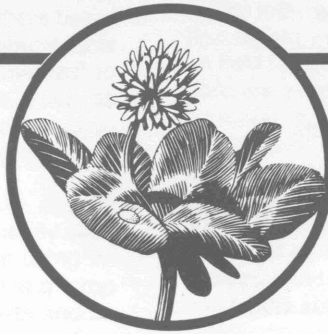


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Texas Agricultural Extension Service

Managing Insect and Mite Pests of Legumes, Grasses and Forage Crops in Texas



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Managing Insect and Mite Pests of Legumes, Grasses and Forage Crops in Texas

C.T. Allen and Clifford E. Hoelscher*

Suggestions in this publication are based on the results of an annual review of pest management research and concepts developed by a committee of state and federal research personnel and Extension specialists. Insect management practices are directed toward the most effective, safest and most profitable means of minimizing crop loss from insect pests.

In planning an insect pest management (IPM) program, the producer should consider the effective use of cultural control practices, natural biological control agents, resistant crop seed and accurate field scouting to determine action levels (when chemical control measures are warranted). IPM programs utilize all available means to keep pest numbers below levels that cause economic crop damage. Management tools include: cultural control, such as timing of crop harvest to limit insect attack; crop management practices, such as varietal selection; biological control, involving conservation of existing natural enemies of pests; host plant resistance; and selected use of insecticides.

Although most of the management tools are usually available, pesticides or insecticides remain a frequently used control tool. Major factors to be considered when using insecticides include: 1) protection of natural enemies of crop pests; 2) resurgence of primary insect or mite pests and increased numbers of secondary insect pests following application; 3) insect resistance to insecticides; and 4) effects on livestock, man and other non-target organisms. Apply insecticides at the proper rates and only when field inspection counts justify the need to prevent economic losses from damaging pests.

INSECTICIDE APPLICATION

Ground equipment or aircraft may be used to apply most insecticides. For best results with aerial applications, flag the swaths to meet or overlap. Spray applications are most effective and drift hazards minimized when wind velocity does not exceed 10 miles per hour.

Nozzle size and number, ground speed and application pressure influence the rate of insecticide output per acre. The sprayer should be carefully calibrated to insure proper application of suggested insecticide rates. Plant coverage is essential for optimum insect or mite control, but use of excess insecticide may result in residue accumulation, possible injury to the plants and an increase in production cost. Extremely low rates may result in poor control.

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Proper sprayer calibration, nozzle choice and placement will insure adequate spray volume, good foliar coverage and application of the required rate of toxicant. Refer to L-764, *Pesticide Application Ground Equipment Calibration Guide*, for additional information.

POLICY STATEMENT FOR MAKING PEST MANAGEMENT SUGGESTIONS

The information and suggestions included in this publication reflect the opinions of Extension entomologists based on field tests and use experience. Our management suggestions are a product of research and are believed to be reliable. However, it is impossible to eliminate all risk. Conditions or circumstances which are unforeseen or unexpected may result in less than satisfactory results even when these suggestions are used. The Texas Agricultural Extension Service will not assume responsibility for risks. Such risks shall be assumed by the user of this publication.

Suggested pesticides must be registered and labeled for use by the 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 printed. County Extension agents and appropriate specialists are advised of changes as they occur.

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

PROTECTING BEES AND OTHER POLLINATORS FROM INSECTICIDES

Pollination is extremely important in the production of many seed crops. This is particularly true of legumes such as alfalfa, clover and vetch. Most grassy plants are wind- or self-pollinated and do not require the assistance of insect pollinators. Where pollen collecting insects are required for flower fertilization, the producer, insecticide applicator and beekeeper should cooperate closely to minimize losses of bees. The following guidelines will prevent or reduce bee losses:

1. Apply insecticides, if practical, *before* bees are moved into the fields for pollination.
2. When insecticides are needed, use materials least toxic to bees.
3. Make all applications late in the evening (6 to 7 p.m.) when bees are not visiting the field. **EVENING APPLICATIONS AFTER BEES HAVE LEFT THE FIELD ARE LESS HAZARDOUS THAN EARLY MORNING APPLICATIONS.**
4. Use spray or granular formulations rather than dust.
5. Where it is necessary to use one of the insecticides in Groups 1 or 2 in the following list, notify the beekeeper so that he can make necessary arrangements to protect the bees.
6. Avoid drifting or spraying an insecticide directly on bee colonies. Heavy losses generally occur in these situations. On hot evenings, bees often cluster on the fronts of the hives. Pesticide drift or direct spray at this time generally results in heavy mortality.

INSECTICIDES GROUPED ACCORDING TO RELATIVE HAZARDS TO HONEY BEES

Insecticides	Remarks
Group 1. Highly Toxic Carbaryl (Sevin® 80S sprayable, Sevin® XLR) Carbofuran (Furadan®) Chlorpyrifos (Lorsban®) Diazinon Dimethoate (Cygon® , Dimethoate®) Fensulfothion (Dasanit®) Malathion (wetable powder or ULV) Methidathion (Supracide®) Methomyl (Lannate® , Nudrin®) Methyl Parathion Naled (Dibrom®) Parathion Phosmet (Imidan®)	This group includes materials that kill bees on contact during application or for several days afterward. With some exceptions, bees should be removed from the area if these materials are used on plants being visited by the bees. Because of short residual activity, Naled can be applied to the crops when bees are not foraging. Malathion occasionally causes heavy bee losses, particularly during periods of extremely high temperatures. Application of malathion should be made in the evening after all bees have completed foraging. Ultra low-volume malathion applications should be avoided after blooms appear. Other insecticide formulations pose far less hazard because there is less potential for pollinator/pesticide contact. This is particularly true of soil-applied granular formulations. Foliar applications of granular formulations should pose an intermediate hazard and should not be applied when bees are working in the field.
Group 2. Moderately Toxic Carbophenothion (Trithion®) Disulfoton (Di-Syston®) Malathion (EC) Phorate (Thimet®)	Do not apply when bees are working in the field. Apply in late evening.
Group 3. Relatively Non-Toxic Amidinohydrazone (Amdro®) Bacillus thuringiensis (Dipel® , Thuricide® , Bactur®) Trichlorfon (Dylox®)	These materials are least toxic to bees. Applications should be made in late evening when bees are not foraging.

PRECAUTIONS

Some insecticides discolor the foliage of certain sorghum varieties. Stunting and foliage burn have resulted from the use of specific chemicals on certain sorghum hybrids. Before application, growers should closely check the insecticide label and contact the manufacturer and the seed company regarding possible phytotoxic effects.

ALFALFA AND CLOVER PESTS

A large variety of insects are found in alfalfa and clover. Some are only visitors or may be feeding on other plants scattered in the alfalfa or clover fields. Other are present in small numbers and do not cause economic damage. Many are beneficial. Beneficial insects include the insect pollinators and parasites and predators that tend to keep insect pest numbers below economic levels. However, several insect pests are injurious. These pests feed on the leaves, stems, crowns, seed pods and flowers, resulting in foliage and/or seed yield loss.

Resistant Cultivars

One of the best ways to avoid insect related losses to hay and forage crops is to plant cultivars which are resistant to insect damage. Many cultivars are available which have both insect and disease resistance. The relative levels of resistance in many of the commercially available alfalfa cultivars are provided in the following table.

CHARACTERISTICS OF AVAILABLE ALFALFA VARIETIES*

Variety	Marketing Contact	FD	BW	VW	FW	AA	PR	SA	PA	BA	SN	RK
Alfalee	NC + Hybrids	4	R	—	R	R	R	MR	R	—	—	—
Magnum	Dairyland	4	R	—	R	MR	LR	R	R	—	MR	—
Magnum +	Dairyland	4	R	LR	R	MR	R	LR	—	—	—	—
Magnum III	Dairyland	4	R	MR	R	R	R	—	—	—	—	—
Maxim	Hoffman	4	R	R	R	MR	MR	R	R	MR	R	—
Mustang	Jung	4	R	MR	R	MR	R	MR	—	—	—	—
Peak	Research Seeds	4	R	LR	R	—	MR	—	HR	—	HR	—
Preserve	Northrup King	4	R	—	R	MR	MR	MR	—	—	—	—
Rador	Northrup King	4	R	—	MR	R	—	—	—	—	—	—
Riley	Public	4	HR	LR	—	MR	—	HR	HR	—	—	—
Salute	United Agriseed	4	HR	MR	R	MR	R	LR	—	—	—	—
Saranac	Public	4	R	—	—	—	—	—	—	—	—	—
Saranac AR	Public	4	MR	—	R	HR	—	—	—	—	—	—
Summit	Northrup King	4	R	R	R	HR	R	MR	R	—	—	—
SX 217	Sexauer	4	R	—	HR	MR	MR	HR	—	—	R	MR
Target	Bio-Plant Research	4	HR	MR	R	MR	HR	LR	—	—	—	—
Tomahawk	Jung	4	R	MR	R	HR	MR	LR	R	—	—	—
Trident	Cargill	4	R	—	HR	MR	HR	MR	—	—	—	—
Trumpetor	Northrup King	4	MR	MR	HR	R	LR	LR	MR	—	R	—
Turbo	Pickseed	4	R	—	R	MR	R	—	—	—	—	—
Vector	L. Peterson Ltd.	4	R	MR	MR	R	R	HR	R	—	R	—
Vemema	Public	4	MR	MR	—	LR	LR	MR	—	—	HR	—
Verta +	NC + Hybrids	4	HR	R	R	HR	R	LR	R	—	—	—
Voris A-77	Voris	4	R	—	R	HR	MR	—	—	—	—	—
WL-315	W-L Research	4	HR	MR	HR	MR	MR	MR	R	LR	MR	—
WL-316	W-L Reseach	4	MR	R	R	HR	MR	R	R	LR	MR	—
Deseret	Public	5	MR	—	—	—	—	—	—	—	R	—
Garst 655	Garst	5	R	LR	R	MR	LR	R	—	—	—	—
Meteor	Northrup King	5	R	LR	HR	—	R	HR	HR	HR	HR	—
Pike	Northrup King	5	MR	—	R	—	MR	MR	R	—	R	—
Shenandoah	Great Plains	5	HR	—	HR	HR	HR	—	—	—	MR	—
Washoe	Public	5	R	—	—	LR	R	R	R	—	R	—
WL-320	W-L Research	5	R	MR	HR	MR	R	R	MR	MR	MR	—
Zia	Public	5	MR	—	MR	—	—	MR	—	—	—	—
581	Pioneer	6	LR	—	HR	—	MR	HR	MR	—	R	—
Baron	NAPB	6	MR	—	R	MR	R	HR	HR	HR	—	—
Diamond	NAPB	6	LR	—	HR	R	R	HR	HR	HR	—	—
Dona Ana	Public	6	MR	—	MR	LR	R	R	R	—	—	—
Lahontan	Public	6	MR	—	LR	—	LR	MR	LR	—	R	—
Mesilla	Public	6	MR	—	MR	—	—	R	R	—	—	—
NPI 445	NPI Seed	6	MR	—	HR	MR	R	R	R	LR	MR	MR
S. Special	W-L Research	6	R	LR	HR	MR	MR	R	HR	MR	MR	—
Valley +	NC + Hybrids	6	MR	—	HR	R	R	HR	HR	R	—	—
Armona	Plant Genetics	7	MR	—	HR	LR	MR	HR	HR	R	R	—
Condor	Northrup King	7	—	—	HR	—	HR	HR	HR	HR	—	—
DK-187	DeKalb-Pfizer	7	LR	—	HR	—	R	HR	HR	MR	—	—
Falcon	NPI Seed	7	LR	—	HR	—	MR	MR	MR	MR	MR	LR
GT 13R Plus	NAPB	7	R	—	HR	LR	R	R	MR	LR	R	—
Madera	Plant Genetics	7	MR	—	HR	LR	MR	HR	HR	LR	MR	—
Maricopa	Plant Genetics	7	MR	—	HR	LR	R	HR	HR	R	R	—
Moapa 69	Public	7	—	—	HR	—	—	R	—	—	—	MR
Nitro	Public	7	—	—	HR	—	R	R	HR	—	—	—
Pierce	Northrup King	7	LR	—	HR	—	R	R	HR	R	R	—
Rincon	Public	7	LR	—	HR	—	—	MR	MR	—	—	—
WL-515	W-L Research	7	LR	—	R	—	R	R	R	MR	R	—
WL-516	W-L Research	7	MR	—	HR	LR	HR	HR	R	R	MR	—
Yoio	Plant Genetics	7	LR	—	HR	LR	MR	HR	HR	R	MR	—
5929	Pioneer	8	—	—	HR	—	R	R	HR	HR	—	—
CUF 101	Public	8	—	—	HR	—	MR	HR	HR	HR	LR	MR
Florida 77	Pioneer	8	—	—	HR	MR	—	MR	—	—	—	R
Florida	NAPB	8	—	—	HR	—	R	HR	HR	HR	—	—
Florida	Public	8	—	—	—	—	—	R	—	—	R	—
Sundor	Northrup King	8	—	—	HR	—	MR	HR	HR	HR	HR	—
UN Cibola	Public	8	—	—	HR	—	MR	HR	R	LR	—	R

(continued)

CHARACTERISTICS OF AVAILABLE ALFALFA VARIETIES*

Variety	Marketing Contact	FD	BW	VW	FW	AA	PR	SA	PA	BA	SN	P
UC Salton	Public	8	—	—	HR	—	LR	HR	LR	—	—	LR
WL-605	W-L Research	8	—	—	HR	LR	HR	HR	HR	HR	MR	—
Spredor II	Northrup King	1	HR	—	MR	—	—	—	—	—	—	—
526	Pioneer	2	HR	—	MR	—	LR	HR	R	—	—	—
Agate	Public	2	HR	—	HR	MR	R	—	—	—	—	—
Baker	Public	2	HR	—	R	LR	—	HR	HR	—	—	—
Chippewa II	Jung	2	HR	R	HR	MR	R	R	R	—	—	—
Fortress	Northrup King	2	R	R	R	R	HR	HR	R	—	HR	—
G2841	Funk Seed	2	HR	R	—	R	R	R	R	—	—	—
Garst 636	Garst	2	HR	R	R	MR	R	—	—	—	—	—
Iroquois	Public	2	R	—	—	—	—	—	—	—	—	—
Mohawk	Public	2	HR	—	MR	HR	—	—	—	—	—	—
Oneida	Public	2	HR	—	R	—	HR	—	—	—	—	—
Vancor	Northrup King	2	HR	—	R	R	MR	—	MR	—	R	—
Vernal	Public	2	R	—	MR	—	—	—	—	—	—	MR
Victoria	Peterson	2	R	—	—	R	LR	R	—	—	—	—
WL 225	W-L Research	2	HR	R	HR	MR	HR	R	R	—	LR	MR
Wrangler	Public	2	R	LR	R	LR	HR	HR	HR	—	—	—
120	DeKalb-Pfizer	3	HR	—	R	LR	R	—	R	—	R	—
532	Pioneer	3	HR	—	R	LR	LR	HR	R	—	—	—
Admiral	Pickseed	3	R	R	HR	MR	R	—	—	—	—	—
AF21	Asgrow/O's Gold	3	HR	R	R	HR	R	R	R	—	MR	MR
Arrow	NAPB	3	HR	R	HR	MR	HR	—	—	—	MR	—
Big 10	Great Lakes	3	HR	—	HR	R	R	LR	R	—	—	—
Blazer	Cenex/Land											
	O'Lakes	3	HR	LR	R	LR	MR	—	HR	—	HR	—
Centurion	Agway/Allied	3	HR	R	R	R	R	MR	R	—	—	—
Crown	Cargill	3	R	R	R	HR	R	MR	R	—	R	—
Dart	AgriPro	3	HR	R	HR	R	HR	—	—	—	—	—
DK 125	DeKalb-Pfizer	3	HR	R	R	HR	R	MR	R	—	—	—
Elevation	Jacques	3	R	MR	R	—	MR	—	R	—	HR	—
Endure	Cargill	3	R	R	R	MR	R	LR	—	—	—	—
Garst 629	Garst	3	R	MR	R	MR	MR	MR	R	—	R	—
Husky	Plant Genetics	3	R	—	R	MR	MR	—	R	—	—	—
Impact	Peterson	3	HR	R	HR	MR	R	—	—	—	—	—
Kingstar	King Grain	3	R	R	HR	MR	R	R	MR	—	R	MR
Mercury	Moews	3	R	—	HR	MR	HR	LR	—	—	—	—
Milkmaker	Plant Genetic	3	R	—	HR	MR	MR	—	R	—	—	—
Oneida VR	Public	3	R	HR	HR	MR	MR	—	—	—	—	—
Perry	Public	3	R	—	R	LR	LR	MR	R	—	—	—
Polar II	Northrup King	3	HR	—	R	—	HR	—	MR	—	—	—
Pro-Cut	L. Herried	3	HR	R	HR	MR	HR	R	R	—	MR	—
Shield	Great Lakes	3	HR	R	R	HR	R	MR	R	—	R	—
Sparta	Cenex/Land											
	O'Lakes	3	R	R	MR	—	MR	—	R	—	HR	—
Sure	Cenex/Land											
	O'Lakes	3	HR	R	HR	HR	R	LR	HR	—	—	—
SX 424	Sexauer	3	MR	—	R	R	R	HR	—	—	—	—
Thorobred	Plant Genetic	3	HR	—	R	—	MR	—	—	—	—	—
Thunder	NAPB	3	R	—	HR	MR	R	LR	—	—	—	—
Ultra	Seed-Tec	3	R	R	HR	HR	R	LR	R	—	—	—
5432	Pioneer	4	HR	R	HR	—	MR	HR	R	—	—	—
5444	Pioneer	4	MR	HR	HR	—	LR	HR	—	—	—	—
555	Pioneer	4	HR	—	MR	—	—	HR	HR	—	—	—
88	L. L. Olds	4	R	R	R	R	MR	MR	R	—	—	—
Action	Research Seeds	4	R	MR	R	HR	R	MR	R	—	—	—
Anstar	FFR	4	R	—	MR	R	—	—	—	—	—	—
Apollo	NAPB	4	R	—	R	LR	R	MR	MR	—	MR	—

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INDEX CODES FOR TABLE:

FD—Fall Dormancy	FW—Fusarium Wilt	BW—Bacterial Wilt	Resistance ratings:
1 = most dormant	SA—Spotted Alfalfa Aphid	AA—Anthracnose	LR = 6-14% of plants resistant
8 = least dormant	SN—Stem Nematode	PA—Pea Aphid	MR = 15-30% of plants resistant
	VW—Verticillium Wilt	RK—Root Knot Nematode	R = 31-50% of plants resistant
	PR—Phytophthora Root Rot	BA—Blue Alfalfa Aphid	HR = 50% or more of plants resistant

Field Scouting

Fields of alfalfa or clover grown for hay or grazing should be checked weekly during the production season for insect activity. Fields grown for seed production should be checked at least weekly until buds begin to form, then twice each week from bud stage until seed harvest.

Sweep Net Sampling Technique. A standard 15-inch diameter sweep net is the basic sampling tool used in alfalfa and clover fields. A sampling unit consists of 10 consecutive (180-degree) sweeps taken while walking through the field. The net is swung from side to side with each step. The net should be held so that the lower half of the opening (7 to 8 inches) is drawn through the foliage. If foliage and stems are not obtained in the sample the net is not being swung hard enough and/or deep enough. Samples may differ somewhat among individuals according to their reach.

Five samples (each consisting of 10 sweeps) taken on each side of the field and one near the center of the field provide a good estimate of insect numbers. Samples should be taken 30 to 50 feet from each edge of the field. The sample number should be increased to 10 in fields of 100 acres and to the equivalent of one sample per 10 acres for uniform fields of 200 acres or more.

A sweep net can be used to sample a field for aphids. Often aphids are too abundant to count individually, but can be estimated in 10's or 100's.

Stem Sampling Technique. Aphid and alfalfa weevil counts may be taken by cutting or gently breaking alfalfa stems at the ground level, carefully lifting them out of the foliage and counting the aphids and alfalfa weevil larvae present. Or, to make counting easier, the insects can be removed by slapping the stems against the side of a small, light colored bucket. To sample a field, five samples of 30 stems each should be taken. Move to a new spot after each 30-stem sample.

Sucking Pests

Pea Aphid. Pea aphid adults are bright green, long legged and about 1/8-inch long. Adults may be winged or wingless. Pea aphids generally cause the greatest amount of damage in the spring and early summer and then again in the fall.

Resistant cultivars are very helpful in reducing pea aphid damage (see table page 5). Use of an insecticide is justified when aphid populations reach the action level (see table below).

Pea aphids prefer to congregate in dense colonies along the stems, terminal shoots and leaves. Heavy infestations cause plants to wilt and turn yellowish-green. Honeydew is usually not abundant on infested plants.

Spotted Alfalfa Aphid. The spotted alfalfa aphid is small (1/16 inch long) and grayish-yellow with four to six rows of raised dark spots on the back. This aphid is usually found on the undersides of lower leaves. However, as the population increases, aphids can be found on all parts of the plant. Spotted alfalfa aphids secrete large amounts of honeydew and will fall from alfalfa plants when disturbed.

Infestations can increase rapidly under favorable conditions. However, rain and high humidity often reduce an infestation or create conditions unfavorable for survival.

When feeding, the spotted alfalfa aphid secretes a toxin that causes considerable plant injury and even death of seedling alfalfa. On established stands, growth will be severely stunted where yellow or chlorotic areas appear on the leaves. Leaf veins frequently remain green.

Resistant varieties offer considerable protection from yield and stand losses due to spotted alfalfa aphid (see table page 5). In some cases insecticides may be needed (see table below).

Blue Alfalfa Aphid. The blue alfalfa aphid was detected in fields in West Texas in 1978, but as of this printing has been of no economic importance. The pest closely resembles the pea aphid but is bluish-green rather than yellowish to light green. The blue aphid tends to congregate in clusters on the terminal growth while the pea aphid may be found over the entire plant. The blue aphids build up to high populations in the early spring, but populations decline when temperatures exceed 85 degrees F. Severe stunting of plants and yellowing of leaves may result from blue aphid feeding on new alfalfa regrowth less than 6 inches tall and when temperatures are below 75 degrees F.

Resistance to this pest is available in several semi-dormant and nondormant alfalfa cultivars (see table page 5).

ACTION LEVELS FOR APHID CONTROL

	Hay height (inches)	Aphids per stem	Aphids per sweep
Pea Aphid	10	40	—
	20	70	300-400
Spotted Alfalfa Aphid	10	20	100-200
	20	40	200-400
Blue Alfalfa Aphid	spring regrowth	10-12	—
	10*	40-50	200

*Treat for blue alfalfa aphid if aphids are present in numbers approaching the thresholds and plants have taken on a stunted, blue-green appearance.

SUGGESTED APHID CONTROL ON ALFALFA AND CLOVER*
(Pea, Spotted Alfalfa, Yellow Clover and Blue Alfalfa Aphids)

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Chlorpyrifos (Lorsban 4 lb.)	1/2 pt.	7	7
Diazinon (Diazinon 50W) (Diazinon AG500)	3/4-1 lb. 3/4-1 pt.	7	0
Dimethoate (Cygon® 4 lb.) (Dimethoate® 2.67 lb.)	1/2-1 pt. 3/4-1½ pts.	10	10
Disulfoton (Di-Syston® 15% G)	6.7 lbs.	28	28
Malathion (Cythion® 5 lb.)	1 1/2-2 pts.	0	0
Methidathion (Supracide® 2 lb.)	3-4 pts.	14	14
Methyl Parathion (4 lb.)	1/2-1 pt.	15	15
Parathion (8 lb.)	1/4-1/2 pt.	15	15

*When weevil control is desired with the same application, see section on weevil control (page 9).

Remarks

Treat when temperatures are above 50 degrees F.

Chlorpyrifos. Do not make more than four applications per year or apply more than once per crop cutting. Not labeled for use on clover.

Diazinon. Do not apply to alfalfa in bloom. Remove livestock from field during application.

Dimethoate. Make only one application per cutting. Do not apply if the crop or weeds in treatment area are in bloom. Not labeled for use on clover.

Disulfoton. Make only one application per crop season.

Malathion. Do not apply when plants are in bloom. Do not use on seed alfalfa.

Methidathion. Make only one application per alfalfa cutting. Do not apply during alfalfa bloom. Do not use on clover.

Lygus Bug (Lygus spp.). Lygus bugs are often serious pests of alfalfa and clover grown for seed, but are not considered major pests of hay crops. Heavy infestations cause blasted buds, blossom drop and shriveled seed. Greatest damage is caused when lygus bugs feed on the buds. Injured buds turn tan or white, die and fall from the plant within a few days.

A sweep net should be used to collect lygus bugs for field counts. Field sampling should be done during the early morning or late afternoon (to avoid high temperatures) and when wind velocity is less than 10 miles per hour. The action level should be based on sweep net counts and the stage of seed crop maturity.

**ACTION LEVELS FOR LYGUS BUG CONTROL
IN ALFALFA GROWN FOR SEED**

Seed crop maturity stage	Number of Lygus per 100 sweeps (count each nymph as 2)
Green bud	> 75
Bloom	> 100
Soft-dough	> 120-150

**SUGGESTED LYGUS CONTROL ON ALFALFA
AND CLOVER CROPS**

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Green Bud Stage			
Carbaryl (Sevin® 80S) (Sevin® XLR Plus)	1 1/4-1 7/8 lbs. 1-1 1/2 qts.	7	7
Carbofuran (Furadan® 4 lb.)	2 pts.	28	28
Dimethoate (Cygon® 4 lb.) (Dimethoate® 2.67 lb.)	1/2-1 pt. 1 1/2 pts.	10	10
Methyl Parathion (4 lb.)	1-2 pts.	15	15
Parathion (8 lb.)	1/4-1/2 lb.	15	15
Trichlorfon (Dylox® 80% SP)	20 oz.	0	0
Bloom to Soft Dough Stage			
Trichlorfon (Dylox® 80% SP)	1 1/4 lbs.	7	7

Remarks

Carbofuran. Do not apply more than twice per season and only once per cutting with no more than 1 pint per acre on second cutting. Treat alfalfa prior to bloom. Do not move bees into alfalfa field within 7 days of application. Not labeled for use on clover.

Dimethoate. Make only one application per cutting. Do not apply if alfalfa or weeds are in bloom. Not labeled for use on clover.

Trichlorfon. Three applications may be made per cutting, with the last application up to the day of cutting. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH to the acid range. For seed crops use 20 to 30 ounces per acre. If crop is grown for seed, do not cut green crop for feed or forage.

Stink Bug. Stink bugs may cause extensive damage on alfalfa and clover seed crops. They often move into fields in large numbers soon after pods begin to form. The most serious damage is caused when they suck juices from the immature seeds. The damaged seeds then collapse into flattened shells that soon shrivel, dry and turn brown.

Sweep net sampling should be used to determine when stink bugs are abundant enough to warrant control. *The action level is an average of 8 to 12 adults and nymphs per 100 net sweeps in late bloom fields of alfalfa or clover grown for seed when there are numerous maturing seed pods present.*

SUGGESTED STINK BUG CONTROL ON ALFALFA AND CLOVER SEED CROPS

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® XLR Plus)	1-1 1/2 qts.	7	7
Trichlorfon (Dylox® 80% SP)	20 oz.	See remarks 0	0

Remarks

Trichlorfon. Three applications may be made per cutting with the last application up to 7 days before harvest. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce pH to the acid range. On seed crops use 20 to 30 ounces per acre and do not cut green crop for feed or forage.

Threecornered Alfalfa Hopper. Threecornered alfalfa hoppers are commonly found in alfalfa and clover fields. Adults and nymphs suck plant juices by puncturing stems either randomly or in a regular circle that completely girdles a stem. Most girdling is done by the nymphs. Girdled stems become stunted and weakened just above the soil surface, resulting in lodging.

Check crowns closely for nymphs at several locations in the field. *The action level in alfalfa and clover crops grown for hay is reached when nymphs average 25 to 30 per crown.* In seed alfalfa and clover crops sample for threecornered alfalfa hopper adults with a sweep net. *The action level is reached when sweep net counts average 150 or more per 100 sweeps.*

SUGGESTED THREECORNERED ALFALFA HOPPER CONTROL IN ALFALFA AND CLOVER

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80S)	1 7/8 lbs.	7	7
(Sevin® XLR Plus)	1 1/2 qts.	7	7
Malathion (Cythion® 5 lb.)	2 pts.	See remarks 0	0
Parathion (8 lb.)	1/2 pt.	15	15

Remarks

Malathion. Do not apply to clover or alfalfa in bloom. Do not apply to seed clover or alfalfa.

Thrips. Thrips feed on alfalfa blooms, buds and leaves. When feeding is severe, leaves become distorted and silvered and blooms turn a mottled brown. *The effect of this damage on alfalfa seed production has not been determined and no control methods or action levels have been developed.*

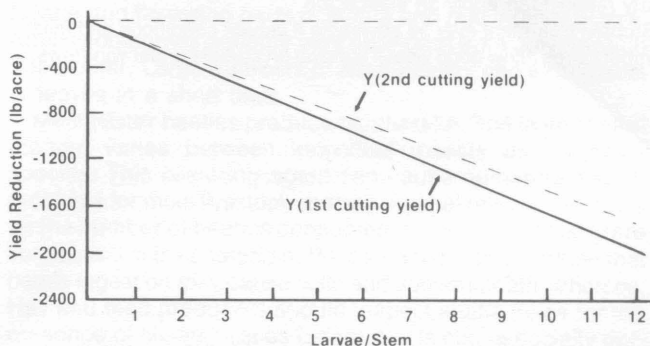
Chewing Pests

Alfalfa Seed Chalcid. The alfalfa seed chalcid is a small (1/12-inch long), jet black wasp that usually deposits one egg per immature alfalfa seed. The developing larva hollows out the seed. Infested seed are plump and light brown, while uninjured seeds have a healthy green appearance before they mature. Populations of chalcids increase from spring through late summer. Consequently, late-season seed often is more severely attacked. *Chemical control is not recommended for the alfalfa seed chalcid.* The following cultural practices are effective in reducing chalcid populations and damage:

- Manage the crop so that it matures uniformly and as early as possible.
- Keep field margins, borders and ditch banks free of volunteer alfalfa that may produce seed. (The chalcid overwinters as a mature larva in seed.)
- Before spring, destroy all chaff and screenings from the previous year.
- Harrow or disk seed fields in the fall or bury infested seed. In the western areas of Texas, an irrigation following the harrowing or disking will greatly aid in decomposition of plant debris and germination of seed shattered at harvest.

Alfalfa Weevil. The alfalfa weevil is primarily a pest of alfalfa, but may attack several species of clover. The first and second alfalfa cutting are most heavily damaged. Upon hatching, larvae feed on leaf buds, usually at the tip of the plant. Older larvae feed mostly on open leaflets, but they also will feed on the terminal buds. Foliage is skeletonized by alfalfa weevil larvae and appears grayish to whitish in color.

Adult weevils lay eggs inside alfalfa stems in late fall and early spring. *Activity ceases on cold days during the winter.* Fall-laid eggs begin to hatch in early spring; spring-laid eggs hatch after being exposed to a few days of warm temperatures. Eggs hatch into small, light green, black-headed larvae. Young larvae are yellowish green and mature larvae are darker green with a single white stripe down their backs. Larvae feed for about 3 to 4 weeks on the terminal and upper leaves. In fields where infestations arise from both fall-and spring-laid eggs, feeding damage is extended over a period of 6 to 8 weeks. The extent of crop damage caused by alfalfa weevil larvae depends on: 1) the size of the alfalfa plant; 2) the size of the larvae; and 3) the number of larvae per alfalfa stem. The following table depicts losses which have been documented from various levels of alfalfa weevil infestations in Oklahoma.



YIELD REDUCTION (lb./acre)

$$Y(2\text{nd cutting yield}) = -138.7x$$

$$Y(1\text{st cutting yield}) = -167.8x$$

When larvae are mature, they spin cocoons about 1/4 inch in diameter either on the plants or within the curl of fallen, dead leaves. They pupate within these cocoons and emerge as adults in 1 to 2 weeks. After emergence, most young adults leave the alfalfa field and go to nearby protected areas to hibernate during the summer.

Once an alfalfa field becomes infested with alfalfa weevil, damage usually occurs year after year. Crop production practices that encourage dense, vigorous plant growth will reduce weevil damage. The first crop should be cut as cleanly and closely as possible when most of the plants are in the bud stage. This deprives the larvae of food and shelter. Exposing the larvae to the hot soil surface when the crop is cut causes extensive mortality. When infested alfalfa is cut, the stubble under the windrows is subject to excessive damage. Care should be taken to scout for alfalfa weevil damage to the regrowth, especially in the strips where hay was stacked in windrows.

Grazing, burning (where enough of the old growth remains on the field), flaming or crushing the stems with a heavy roller during the months of December, January and February will aid in destruction of fall-laid eggs.

Close field inspections are necessary to determine when the action level has been reached. *The action level should be based on plant size, plant damage and numbers of weevil larvae.* When conditions approaching the action level exist, cutting or insecticide treatment should be considered. If insecticide use is required, sprays should be delayed until the oldest grubs are half grown to allow as much egg hatch as possible. This will minimize the chances of having to spray one cutting twice. The following table is a general guide for determining the action level:

ACTION LEVEL FOR ALFALFA WEEVIL

Plant height (inches)	Larvae per terminal	Larvae per sq. ft.	Percent damaged terminals	Larvae per sweep
2-6 (before 1st cutting)	1	—	30-40	—
7-14	1.5	40	25-30	20
Near cutting ¹	2.0	80-100	50	40-50
Stubble ² (after cutting)	—	20	—	—

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 good weevil survival on stubble under windrows.

SUGGESTED ALFALFA WEEVIL CONTROL ON ALFALFA

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80S)	1 7/8 lbs.	7	7
(Sevin® XLR Plus)	1 1/2 qts.	7	7
Carbofuran (Furadan® 4 lb.)	1-2 pts.	See remarks	
Chlorpyrifos (Lorsban® 4E)	1-2 pts.	14-21	14-21
Diazinon (4 lb.)		See remarks	
(Diazinon 50W)	2-3 lbs.	10	2
(Diazinon AG500)	2-3 pts.	10	2
Malathion (Cythion® 5 lb.)	1 1/2-2 pts.	0	0
(Malathion ULV® 9.33 lb.)	16 fl. oz.	5	5
Methidathion (Supracide® 2 lb.)	3-4 pts.	14	14
Methyl Parathion (4 lb.)	1/2-1 pt.	15	15
Parathion (8 lb.)	1/4-1/2 pt.	15	15
Phosmet (Imidan® 50% WP)	2 lbs.	7	7

Remarks

Carbaryl. Not effective against aphids.

Carbofuran. Do not apply more than twice per season or once per cutting with no more than 1 pint per acre on second cutting. Not labeled for use on clover. Apply only to pure stands of alfalfa. Not effective against aphids. Do not cut or graze within 14 days after using 1 pt. of Furadan 4 lb. or within 28 days after using 2 pts. of Furadan 4 lb.

Chlorpyrifos. Do not make more than four applications per year or apply more than once per crop cutting. Do not graze within 14 days after application of 1 pint per acre, or within 21 days after application rates above 1 pint per acre.

Diazinon. Do not apply to alfalfa in bloom. Remove livestock from field during application. Recommendation is for alfalfa weevil larvae in spring.

Malathion. Do not apply when plants are in bloom. Do not use on seed alfalfa. For alfalfa weevil larvae only.

Methidathion. Make only one application per alfalfa cutting. To avoid injury to pollinating insects do not apply during bloom.

Phosmet. Do not apply more than once per cutting. Not effective against aphids.

Clover Head Weevil. The clover head weevil, crimson clover's number one insect enemy, was first observed in Texas in light, scattered infestations during the spring of 1965. It now occurs in all eastern and northeastern Texas counties where crimson clover is grown. Since crimson clover produces only one crop of seed annually, the economic importance of this pest becomes obvious. Producers have also observed the loss of clover stands in pastures where clover head weevil infestations occurred the previous year. This weevil prefers clovers, particularly crimson, aslike and red; however, the adults have been observed on alfalfa, black medic and snap beans.

Adults become active in early spring and begin egg laying in late March or early April. Each female deposits 200 to 300 eggs in stalks or petioles of host plants during a 2- to 6-week period. Eggs hatch in 5 to 8 days and emerging larvae feed primarily in the florets. Larval populations normally reach a peak around April 15 to May 1. Full-grown larvae are about

1/2 inch long, legless and vary in color from light green to yellowish. Mature larvae spin a silken cocoon in the floral head of host plants where they spend several days before pupating, a stage requiring 3 to 6 days. The life cycle requires 22 to 28 days from egg to adult. Adults are inactive during the remainder of the summer. They hibernate in ground trash and clump grasses in or near clover fields.

Principal damage is caused by larvae feeding on developing flowers and seed pods. Some damage also is caused by adults feeding on stems, which often results in lodging of the flowers.

The action level is based on the history of damage in the field in previous years plus the presence of weevils at the beginning of the bloom period. Apply treatment when clover has reached a 25 to 50 percent bloom stage. If a second application is required, apply 7 to 10 days after the first.

SUGGESTED CLOVER HEAD WEEVIL CONTROL ON CLOVER

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Methyl Parathion (4 lb.)	1 pt.	15	15
Parathion (8 lb.)	1/2 pt.	15	15

Grasshoppers. A number of grasshopper species may damage alfalfa or clover. These pests generally migrate into the field from adjoining fence rows, ditch banks, field margins or native pastures. Grasshopper nymphs and adults are foliage feeders and can cause extensive forage loss if the population is large. Grasshoppers may devour the entire plant, including leaves, buds, flowers and young seedpods; but extensive damage is not common.

Grasshopper control should be initiated before the pests move out of hatching areas and into the field. Grasshoppers are most damaging in dry years when their food is limited.

Eliminating weedy field margins (roadsides and fence rows) will aid in reducing grasshopper numbers since these areas are favored habitat for egg laying and early nymphal feeding.

Chemical treatment of fields and field margins is suggested in early summer where grasshopper nymphs are abundant. The action level for field infestations is an average of 10 or more grasshoppers per square yard.

SUGGESTED GRASSHOPPER CONTROL ON ALFALFA AND CLOVER

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80S)	2/3-1 7/8 lbs.	7	7
(Sevin® XLR Plus)	1/2-1 1/2 qts.	7	7
Carbofuran (Furadan® 4 lb.)	1/4-1/2 pt.	7	7
Diazinon (Diazinon 50 W)	1 lb.	7	0
(Diazinon AG500)	1 pt.	7	0
Dimethoate (Cygon® 4 lb.)	1/2-1 pt.	10	10
(Dimethoate® 2.67 lb.)	3/4-1 1/2 pts.	10	10
Malathion (Cythion® 5 lb.)	1 1/2-2 pts.	0	0
(Malathion ULV® 9.33 lb.)	8 fl. oz.	0	0
Parathion (8 lb.)	1/4-1/2 pt.	15	15

Remarks

Carbofuran. Do not apply more than twice per season, once per cutting, with no more than 1 pint per acre on second cutting. Treat alfalfa prior to bloom. Do not move bees into alfalfa field within 7 days of application. Apply only to pure stands of alfalfa. Not labeled for use on clover.

Diazinon. Do not apply to alfalfa in bloom. Do not spray livestock directly with either air or ground equipment.

Dimethoate. Make only one application per cutting. Do not apply if crop or weeds in treatment area are in bloom. Not labeled for use on clover.

Malathion. Do not apply to alfalfa or clover in bloom. Do not apply to seed alfalfa. Use 8 to 12 fluid ounces per acre for clover.

Blister Beetle. Several species of blister beetles may be found in alfalfa fields during the growing season. The beetles range from 1/2 inch to more than 1 inch long and are black, gray or brown in color; some species are striped. Adult blister beetles are narrow, cylindrical, rather soft-bodied beetles with heads distinct from the rest of their bodies. Adults feed on foliage and flowering parts of alfalfa and many other plants. Adults sometimes become very abundant from July through September. Large numbers of adult beetles can strip plants of leaves in a short time.

Most blister beetles produce cantharidin. The level of cantharidin varies between individual insects of the same species. This blistering agent can cause numerous health problems for most livestock species. Animal reaction depends on the number of beetles consumed. Horses and poultry are very sensitive to cantharidin. Research has demonstrated that beetle ingestion may cause colic and sudden death in horses. Hay and feed producers should inspect alfalfa fields for the presence of blister beetles before hay is cut, especially dur-

ing the months of July through September. Fields should be scouted for blister beetles within 2 days of hay harvest and throughout the baling process. Adult beetles are mobile and will frequently congregate in one or a few small spots within a field. Infested areas should be left unharvested or sprayed with insecticide.

Do not bale hay if blister beetles are present. The cantharidin is highly toxic to all types of livestock, especially horses and poultry. Spraying the field just before harvest is not a sure method of eliminating the beetles, because they can enter cut hay before it is baled.

Drivers of cutting and baling equipment should be taught to recognize blister beetle swarms and instructed to avoid them.

SUGGESTED BLISTER BEETLE CONTROL ON ALFALFA

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80S)	2/3-1 1/4 lbs.	7	7
(Sevin® XLR Plus)	1/2-1 qt.	7	7

Common Caterpillar Pests

Several species of caterpillar larvae feed on the tender stems and leaves of alfalfa. These pests are quite similar in the amount of damage they cause. Because of this similarity, it is possible to use one action level for all caterpillars in alfalfa. It is important, however, to be able to identify these worms since insecticides which work against one worm may be ineffective against another.

The action level for caterpillars in alfalfa is seven to ten worms per sweep or one to two worms per square foot.

Alfalfa Caterpillar. The alfalfa caterpillar is the larval stage of a yellow butterfly that has a 2-inch wingspan and black margins on the wings. The butterflies are seen actively flying through the fields in late spring and summer. Mature larvae are about 1 1/2 inches long and are dark, velvety green with white stripes along each side. They have large, round heads. Larvae feed on foliage and numbers usually increase when not held in check by disease or beneficial insects and spiders.

The alfalfa caterpillar usually becomes a pest after the second alfalfa hay cutting and is usually most abundant in mid to late summer. Crop damage can sometimes be avoided by early cutting.

SUGGESTED ALFALFA CATERPILLAR CONTROL ON ALFALFA

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Bacillus thuringiensis (Dipel® , Thuricide Javelin)	See remarks	0	0
Carbaryl (Sevin® 80S)	1 1/4 lbs.	7	7
(Sevin® XLR Plus)	1 qt.	7	7
Methomyl (Lannate 90% SP)	1/4-1/2 lb.	0	7
(Lannate 1.8 lb.)	1-2 pts.	0	7
Methyl Parathion (4 lb.)	1/2-1 pt.	15	15
Parathion (8 lb.)	1/4 pt.	15	15
Trichlorfon (Dylox® 80% SP)	7 1/2-10 ozs.	0	0

Remarks

Bacillus thuringiensis. Application rates must be taken from the individual product labels due to the variation in formulations.

Trichlorfon. Three applications may be made per cutting with the last application up to the day of cutting. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH to the acid range.

Armyworm. Armyworms are the immature stages of dull-colored, nocturnal moths. Armyworms range in color from pale green to brown or black and are often striped with white to yellowish lines from head to tail.

The true armyworm, fall armyworm and beet armyworm are commonly found on alfalfa and clover crops and may develop into damaging numbers that require chemical control. The yellowstriped armyworm is an occasional pest in alfalfa. Infestations of armyworm are usually most severe in mid to late summer.

SUGGESTED ARMYWORM CONTROL ON ALFALFA

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Chlorpyrifos (Lorsban® 4E)	1-2 pts.	See remarks	
Methomyl (Lannate® 90% SP)	1/4-1/2 lb.	0	7
(Lannate® 1.8 lb.)	1-2 pts.	0	7

Remarks

Chlorpyrifos. Do not make more than four applications per year or apply more than once per crop cutting. Do not cut or graze within 14 days after application of 1 pint per acre or within 21 days after application at rates above 1 pint per acre.

Methomyl. Do not apply to dormant or semi-dormant alfalfa when minimum daily temperature is 50 degrees F. or lower. Do not apply during bloom or when bees are present in field. Not registered for use on clover.

Corn Earworm. Corn earworm moths are tan in color, about 3/4 inch long, with a wing span of 1 to 1 1/2 inches. Young larvae are greenish with black heads. Fully developed worms are about 1 1/2 inches long and range in color from pale green or pinkish to brown.

Earworm larvae feed on numerous plants. In alfalfa, larvae seem to prefer the leaves, but they will feed on other plant parts. Earworms may be present in alfalfa hay crops throughout the growing season, but usually are most abundant from July through September.

SUGGESTED CORN EARWORM CONTROL ON ALFALFA AND CLOVER

Insecticides (listed alphabetically)-toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80S)	1 1/4-1 7/8 lbs.	7	7
(Sevin® XLR Plus)	1-1 1/2 qts.	7	7
Chlorpyrifos (Lorsban 4 lb.)	1-2 pts.	14-21	14-21
Malathion (Cythion® 5 lb.)	2 pts.	0	0
(Malathion ULV® 9.33 lb.)	16 fl.oz.	5	5
Methyl Parathion (4 lb.)	1 pt.	15	15
Methomyl (Lannate® 90% SP)	1/4 lb.	0	7
(Lannate® 1.8 lb.)	1 pt.	0	7
Parathion (8 lb.)	1/2 pt.	15	15

Remarks

Chlorpyrifos. Do not make more than four applications per year or apply more than once per crop cutting. Do not graze within 14 days after application of 1 pint per acre or within 21 days after application at rates above 1 pint per acre. Not labeled for use on clover.

Malathion. Do not apply to alfalfa or clover seed crops. See label for specific pests mentioned.

Methomyl. Do not apply to dormant or semi-dormant alfalfa when minimum daily temperature is 50 degrees F. or lower. Do not apply during bloom or when bees are present in field. Not registered for use on clover.

Occasional Caterpillar Pests

Army Cutworm. There is only one generation per year of the army cutworm. Female moths lay eggs in the fall on the soil surface. Moisture is required for the eggs to hatch. Young larvae pass the winter hibernating in the soil. As the weather warms during the day in late winter and spring, the young larvae resume their feeding and growth. Mature larvae are about 1 to 1 1/2 inches long and pale greenish-gray to brown. The back has pale stripes and is finely mottled with white and brown.

Larvae feed on a variety of plants, although alfalfa and winter wheat are the principal crops damaged. The army cutworm feeds entirely above the soil surface. Larvae prefer to feed on plant leaves and only eat stems and other plant parts

when food is scarce. Feeding occurs from late afternoon until dark on most days. When the temperature is relatively high, the larvae hide under clods and in the soil during hours of bright sunshine. On dark, cloudy days, the larvae often feed both day and night. Army cutworms can cause heavy damage to newly planted stands of alfalfa.

The action level is three to four larvae 1/2 inch or less in length per square foot, or two to three larvae more than 1/2 inch in length per square foot.

SUGGESTED ARMY CUTWORM CONTROL ON ALFALFA

Insecticides (listed alphabetically)-toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80S)	1 1/4-1 7/8 lbs.	7	7
(Sevin® XLR Plus)	1-1 1/2 qts.	7	7

Webworm. Webworms are larval stages of small, buff-yellow to brown moths with 1-inch wing spans. The alfalfa webworm, the garden webworm and the beet webworm feed on alfalfa, clover, cowpeas, peas and similar crops, as well as several weed species, especially pigweed. The larvae of all three species create webs in the tops of plants and feed within the webs, completely skeletonizing the leaves and stems. Flimsy webs near the plant terminals are noticeable in alfalfa and clover crops infested with these insects. Webworms occasionally cause serious damage to alfalfa, particularly to the second and third cuttings.

On alfalfa hay crops, early harvest is suggested if the infested crop is near the cutting stage. The action level is reached when the crop is more than 2 weeks from cutting and 25 to 30 percent of plant terminals are infested.

SUGGESTED WEBWORM CONTROL ON ALFALFA AND CLOVER (Alfalfa Webworm, Beet Webworm, Garden Webworm)

Insecticides (listed alphabetically)-toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80 S)	1 1/4-1 7/8 lbs.	7	7
(Sevin® XLR Plus)	1-1 1/2 qts.	7	7
Methyl Parathion (4 lb.)	1 pt.	15	15
Parathion (8 lb.)	1/4-1/2 pt.	15	15
Trichlorfon (Dylox® 80% SP)	5-10 ozs.	0	0

Remarks

Trichlorfon. Labeled for alfalfa webworm only. Three applications may be made per cutting with the last application up to the day of cutting. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH into the acid range.

VETCH PESTS

Sucking Pests

Pea aphid, thrips and lygus bug are insect pests of vetch grown for seed production.

The action level for these insects is reached when the following activity occurs in a field:

PEST ACTION LEVEL—PEA APHID, THRIPS AND LYGUS BUG

Pea aphid	When visible signs of plant wilting are observed, accompanied by foliage yellowing, honeydew and increasing aphid numbers.
Thrips	When excessive blasting and shedding of blooms are observed.
Lygus Bug	When lygus average two per sweep in bud and early bloom stages.

SUGGESTED APHID, THRIPS AND LYGUS BUG CONTROL ON VETCH

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Malathion (Cythion 5 lb.)	1 1/2-2 pts.	0	0
Parathion (8 lb.)	1/4-1/2 pt.	15	15

Remarks

Malathion. Not labeled for thrips and lygus bugs on vetch.

Chewing Pests

Vetch Bruchid. The vetch bruchid or "vetch weevil" is one of the most damaging pests for the vetch seed producer. Adults are about 1/8 inch long and black with irregular white patches on the wing covers. Larvae are grub-like in appearance, 1/8 inch long and white to cream in color. Adults feed upon developing flower buds and pollen, but the primary damage is caused by larvae. Larvae consume the contents of the seed and may cause yield losses of 10 to 74 percent. Bruchids do not reproduce in stored vetch seed, although they may be found occasionally inside the seed hull.

The action level for vetch bruchid control is 10 to 25 percent fallen blooms with bruchids present. A sweep net is preferred over individual plant inspection for detection of bruchids. Check fields 6 to 8 days after treatment; if bruchids are still present, repeat application.

SUGGESTED BRUCHID CONTROL ON VETCH

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Malathion (Cythion 5 lb.)	1 1/2-2 pts.	0	0
Methyl Parathion (4 lb.)	1 pt.	20	20

Armyworm and Cutworm. Armyworms and cutworms may occur in damaging levels in fields of vetch or vetch planted with a small grain crop. Armyworms and cutworms should be controlled when visible foliage loss occurs.

SUGGESTED ARMYWORM AND CUTWORM CONTROL ON VETCH

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Methyl Parathion (4 lb.)	1/2-2 1/2 pts.	20	20
Parathion (8 lb.)	1/4-1/2 pts.	15	15

FORAGE SORGHUM PESTS

Soil Pests

True and false wireworm, white grub, corn rootworm, cutworm and seedcorn maggot are the most common soil pests of sorghum in Texas. Non-crop plant materials are important food sources for soil pests. Careful cultivation and/or the use of herbicides to reduce crop residues and eliminate weeds are important practices for reducing soil pest numbers. Proper seedbed preparation that provides for rapid seedling emergence and establishment, and preplant soil inspection for the presence of soil pest populations, are important. If damaging pest numbers are present, approved insecticides may be applied to the seed prior to planting or to the soil using the broadcast, row band or infurrow method of application. Preplant seed treatment or planter box treatment has proved effective in controlling wireworm, seed corn maggot and seed corn beetle. Moderate to large populations of white grub and corn rootworm require broadcast or band application of insecticides. Effective control of large white grub populations often requires a broadcast application.

Wireworm. True and false wireworms are the immature stages of click and darkling beetles. Wireworms are generally shiny, slender, cylindrical and hardbodied. They range in color from yellow to brown.

Wireworms damage forage sorghum by destroying planted seed and, to a lesser degree, by feeding on seedling plant roots. Stand establishment and plant vigor is reduced. Fields should be sampled for the presence of wireworms prior to planting. Soil samples 1 foot square by 4 inches deep should

be examined thoroughly. *If two or more wireworm larvae per linear foot are detected, control measures are warranted.*

Cultural practices that reduce non-crop plant materials in fields, and rotation to certain tap-rooted crops that are unfavorable for wireworm development, are important non-chemical control methods.

Approved insecticides, applied as seed treatment or planter box treatment, are effective in controlling wireworms. See Seed Treatment, page 15, for procedures.

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

Larvae damage plants by feeding on the roots. Small seedlings often are killed, resulting in stand loss. Severely pruned roots of larger plants result in stunting, plant lodging and increased susceptibility to drought and stalk rot organisms.

The action level for white grub is based on the number of grubs per square foot of soil. Examine one square-foot soil sample for each 5 and 10 acres before planting. An average of one white grub per square foot is sufficient to cause significant stand loss. Where grub numbers are high (approximately two per square foot) seed furrow treatments are not sufficiently effective. Best control is obtained by broadcasting an approved insecticide to plowed ground before planting. Then thoroughly incorporate it by disking it into the top 3 to 5 inches of soil (see Soil Treatment, page 16.)

SUGGESTED WHITE GRUB CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Diazinon		See remarks	
(D.Z.N® 14G)	14-28 lbs.		
(D.Z.N® AG500 4 lb.)	2-4 qts.		

Remarks

Diazinon. Preplant broadcast applications are most effective, though soil incorporation is necessary. Do not apply directly to seed. Make application where populations average one grub per square foot of soil.

Corn Rootworm. Corn rootworms are the larval stages of a complex of leaf-feeding beetles. The southern corn rootworm is the most important sorghum pest of the rootworm complex. Rootworms are small, creamy white larvae with brown heads. They burrow into the roots and crowns of sorghum plants. Reduced stands and plant vigor, and the occurrence of dead heart in young plants, are characteristic of rootworm damage. Plant lodging may occur later in the season.

Presently no insecticides are labeled for in-furrow or preplant use for corn rootworm control. Seed treatments with lindane are effective in controlling light infestations of corn rootworm at planting time. See Seed Treatment, page 15, for procedures.

Cutworm. A complex of cutworms can damage forage sorghum. Cutworms are the immature stages of moths that are active at night. Grassy sod and weedy fields are attractive to moths for egg laying. Newly hatched cutworms feed on sorghum seedlings and often clip plants just above the ground. Some subterranean cutworms feed on the seedling root system. Infested fields appear to be closely grazed and damage may be clumped in spots in the field. Larval feeding commonly occurs at night.

Cultivation and the use of herbicides to kill non-crop plants in season and weeds in fallowed fields are important methods for controlling cutworms.

Aerial or ground application of insecticides effectively controls cutworms in established forage sorghum stands. Cutworms usually damage forage sorghum only during the seedling stage.

Well defined action levels do not exist for this pest; therefore, control decisions are a matter of individual judgment related to possible stand loss. Insecticides should be applied as a direct spray to the plants and adjacent soil.

SUGGESTED CUTWORM CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl			
(Sevin® 80S)	2 1/2 lbs.	0	0
(Sevin® XLR Plus)	2 qts.	0	0

Soil Pest Treatment Methods

Seed Treatment. On-farm seed treatment can be accomplished by using a concrete mixer, custom designed seed treatment equipment or a similar device. Seed should be evenly coated with insecticide. Sprinkle 1 pint of water on each 100 pounds of seed and mix to coat the seed evenly with moisture. Add the correct amount of insecticide to the seed as specified by the pesticide label and mix thoroughly. Lindane is available for seed treatment. Follow recommendations on the insecticide label to achieve effective control. Lindane is phytotoxic on sorghum seed and will adversely affect germination. *Do not treat seed with lindane more than 3 to 4 weeks prior to planting.*

Insecticides such as malathion often are applied to seed to control stored grain pests. These insecticides are not effective for the control of soil pests.

Planter Box Treatment. Some insecticides are formulated to be applied to seed in the planter box. This direct seed method is effective only against certain pests and certain population levels. Use this soil insect control technique in strict accordance with recommendations on the insecticide label. Lindane can be used for planter box treatments.

Uniform distribution of insecticide in the planter box is important. Do not get insecticide on the skin or in the eyes and do not breath insecticide dust.

Soil Treatment. To control wireworm, corn rootworm, white grub and cutworm an insecticide must be applied before the crop is planted or at planting time. Granular, wettable powder or emulsifiable concentrate formulations may be used. The formulation used usually depends on available application equipment.

Preplant. Soil can be treated before planting. Broadcasting insecticide gives the best control of soil insects and is the only means of controlling heavy infestations of white grub. However, it is more expensive because of the additional insecticide required, as compared to a rowband or in-furrow treatment. Broadcast insecticides uniformly to plowed ground and disk immediately to a depth of 3 to 5 inches. Where sorghum is to be planted on beds, soil insecticides should be incorporated in the beds to a depth of 3 to 5 inches before planting. This often is referred to as a row incorporated treatment. Row treatments must be made after the bed is prepared for planting because any manipulation, such as bed shaping, likely will alter the position of the insecticide in the row. Row or band application can be done when bed shaping is done. A treated band 7 to 10 inches wide and 3 to 5 inches deep, with seed placed in the center of the treated band, is necessary to obtain maximum control. For narrow-row plantings, use rates recommended on the insecticide label.

At Planting. Insecticides also can be applied to the soil at planting time by the in-furrow technique. This method is less applicable where a bed planter is used because insecticide incorporation within the root zone may defeat major objectives of bed planting. Where bed planting is to be used, soil insecticides can be incorporated in a band when bed shaping is done, as previously described.

With lister or conventional planters, mount spray or granular application equipment on the planter with the nozzle or spout just behind the opening plow and in front of the covering shovels. Adjust nozzles or spouts so that the treatment band is about 7 to 10 inches wide and the seed furrow, as well as the covering soil, is treated. Usually, insecticide is adequately incorporated during seed covering. Applying the insecticide directly in the seed furrow and in direct contact with the seed may affect germination. Poor control may result from in-furrow application where pest populations are high.

For specific soil treatment suggestions, limitations and rates of each insecticide labeled for use on forage sorghums, refer to the suggestion table on page 15 for white grub control.

Above-ground Pests

Greenbug. Greenbugs are aphids that suck plant juices and inject toxin into forage sorghum plants. This aphid is pale green, approximately 1/16 inch long and has a dark green stripe on the back.

Greenbugs can cause stand loss, stunting and plant death in forage sorghums, although they are not as damaging in forage sorghum as in grain sorghum. However, plant death in the seedling stage may occur, and growers should inspect plants frequently from plant emergence until the plants are 6 to 10 inches tall.

The action level from emergence to about 6 to 10 inches is any visible damage (plants beginning to yellow) with greenbug colonies on plants and probable excessive stand loss.

SUGGESTED GREENBUG CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Attention: Review all remarks below thoroughly.			
Diazinon (AG 500)	1/2-1 pt.	7	0
Dimethoate		See remarks	
(Cygon® 4 lb.)	1/2-1 pt.	28	28
(Dimethoate® 2.67 lb.)	1/3-1 1/2 pts.	28	28
Disulfoton		See remarks	
(Di-Syston® 15% G)			
in-furrow	5-6.7 lbs.		
band	5-6.7 lbs.		
whorl	6.7 lbs.		
(Di-Syston® 8 lb.)			
furrow	12-16 ozs.	45	45
band	1 pt.		
side dress	1 pt.	45	45
foliar spray	4-8 ozs.	45	45
Parathion (8 lb.)	1/4 pt.	12	12
Phorate		See remarks	
(Thimet® 15% G)	6.5 lbs.	28	28

Remarks

Difficulty in controlling greenbugs has been encountered in several counties of the Texas High Plains. Resistance to most registered materials exists in some localized areas, and continued extensive use of insecticides is likely to expand the resistance problem. In areas where resistance exists, the initial insecticide application should be made at the higher labeled dosage rate. See remarks for use of lower rates.

In areas where insecticide resistance has not been observed, effective use of reduced rates is dependent on proper application timing. Reduced rates are designed to suppress greenbug densities below injurious levels while providing maximum protection of beneficial species. Using insecticides to eliminate greenbugs completely is not desirable. To conserve beneficial species, a sub-economic greenbug density must be maintained as a food source.

Dimethoate. Do not apply more than three times per season. Do not apply after heading.

Disulfoton. Do not apply directly to the seed. Do not apply foliar spray or granules more than three times per crop season. See label for waiting period for different types of applications. Rates are given for 40-inch row spacing. Consult label for rates for other row spacings.

Parathion. Do not substitute methyl parathion. Phytotoxicity may be a problem with certain varieties.

Phorate. Labeled for use at planting or as foliar application in the whorl. Only one application post-planting is allowed. At planting application rates depend on row widths (consult label).

Grasshoppers. A number of grasshopper species are common pests of forage sorghum. These pests generally migrate into the field from adjoining fence rows, ditch banks, field margins or native pastures. All grasshoppers, nymphs and adults, are foliage feeders and can cause extensive forage loss if the pest population is large. An average of six to seven grasshoppers per square yard can consume as much forage as one cow per acre.

Grasshopper control should be initiated before the pests move out of hatching areas such as fence rows, ditch banks, weedy fields, etc. Grasshoppers are most damaging in dry years when their food supply is limited.

The action level is seven to ten grasshoppers per square yard accompanied by excessive leaf loss.

SUGGESTED GRASSHOPPER CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl		See remarks	
Sevin® 80S)	2/3-1 7/8 lbs.	0	0
(Sevin® XLR Plus)	1/2-1 1/2 qts.	0	0
Parathion		See remarks	
(8 lb.)	3/8-1/2 pt.	12	12

Remarks

Carbaryl. Where dosage range is indicated, use lower rate on young plants and higher rate on mature plants (1-2 pounds per acre for nymphs on small plants and 2-3 pounds per acre when grasshoppers are mature or crop has more foliage).

Parathion. Do not substitute methyl parathion. Phytotoxicity may be a problem with certain forage sorghum varieties.

Chinch Bug (True Chinch Bug). Chinch bugs occasionally damage forage sorghum in the eastern half of Texas. The black-bodied adult chinch bug has reddish-yellow legs and fully developed wings. The mostly white wings are marked with a triangular black spot at the middle of the outer margin. Immature chinch bugs resemble adults in shape but are reddish in color with a white band across the back.

Adult and immature chinch bugs suck plant juices and cause leaf reddening. Wilting and severe stunting of plants attacked by chinch bugs has been noted from the time of seedling emergence until plants are 18 inches high. 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 the lower leaf sheaths of sorghum plants.

The action level is reached when two or more adult chinch bugs are found on 20 percent of the seedlings less than 6 inches high. Make at least five random checks per field. On taller plants, initiate control when immature and adult bugs infest 75 percent of the plants. With ground application equipment, direct nozzles at the infested portion of the plants. To be effective, apply insecticide in 20 to 30 gallons of water per acre.

SUGGESTED CHINCH BUG CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl		See remarks	
(Sevin® 80S)	1 1/4-2 1/2 lbs.	0	0
(Sevin® XLR Plus)	1-2 qts.	0	0
Carbofuran		See remarks	
(Furadan® 15G)	See remarks	75	75
Parathion		See remarks	
(8 lb.)	3/4 pt.	15	15

Remarks

Carbofuran. See label for rates of application with various row spacings.

Parathion. Do not substitute methyl parathion. Phytotoxicity may be a problem with certain forage sorghum varieties.

PERMANENT AND IMPROVED PASTURE PESTS

Grasshoppers, fall armyworm and true armyworm are the most common insect pests of pastures. In some areas of the state, desert termites have become an insect pest problem.

Grasshoppers. Grasshoppers are the most important insect pest of native pasture grasses. Ranchers should closely watch the development of grasshopper populations in the hatching areas during spring and early summer. Insecticides can be most effectively used in these sites before the grasshoppers have dispersed over large areas. Hatching begins when daytime temperatures are 70 degrees F. or higher for several days and soil is moist.

Eight or more grasshoppers per square yard is considered the action level on rangeland and pastures.

SUGGESTED GRASSHOPPER CONTROL ON PASTURES

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80S)	2/3-1 7/8 lbs.	See remarks	
(Sevin® XLR Plus)	1/2-1 1/2 qts.	See remarks	
Diazinon (Diazinon AG 500)	3/4-1 pt.	21	0
(Diazinon 50 W)	3/4-1 lb.	21	0
Malathion (Cythion® 5 lb.)	1 1/2-2 pts.	0	0
(Malathion ULV® 9.33 lb.)	8-12 ozs.	0	0
Naled (Dibrom® 8 lb.)	1/2-3/4 pt.	See remarks	
Parathion (8 lb.)	1/4-1/2 pt.	15	15

Remarks

Carbaryl. Do not allow foraging or cut for hay within 14 days of last application by ground. Aerially treated pastures may be grazed or cut for hay on the day of treatment.

Diazinon. Dairy and beef cattle and sheep can be fed hay provided grass is not cut for hay within 30 days if the insecticide spray is an oil solution. Do not repeat application for 30 days. Remove animals from pasture during application.

Malathion ULV. Do not apply to clover in bloom.

Naled. Animals may be present during treatment. Do not graze lactating dairy animals on treated areas. Apply by air or ground equipment. Use 1/2 pint per acre for young grasshoppers.

Armyworm. The fall armyworm and true armyworm generally are the most damaging insect pests of improved pastures, temporary winter pastures, permanent pastures and small grains. These insects commonly occur in spring, late summer or fall and are often associated with wet weather. These pests are easily controlled, but extensive damage may occur before growers notice an infestation. Improved, temporary and permanent pastures, as well as small grains, should be watched closely during rainy periods in late summer and fall.

The action level is three or more small worms per square foot.

SUGGESTED FALL ARMYWORM CONTROL ON PASTURES

Insecticides (listed alphabetically)- toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® 80S)	1 1/4-1 7/8 lbs.	See remarks	
(Sevin® XLR Plus)	1-1 1/2 qts.	See remarks	
Naled (Dibrom® 8 lb.)	1 pt.	—	—
Parathion (8 lb.)	1/4-1/2 pt.	15	15

Remarks

Carbaryl. Zero days for harvest and grazing with aerial application, 14 days for ground application.

Naled. Animals may be present during treatment. Do not graze lactating dairy animals on treated areas.

Desert Termites. Desert termites will infest coastal bermuda pasture and bunch grass areas. Populations increase during years when the summer months are extremely dry. Highest above-ground populations occur from March through September. Few or no termites are present above ground from December through February. Infestations occur in a circular pattern and are enhanced by a high clay content of the soil. Clay chimneys covering grass stems are built during the night or cooler parts of the day by the worker and soldier termites. Infested areas have a dark and unusual appearance as the population increases. Rainfall will naturally decrease termite numbers but termites become very active following rains. If dry weather continues and stand loss of the grass is occurring, a chemical spot treatment is suggested. A spring-toothed harrow or light disc harrow must be used to break up chimneys and expose developing termites.

There are no specific insecticides labeled for desert termite control in pastures, but several insecticides labeled for other insects in pastures may help to reduce their populations. Malathion (5 lb. EC) has been used at the rate of 1 quart per acre applied in 35 to 40 gallons of water. Two treatments, 1 week apart, should be applied to the infested areas. A length of chain should be dragged ahead of the spray boom to break up the chimneys and expose termites to the insecticide.

Red Imported Fire Ants. In the eastern half of Texas, red imported fire ants (*Solenopsis invicta*) can be a serious problem to forage production. The ants build mounds as large as 1 to 2 feet or more in diameter. Farm and pasture lands may become heavily infested with up to 30 per acre. In the hot summer sun these mounds may become hard, and farm machinery is often broken when a mound is hit. In an effort to reduce machinery damage, farmers may be forced to alter harvesting practices. Grazing problem fields or dragging a heavy bar to break up mounds between cuttings may be required.

There are few insecticides labeled for imported fire ant control. Products containing diazinon (AG-500), chlorpyrifos (Dursban®) and methylchloroform (MC 96) may be used for individual mound treatment. AMDRO® is registered both for broadcast and individual mound applications.

An excellent publication, B-1536, *Fire Ants and Their Control*, is available at your local county Extension office. This publication gives a complete description of the biology, development, identification and control of this pest.

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