, Lambda-cy and other generics	—	7 for hay, 1 for forage	Restricted use
zeta-cypermethrin	Mustang Maxx, Respect	3	3	Restricted use

Table 18. Insecticides labeled for clover. Follow label directions.

Pest	Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval for hay (days)	Remarks
Aphids	malathion	Malathion	—	0	Restricted use
	zeta-cypermethrin	Mustang Maxx, Respect	3	3	Restricted use
Armyworms	carbaryl	Sevin 4F, Carbaryl 4L	7	7	General use
	chlorantraniliprole	Prevathon	0	0	General use
	methoxyfenozide	Intrepid 2F	0	7	General use
	zeta-cypermethrin	Mustang Maxx, Respect	3	3	Restricted use
Clover head weevil	carbaryl	Sevin 4F, Carbaryl 4L	7	7	General use
Grasshoppers	chlorantraniliprole	Prevathon	0	0	General use
	zeta-cypermethrin	Mustang Maxx, Respect	3	3	Restricted use

Figure 71. Vetch bruchid adult

Figure 72. Lygus bug

they deposit eggs. Begin sampling for weevils when the plants start to bloom.

Consider treating with a labeled insecticide (Table 18) if adult weevils are present on 10 to 20 percent of the flower heads and 25 to 50 percent of the plants are in bloom. A second insecticide treatment may be needed if clover head weevil adults are present 7 to 10 days after the first application.

Avoid applying an insecticide when pollinating insects are in the field. Check the insecticide label for restrictions protecting pollinators. See the discussion on alfalfa weevil if this pest is attacking clover.

Grasshoppers

For information on the biology, damage, and management of grasshoppers, see page 5. Table 18 lists insecticide recommendations for controlling these pests on clover.

Vetch insects

Vetch bruchid

One of the most damaging pests of hairy vetch grown for seed is the vetch bruchid, or vetch weevil (Fig. 71). This insect does not attack the seed of plain or smooth varieties of vetch.

The legless larva is yellowish white with a black head and is found only inside the vetch seed. The adults are about ⅛ inch long and black with mottled markings of white and gray.

Although the adults feed on developing flower buds and pollen, the larvae cause the primary damage by consuming the developing seed.

Bruchids do not reproduce in stored vetch seed but may be found occasionally inside the seed hulls. The adult bruchid overwinters in vetch fields or nearby. In the spring, the females glue their eggs to the developing seed pods.

After hatching, the larva tunnels through the pod wall and into the immature seed. Only one weevil develops within a seed. The larvae feed on the developing seed for about 4 weeks.

The adult bruchid emerges from inside the seed through the circular hole previously made by the larva. There is only one generation per year.

Management

Insecticide treatments must be timed to kill adults before they begin to deposit eggs on the seed pods. Larvae hatching from eggs will tunnel directly into the pod, thus avoiding contact with insecticides.

Apply insecticide (Table 19) shortly after the first pods appear and when the eggs are on the pods. If adult bruchids are present about a week after application, a second application may be necessary to maintain control. A sweep net (page 15) is effective in sampling a field for adult bruchids.

Note that insecticides such as malathion and zeta-cypermethrin are toxic to all bees. To minimize the impact of insecticides on bees, treat in the late evening or at night after the bees are no longer foraging. Also, work with nearby beekeepers to protect bees from insecticide treatments. Refer to the insecticide label for restrictions regarding pollinators.

Table 19. Insecticides labeled for vetch. Follow label directions.

Pest	Active ingredient	Insecticide	Pre-grazing interval (days)	Pre-harvest interval (days)	Remarks
Armyworms	methoxyfenozide	Intrepid	—	7	General use
	zeta-cypermethrin	Mustang Maxx, Respect	3	3 for hay, 7 for harvest of seed	Restricted use
	chlorantraniliprole	Prevathon	0	0	General use
Grasshoppers	chlorantraniliprole	Prevathon	0	0	General use
	zeta-cypermethrin	Mustang Maxx, Respect	3	3 for hay, 7 for harvest of seed	Restricted use
Lygus bugs, Aphids	zeta-cypermethrin	Mustang Maxx, Respect	3	3 for hay, 7 for harvest of seed	Restricted use
Vetch bruchid	malathion	Malathion	—	0	General use

Pea aphids, thrips, and lygus bugs
Sucking insect pests of vetch include pea aphids (Fig.46), thrips, and lygus bugs (Fig. 72). Treatment guidelines have not been developed for these vetch pests.

Pea aphids are bright green and often most abundant in the spring. They suck plant sap from the terminals and stems. Feeding can cause plant wilting, yellowing foliage, and reduced seed production.

Lady beetles, lacewing flies, and other beneficial insects feed on pea aphids. If warranted, apply insecticide (Table 19) to control these aphids.

Thrips are tiny (1/15 inch long), cigar-shaped insects with bodies that are much longer than they are wide. They are generally yellow to light brown.

Large numbers of thrips may cause blasting (abortion or deformed at emergence) and shedding of blooms in seed-production fields.

Lygus bugs are oval, 1/4 inch long, and relatively flat in profile. They may be dark brown, light tan, light yellow, or light green and have a distinctive light-colored triangle in the middle of the back.

Lygus bugs are a concern in seed production fields because they feed on flower buds, causing flower abortion.

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