MP-339

GGESTIONS FOR ONTROLLING SECTS AND MITES

Corn, Sorghums d Small Grains

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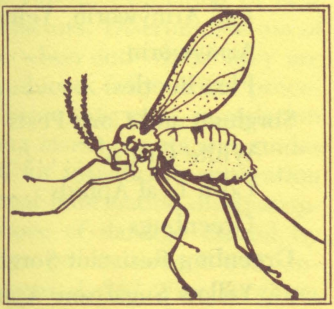

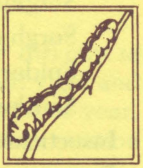

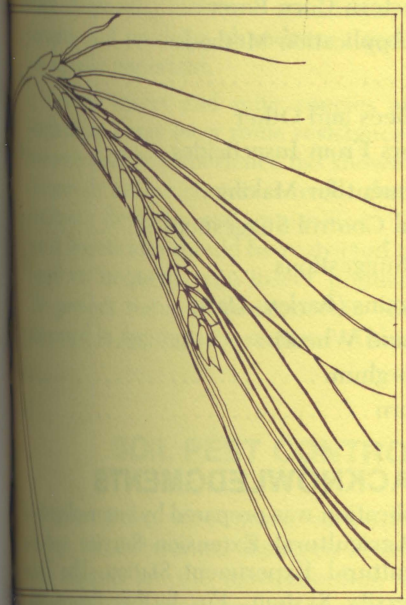

TEXAS AGRICULTURAL EXTENSION SERVICE
THE TEXAS A&M UNIVERSITY SYSTEM
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ACKNOWLEDGMENTS

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SUGGESTIONS FOR CONTROLLING INSECTS AND MITES ON CORN, SORGHUMS AND SMALL GRAINS

GRAIN CROPS are subject to insect attack throughout the growing period. Some insects reach damaging levels in spite of natural suppressive agents and may require artificial control methods. Base chemical pest control on careful evaluation of economic and natural control factors. Discriminate use of insecticides, applied only when and where they are needed, requires that producers fully utilize procedures for determining economic pest population levels. Methods for making insect counts and guides for determining the need for insecticide application are included. For additional information on description, life history and nature of damage caused by major pests, see Extension publications B-975, *Insects Attacking Forage Crops*; L-842, *The Sorghum Midge and Its Control*; L-819, *Greenbugs on Sorghum and Small Grains*; and L-1417, *Insect and Mite Pests of Field Corn*.

Plant damage does not always relate directly to insect numbers. Other factors such as plant vigor and stage of growth, moisture conditions, time of year, parasite and predator abundance, and crop rotation are equally important.

Several insect and mite species attacking grain sorghum in Texas show some resistance to once effective insecticides. Experience has shown that the more extensively an insecticide is used, the more rapidly resistance develops and intensifies. Therefore, the use of insecticides should be restricted to actual need, based on frequent crop-insect population analysis. The present status of resistance in specific pests is discussed in appropriate sections of this publication.

SOIL PEST CONTROL

White grubs, wireworms, corn rootworms, cutworms, sod webworms, seedcorn beetles, and seedcorn maggots are the most common soil insects in Texas. Cultural practices are of utmost importance since soil pests increase with continuous cropping of the same or similar plant species. For example, losses from corn rootworms may be reduced greatly or eliminated by rotating corn, grain sorghum or other grass-

type crops with cotton, soybeans or other non-h crops. Keeping fields weed-free throughout the ye important in reducing soil insect problems. This es cially is true for fallowed or layout land.

Presently, there are no effective insecticide app cation methods once the crop has been planted a newly emerged seedlings are attacked by soil pes Thus, producers should sample their fields for pr ence of soil pests before bed formation to avoid exc cultivation. If chemical control of soil pests is deem necessary, two alternative treatment methods a available. One method may be more effective for particular soil pest than the other.

Insecticide may be applied to the soil or the see With the soil treatment method, there are two app cation techniques — the preplant broadcast or row band and the planting-time in-furrow. There are al two application techniques for the seed treatme method — the direct treatment of seed before plan ing and the planter box treatment at seeding time The preplant seed treatment usually has been don by the seed company; however, due to pending re strictions on chemicals used on seed, many commer cial seed companies are not treating seed. This tech nique can be used by the producer. Planter box treat ments have been used where commercially treated seed are not available.

Soil Treatment

Insecticide application for controlling some soil pests must be made before the crop is planted or at planting time. Granular or emulsifiable concentrate formulations may be used. The formulation used usually depends on available application equipment and the target insect.

Preplant — Soil treatments may be applied before planting. A broadcast application generally results in the best protection against the soil insects and is *the only means of controlling heavy infestations of white grubs.* However, it is more expensive because of the additional insecticide required compared with a row-band or in-furrow treatment. Apply broadcast applications uniformly to plowed ground and disk immediately to a depth of 3 to 5 inches.

Where sorghum and corn are to be planted on beds, special equipment for insecticide incorporation to a depth of 3 to 5 inches is required for preplant soil treatment. This is often referred to as a row 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 applied 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 time — Insecticides also may be applied to the soil at planting time by the in-furrow technique. This method is less applicable where a bed planter is used since insecticide incorporation within the root zone may defeat major objectives of bed planting. Where bed planting is to be used, soil insecticides may 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 covering soil, is treated. Incorporation accomplished during seed covering generally is adequate. 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 control suggestions, limitations and rates of each insecticide labeled for use on grain crops, refer to the insecticide suggestions table.

Seed Treatment

Insecticide treatment of seed, whether by the preplant seed treatment or planter box treatment technique, has proved effective in controlling wireworms, seedcorn maggots, seedcorn beetles and corn rootworms where light populations are present. Use lindane or heptachlor as seed protectants. Distribute the insecticide evenly so that each seed is coated.

Use a concrete mixer or a homemade seed treater to treat seed. Sprinkle 1 pint of water on each 100 pounds of seed and mix to coat the seed with moisture. Add the correct amount of insecticide to the seed as specified by the label and mix thoroughly.

Planter Box Treatment

Some insecticides are formulated as materials to be applied to seed in the planter box. This also may be looked upon as an in-furrow application technique.

This method is effective only against those pests their population levels which can be controlled effectively by direct seed treatment. Use this soil insect control technique in strict accordance with recommendations on the insecticide label.

SMALL GRAIN PESTS

White Grubs

No pesticide is currently labeled for preplant application to fields to be planted in small grains. Fields known to be infested with damaging populations of white grubs should be planted in late fall or early winter after grub feeding has lessened. Since grubs feed on the root systems of many grasses, summer fallowing of small grain fields is strongly recommended.

Greenbug

Greenbugs develop in large numbers under certain conditions and may cause economic losses. In some cases, entire fields of grain are killed. Greenbugs or plant lice suck sap and inject toxins into small grain plants. During the winter, infested fields may have yellowed spots preceding the appearance of small "deadened" areas. Later, greenbugs in these spots may increase and spread throughout the field. Greenbugs cause more damage when small grain crops suffer from deficient moisture during mid-winter and cool springs.

The greenbug reproduces rapidly at temperatures between 55 and 95 degrees F. Its natural enemies, however, reproduce slowly when temperatures are below 65 degrees F. Thus, in cool weather the greenbug may increase to enormous numbers while its natural enemies multiply slowly. Greenbug damage may be confused with moisture stress and/or nitrogen deficiency.

How to make counts. Make a minimum of five random counts, each consisting of 1 linear foot of row, while walking diagonally across the field. More counts may be necessary in large acreages. On small plants, greenbugs can be counted on the plants. On larger plants, slap the plants against the ground to jar greenbugs loose for counting. If greenbugs are numerous, estimate the number present. Make counts during the warmest part of the day when

greenbugs are most likely to be exposed on the above-ground part of the plants. (During periods of cool, dry weather, greenbugs may congregate in loose soil at the base of plants, making detection and chemical control difficult.)

When to spray. The need for applying insecticide depends on the number of greenbugs present, size and vigor of plants, temperature, time of year, moisture conditions, stage of growth and presence of parasites and predators. Irrigated crops can withstand larger greenbug populations than dryland crops without marked yield loss.

It is impractical to outline specifically all conditions under which insecticides should be applied for greenbug control. However, information in the following table may serve as a guide in determining the need for treatment.

Plant height (inches)	Number of greenbugs per linear foot
3-6	100-300
4-8	200-400
6-16	300-800

The appearance of dead plants caused by greenbug feeding in spots within the field also indicates a need for treatment. Occasionally, populations of 25 to 50 greenbugs per foot of very young, small grain plants may warrant treatment.

Mites

The *winter grain mite* may damage oats, wheat and barley in North Central and Central Texas. Mite damage generally is more severe in grain growing on land planted to small grain in previous years. Crop rotation with crops other than small grains reduces infestations. Mites range from 1/32 to 1/16 inch long. The adult has four pairs of reddish-orange legs, and the body is dark brown to black. Mites may appear to have a bluish cast. This pest feeds primarily at night, remaining around the base of the plant during the day. The mite's activity is retarded during hot, dry periods and greatest damage occurs during winter and early spring. Mites cause leaf tips to brown and plants to become stunted with a silvery-gray appearance. These symptoms indicate the need for control.

The *brown wheat mite* is considerably smaller than the winter grain mite — scarcely larger than a

period in newsprint. Its rounded body is metallic d brown or blackish with a few short hairs on the bu The front legs are about twice as long as the oth three pairs of legs. This species is most prevalent dry weather and often increases considerably wheat suffering from deficient moisture. Effecti ness of insecticides in controlling this pest is qu tionable.

Fall Armyworm and Yellow-Striped Armyworm

These foliage feeders can be extremely destru tive, particularly on seedling stands. Base the need f insecticide application on extent of stand loss on see ling plants, and foliage loss on older plants.

Flea Beetles

Flea beetles have caused stand losses during th fall and early winter. Movement into fields generall occurs from borders. Treatment of the infested field margins, plus about 50 additional feet into the field generally is adequate for effective control.

SORGHUM AND CORN PESTS

White Grubs

White grubs are the larval stage of May and June beetles. Damage to plants results from larvae feeding on the roots. Small plants often are killed, resulting in plant stand loss. Severely pruned roots of larger plants result in stunting or plant lodging.

Base soil application of insecticides to control white grubs on need. Examine 1 square-foot soil sample for each 5 to 10 acres before planting. Research data have shown that an average of one white grub per square foot is sufficient to cause significant stand loss. Best results are obtained by broadcasting the insecticide to the soil before planting, followed by thorough incorporation 3 to 5 inches deep. Where grub populations are high, seed-furrow treatments are not effective. (Refer to soil insect control section for application techniques and the insecticide suggestions table for rates, waiting period, etc.)

orn Leaf Aphid

Heavy populations of corn leaf aphids sometimes use damage to seedling grain sorghum or corn nts. Larger sorghum or corn in pre-boot, pre-tassel d later growth stages generally can tolerate large mbers of aphids without significant damage. Reurch has shown that yield losses have occurred only here corn leaf aphids cause stand loss on seedling nts. Although rare, head infestations have caused rvesting problems.

reenbug

The extent of greenbug damage in grain sorghum dependent upon greenbug numbers, plant size, gor and stage of growth, moisture conditions and esence or absence of parasites and predators which fectively destroy greenbugs. Producers are tioned to observe plant conditions closely as well the development of greenbug numbers and damge. Damage from seedling stage up to early pre-boot ay result in stand loss.

Treat plants up to about 6 inches in height when sible damage and greenbug colonies are observed. se the extent of stand loss as a treatment guideline. esearch data indicate that larger plants up to the re-boot stage will tolerate more greenbugs. Control rge numbers of greenbugs on this size plant before y entire leaves are killed.

Yield reductions during the pre-boot, boot, looming and grain development stages are depenent on greenbug numbers, length of time that reenbugs have infested plants and plant condition. eavy populations on pre-boot and older plants can use yield reductions.

In the Texas Blacklands, insecticide applications re suggested if greenbugs are colonizing on the pper leaves of booting sorghum and death of tissue is ccurring. Plants can tolerate approximately 30 perent leaf loss before yield reduction occurs. Indicaions are that greenbug populations which cause the eath of more than two normal-sized leaves before he hard-dough stage should be controlled.

The above general guides are based on the assumption that the greenbug buildup is occurring so apidly that control by beneficial insects is not effective. Also, if plants are undergoing drought or other tress, they cannot support as many greenbugs without suffering yield reductions.

The following table will serve as a general guid determining the need for treatment.

Plant Size	When to Treat
Emergence to about 6 inches	Visible damage with colonies of gr bug on plants
Larger plant to pre-boot	Before any entire leaves are killed
Boot to hard-dough	When greenbug damage is sufficie cause death of more than two normal-sized leaves

GREENBUG RESISTANT SORGHUM HYBRIDS

Sorghums resistant to the sorghum greenbug a available. These hybrids may become the most effi tive means of controlling the greenbug. Produce should be aware that the primary type of resistance tolerance, and should not expect plants to be free greenbugs. However, resistant hybrids gener support lower greenbug populations than do suscep ble hybrids. Based on previous research, the *dama* threshold for resistant sorghums is the same as susceptible sorghums.

Misunderstanding may exist relative to the te minology used in describing insect-resistant plant Therefore, the following terms are defined:

(1) Susceptibility — A susceptible plant is on which displays average or more than average damag by a pest.

(2) Immunity — An immune plant is one which specific pest will never consume or injure under a known condition.

(3) Resistance — A resistant plant possess heritable qualities which enable it to produce greater yield of better quality than other plants of th same species when exposed to the same pest popula tion or conditions.

Plant resistance is relative and must be deter mined by comparison with plants which are more se verely damaged under the same set of conditions.

Types, bases or causes of resistance are defined as

1. Non-preference — A type of resistance demo ing plant characters which cause a pest to de sire it less than a susceptible plant for ovipo tion, food, shelter, or a combination of th three.

2. Tolerance — A type of resistance in which a plant is able to withstand damage in spite of supporting a pest population approximately equal to that which would damage a susceptible host.
3. Antibiosis — A type of resistance denoting some adverse effect of the plant on the pest, such as reduced reproduction, decreased size, abnormal length of life, or increased mortality.

Growers must be able to distinguish greenbugs from other aphids occurring in corn and sorghums to properly assess damage potential and avoid unnecessary applications. Additional information on aphids occurring in grains is discussed in L-819, *Greenbugs on Sorghum and Small Grains.*

Yellow Sugarcane Aphid

This lemon-yellow aphid injects a potent plant toxin during feeding which causes purple colored leaves in seedling plants, and a yellowing of more mature leaves. This aphid has caused plant death in the pre-boot stage. The yellow sugarcane aphid has a wide wild host range and is often found on Johnsongrass in the Gulf Coast, Blacklands and Rolling Plains counties of Texas.

Corn Earworm and Fall Armyworm

Corn earworm moths deposit eggs on the leaves, heads, tassel or silks, and the newly hatched larvae begin to feed almost immediately. On young sorghum or corn plants, corn earworm and certain other species such as the fall armyworm often feed in the whorl. Experimental results indicate that control of corn earworm or fall armyworm in the whorl stage seldom is justified economically. Although rare, insecticidal control may be necessary if examination of larval feeding indicates damage to the developing head or growing point. Corn earworm larvae are cannabalistic. Populations exceeding an average of two small larvae per head in maturing grain sorghum are considered a damaging infestation in the absence of effective natural predators.

Sorghum Midge

The sorghum midge can be one of the most damaging insects to grain sorghum in Texas. Its damage usually is more severe in late blooming grain sorghum. Planting hybrids of uniform maturity at the

right time to avoid late heading is strongly recommended, especially in the Gulf Coast and Texas Valley where the midge has been a problem. Area-wide control of Johnsongrass that serves as an alternate host for the sorghum midge may limit early season infestation of grain sorghum. In late planted grain sorghum, early maturing varieties sometimes can be used to escape midge damage. Uniformity of heading in a community and field is important in avoiding midge damage.

Females may deposit an average of 150 eggs in blooming florets. The larvae prevent seed development, causing "blasted heads." Only adults can be controlled with presently approved insecticides; thus effective control requires precise timing of application to kill adults before eggs are deposited. Since eggs are deposited in blooming florets, sorghum heads are susceptible to oviposition during the entire blooming period. Carefully inspect fields daily for adult midges beginning when heads *first start to bloom at the top*. Use a clear plastic bag as a trapping device, quickly slipping it over sorghum heads, to help detect midge infestations. Apply treatment when 25 to 30 percent of the heads *begin to bloom and the number of midge adults averages 1 per head.* If adults are still active three to five days later, immediately apply a second treatment. Because midge frequently reinfest treated fields, several applications at three-day intervals may be justified if the yield potential is high and midge are abundant. For additional information see L-842, *The Sorghum Midge and Its Control.*

Sorghum Webworm

The sorghum webworm occurs primarily in the more humid eastern half of the state. It frequently occurs in large numbers on grain sorghum heads where it gnaws circular holes in the grain and feeds upon the starchy contents.

Make frequent head inspections beginning in the bloom-stage and continuing until hard dough. To examine heads for sorghum webworm, beat heads on a piece of paper or white handkerchief. Small larvae will dislodge. This size larva (less than 1/8 inch long) commonly is overlooked during head inspections. Control is suggested when heads are infested with five or more small larvae per head.

Spider Mites (*Oligonychus spp.*)

High numbers of spider mites have been observed on sorghum and corn in certain areas. Although mites

re observed earlier in the growing season, population increases generally occur after the boot or tassel stage of plant growth. Initial infestations appear on the lower leaves; however, leaves may be killed as populations become exceedingly heavy, and mites move up the plants and into the head on sorghum. Extremely high populations cause extensive webbing of sorghum heads and corn and may be associated with stalk rot and lodging. Although yield reduction can result from severe infestations before the soft-dough stage, the heaviest populations have been observed on more mature corn and sorghum. Periods of hot, dry weather favor rapid mite population increases.

Southwestern Corn Borer

The southwestern corn borer causes damage from extensive tunneling and girdling of the corn stalk, which often results in stalk lodging. For many years light infestations also have been reported in grain sorghum. Efforts at chemical control generally have given sporadic results. Various cultural control practices seem to afford the most effective means of controlling this pest.

Area-wide stalk destruction, through practices such as double disking and deep plowing, destroys the plant crowns and destroys overwintering larvae. Research indicates that early planted corn is less susceptible to plant lodging from the corn borer. A reasonable plant population to insure large healthy stalks, along with proper fertilization and adequate irrigation, help prevent lodging of borer-infested stalks. Crop rotation, use of early maturing varieties and early harvest with equipment designed to pick up lodged stalks aid in reducing yield losses. See L-1417, *Insect and Mite Pests of Field Corn* for additional information.

INSECTICIDE APPLICATION METHODS

Ground machines or aircraft may be used to apply most insecticides. For best results with aerial applications, flag the swaths so that they meet or overlap.

Spray applications are most effective when wind velocity does not exceed 15 miles per hour. Avoid spraying when plants are wet. For broadcast crops, No. 3 cone nozzles set 20 inches apart on a rear-mounted boom of a tractor sprayer are satisfactory. A pump pressure of 60 pounds per square inch is recommended.

Nozzle size and number, ground speed and pressure influence the rate of output per acre; therefore, calibrate the sprayer carefully to insure application of recommended insecticide amounts. One nozzle per row usually is adequate for young row crops, but two or three nozzles per row may be desirable on large plants to obtain adequate coverage. See L-486, *Insecticidal Spraying of Field Crops with Ground Machinery* and L-764, *Pesticide Application Ground Equipment Calibration Guide* for additional information.

PRECAUTIONS

A number of insecticides discolor the foliage of certain grain sorghum varieties. Yield losses have resulted from extensive leaf damage following the use of these chemicals on susceptible grain sorghum hybrids. Before application, check the insecticide label closely and consult the manufacturer and the seed company regarding possible phytotoxic effects. Where extensive phytotoxicity has occurred in research programs, the chemicals involved have been eliminated from the recommendations in this publication.

PROTECTING BEES AND OTHER POLLINATORS FROM INSECTICIDES

Pollination is extremely important in producing many seed crops. This is particularly true for legumes such as alfalfa, clovers and vetch. Most grass-type plants are wind- or self-pollintaed 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 reduce bee losses:

1. Apply insecticides, if practical, *before* bees are moved into fields for pollination.

2. Where insecticides are needed, use materials least toxic to bees.

3. Make all applications when bees are away from the field. Evening or early morning treatments between the hours of 7 p.m. and 6 a.m. generally are most satisfactory. Evening applications, after bees have left the field, are less hazardous than early morning.

4. Use spray or granular formulations rather than dusts.

5. Where it is necessary to use an insecticide in Groups 1 or 2 in the following list, notify the beekeeper so that he can make necessary arrangements to protect his bees.

6. Avoid drifting or spraying any insecticide directly on colonies. Heavy losses generally occur in these situations. On hot evenings, bees often cluster on the front of the hives. Pesticide drift or direct spray at this time generally results in heavy mortality.

INSECTICIDES GROUPED ACCORDING TO THEIR RELATIVE HAZARDS TO HONEY BEES

Insecticides	Remarks
GROUP 1 — *Highly Toxic*	
Azinphosmethyl (Guthion) Carbaryl (Sevin) Chlordane Diazinon Malathion (wettable powder or ULV) Methyl parathion Mevinphos (Phosdrin) Naled (Dibrom) Parathion	This group includes materials that kill bees on contact during application or for several days following application. Remove bees from the area if these are used on plants being visited by the bees, with some exceptions. Because of short residual activity, apply naled and mevinphos to the crops when bees are not foraging. Malathion occasionally causes heavy bee losses, particularly during periods of extremely high temperatures. Make malathion applications in the evening after all bees have completed foraging. Avoid ultra-low-volume malathion after blooms appear.
GROUP 2 — *Moderately Toxic*	
Malathion (EC)	Do not apply when bees are working in field. Apply in late evening.
GROUP 3 — *Relatively Non-Toxic*	
Demeton (Systox) Toxaphene Trichlorfon (Dylox) Methoxychlor	Use these materials with little precaution. Make applications in late evening or early morning when bees are not foraging.

POLICY STATEMENT FOR MAKING CHEMICAL CONTROL SUGGESTIONS

Suggestions on use of pesticides made by the Texas Agricultural Extension Service and the Texas Agricultural Experiment Station are based upon:

- Effectiveness under Texas conditions
- Avoidance of residues in excess of allowable tolerances
- Avoidance of toxicity to desirable vegetation, animals and humans
- Avoidance of adverse side effects upon beneficial predators, parasites, honeybees, fish and other wildlife, plants, animals and humans.

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 always is 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 his property to that of others. *Always read and follow carefully the instructions on the container label.*

Proper disposal of waste pesticides and "empty" or used containers is an essential step in the safe use of pesticides. For additional information see L-1008, *Disposal — Pesticide and Pesticide Containers.*

Pest	Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to Harvest	Days from last application to Grazing	Remarks
Wireworms	Seed treatment with heptachlor or lindane is effective in controlling wireworms; refer to *Seed Treatment,* page 5, for procedures. Do not use treated seed for food or feed.				
Army cutworm*	A. Methyl parathion (4 lbs.)	¾-1 pt.	15	15	**Parathion** — not cleared for use on rye.
Armyworms	B. Parathion (4 lbs.)	½ pt.	15	15	**Toxaphene** — do not feed treated forage to dairy animals or animals being finished for slaughter.
	C. Toxaphene (6 lbs.)	1-1½ qts.	See remarks 0	See remarks	**Trichlorfon** — not cleared for use on rye.
	D. Trichlorfon (Dylox) (80% SP)	1 lb.	21	0	*Late afternoon or evening pesticide applications may improve control of these pests.
Greenbug	A. Dimethoate (2.67 lbs.) (Cygon, De-Fend)	¾-1 pt.	60	14	Greenbug control is more effective when temperature is above 50 degrees. Use the higher recommended rates when temperature is below 65 degrees. See page 6.
	B. Disulfoton (Di-Syston) (6 lbs.) (Wheat only)	¼-1 pt.	See remarks See remarks		**Dimethoate** — cleared for use on wheat only.
	C. Malathion (5 lbs.)	½-1 pt.	7	7	**Disulfoton** — cleared as foliar spray only on wheat. Do not graze treated fields. Do not repeat application within 30 days. Do not harvest grain within 30 days of application.
	D. Methyl parathion (4 lbs.)	½-1 pt.	15	15	**Malathion** — is not as effective as disulfoton, methyl parathion or parathion, but may be used where a less toxic material is preferred for ground applications.
	E. Parathion (4 lbs.)	½-1½ pts.	15 See remarks	15	**Parathion** — not cleared for use on rye.

Difficulty in controlling greenbugs has been encountered in several counties of the Texas High Plains. Resistance exists to most registered materials in some localized areas but continued heavy use of insecticides is apt to expand the resistance problem.

Pest	Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to Harvest	Grazing	Remarks
Winter grain mite	A. Disulfoton (Di-Syston) (6 lbs.)	1/3-2/3 pt.	See remarks		**Disulfoton and parathion** — see remarks under greenbug.
	B. Methyl parathion (4 lbs.)	½ pint	15	15	
	C. Parathion (4 lbs.)	½ pint	15	15	
Chinch bug False chinch bug	A. Parathion (4 lbs.)	½ pint	15	15	**Parathion and toxaphene** — see remarks under cutworms and armyworms for use restrictions.
	B. Toxaphene + parathion (6 lbs. + 4 lbs.)	1/3 gal.+1 pt. or ½ gal.+½ pt.	See remarks		**Toxaphene + parathion** — more effective in controlling chinch bugs.
Grasshoppers	A. Malathion (5 lbs.)	2 pints	7	7	**Toxaphene** — see remarks under cutworms and armyworms.
	B. Toxaphene (6 lbs.)	1-1½ qts.	0	See remarks	
GRAIN SORGHUM					
Wireworms Corn rootworms	No insecticides are presently labeled for in-furrow or preplant use for control of wireworms or corn rootworms. Seed treatments with heptachlor or lindane are effective in controlling wireworms and light infestations of corn rootworms at planting time. See *Seed Treatment*, page 5, for procedures.				

Cutworms	A. Toxaphene (6 lbs.)	1 1/3 qts.	See remarks		Apply thoroughly to soil and seedling plants when cutworms are causing damage. **Toxaphene** — 1 1/3 quarts, do not apply within 28 days of harvest. Apply only once after heads start to form. Do not graze dairy cattle or animals being finished for slaughter on treated fields. Do not ensile treated forage.
White grubs	A. Diazinon (14.3% G) or (4 lbs.)	7-10 lbs. 1½-2 qts.	7 7	0 0	Preplant broadcast applications are most effective though soil incorporation is necessary. Do not apply directly to seed. Make applications where populations average 1 grub per square foot of soil.
Sorghum midge	A. Carbaryl (Sevin) (80% WP)	1.25-1.8 lbs.	21	0	Timing of application is important in obtaining effective control. First application should be made when approximately 25 to 30 percent of the heads have just begun to bloom at the tip and sufficient adult midge are present. Economic damage occurs when adult midge numbers average one per head. Repeat the application 3-5 days later where adult population warrants. See *Sorghum Midge* page 11.
	B. Carbophenothion (Trithion) (8 lbs.)	½ pint	21	21	
	C. Diazinon (4 lbs.)	½ pint	See remarks 7	0	
	D. Disulfoton (Di-Syston) (6 lbs.)	1/3-2/3 pt.	7	28	
	E. Ethion (4 lbs.)	½-1 pint	30	30	
			See remarks		
	F. Malathion ULV (95%)	8 ounces	7	7	**Disulfoton** — do not apply more than 3 times per season.
	G. Parathion (4 lbs.)	1 pint	12	12	**Carbophenothion** — up to 2 applications per season. **Ethion** — do not apply more than 3 times per growing season. Do not substitute **methyl parathion** for **parathion.**
Sorghum webworm	A. Carbaryl (Sevin) (80% WP)	1¼-2½ lbs.	21	0	Make application when 10-25% of heads are infested with 5 or more larvae per head. Apply insecticides when worms are small. See *Sorghum Webworm* discussion on page 12. Do not substitute **methyl parathion** for **parathion.**
	B. Parathion (4 lbs.)	½-1 pint	12	12	
	C. Toxaphene (6 lbs.)	2½-3 1/3 pts.	See remarks under cutworm		

Pest	Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to Harvest	Grazing	Remarks
	Attention: Review thoroughly all remarks.				
Greenbug	A. Carbophenothion (Trithion) (8 lbs.)	1/5-½ pt.	21	21	*See Greenbugs* on page 9 for details on timing applications, type of damage and need for control. It is important to be able to distinguish between the greenbug and other aphids occurring in grain sorghum. Lower rates in the table have been effective in controlling economic infestations. In areas of no insecticide resistance, effective use of reduced rates is dependent on proper application timing. Reduced rates are designed to suppress greenbug populations below injurious levels while providing maximum protection of beneficial species. Using insecticides to achieve total elimination of greenbugs is not desirable. To conserve beneficial species, subeconomic greenbug populations must be maintained as a food source.
	B. Demeton (Systox) (2 lbs.)	2/5-1 pint	35	35	
	C. Diazinon (4 lbs.)	¼-1 pint	7	0	
	D. Dimethoate (Cygon, De-Fend) (2.67 lbs.)	1/3-1½ pts.	28	28	
	E. Disulfoton (Di-Syston) (6 lbs.) (15% G) (whorl application)	1/8-2/3 pt.	7	28	
		3.5-6.7 lbs.	30	14	
	F. Malathion (5 lbs.)	½-1½ pts.	7	7	
	G. Meta-Systox-R (MSR) (2.0 SC)	1-2 pts.	45	21	
	H. Parathion (4 lbs.)	¼-2 pts.	12	12	
	I. Phorate (Thimet) (15% G)	5-6.5 lbs.	28	28	

See remarks

Carbophenothion and **dimethoate** — do not apply more than twice per season.

Demeton — apply once per season.

Disulfoton — do not apply foliar spray more than twice per crop season or granular application more than once per season. Granular formulation recommended as whorl application only.

Meta-Systox-R — Apply with not less than 1 gallon of water per acre, up to 3 applications per season. Do not use on sweet

Difficulty in controlling greenbugs has been encountered in several counties of the Texas High Plains. Resistance exists to most registered materials in some localized area but continued use of insecticides is apt to expand the resistance problem. Where resistance exists in an area, the initial insecticide application should be made at the higher labeled dosage rate. *See remarks for use of lower rates.*

					per acre, up to 3 applications per season. Do not use on sweet sorghum. Slight phytotoxicity may occur in some sorghum hybrids. **Phorate** — whorl application only. Only one application per season. Do not substitute **methyl parathion** for **parathion.**
Yellow sugarcane aphid	A. Demeton (Systox) (2 lbs.)	1 pt.	35 See remarks	35	This aphid is lemon yellow in color, covered with small spines and has two double rows of dark spots down the back. Feeding aphids inject a toxin and 5 to 10 per leaf can kill grain sorghum up to 18 inches high. Treatment should begin at the first sigh of damage in seedling sorghum. See page 11. **Demeton** — apply only once per season. Do not substitute **methyl parathion** for **parathion.** **Disulfoton** — A maximum of 3 foliar applications may be made at rates 2/3 pt. or less per acre.
	B. Disulfoton (Di-Syston)	1/3-2/3 pt.	34 See remarks	34	
	C. Parathion (4 lbs.)	1 pt.	12 See remarks	12	
Chinch Bug	A. Parathion (4 lbs.) B. Toxaphene + Parathion (6.0 lbs.) (4.0 lbs.)	1 pt. 1/3 gal.+1 pt. or 2 2/3 pt.+½ pt.	12 See remarks	12	Severe stunting by chinch bugs has been noted from time of seedling emergence to 18 inches high. Control is not generally justified on larger sorghum. Apply controls when two or more adult chinch bugs are found on 20% of the seedlings less than 6 inches high. Make at least 5 checks randomly in field. On taller plants, initiate control when nymphs or adults are on 75% of plants. Satisfactory control is seldom obtained on booting or larger plants.
Flea beetle	A. Toxaphene (6 lbs.)	1/3 gal.	See remarks		**Toxaphene** — 1/3 gallon, do not apply within 28 days of harvest. Apply only once after heads start to form. Do not graze dairy animals or animals being finished for slaughter on treated fields. Do not ensile treated forage.

Pest	Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to Harvest	Days from last application to Grazing	Remarks
Stink bugs	A. Carbaryl (Sevin) (80% WP)	1½-2 lbs.	21	0	
False chinch* bug	A. Parathion (4 lbs.)	1/3-½ pt.	12	12	Do not substitute **methyl parathion** for **parathion.** *Pest population is often clumped making pesticide application to infested areas possible. Make application when an average of 140 false chinch bugs/head are found.
Spider mites	A. Carbophenothion (Trithion) (8 lbs.)	½ pt.	21	21	Mite populations, size and maturity of the plants will dictate the need for applications. See *Spider Mites,* page 12. Research has shown no yield increase or reduced lodging following treatments in the hard dough or later stages of plant growth. Erratic control with all recommended materials has been experienced in some areas of Texas. Thorough application is required; apply at least 3 to 5 gallons of spray mix per acre.
	B. Comite (6.75 lbs.)	1½-2 pts.	See remarks 30	0	
	C. Disulfoton (Di-Syston) (6 lbs.) (Excluding Trans-Pecos area)	2/3 pt.	7	28	
	D. Ethion (4 lbs.)	1 pt.	30	30	
	E. Phorate (Thimet) (15% G)	5-6 lbs.	See remarks 28	28	
	F. Methidathion (Supracide) (2 lbs.)	2 pts.	30	30	**Comite** — do not apply more than once per season. Slight phytotoxicity may occur on some sorghum hybrids. Disulfoton and phorate — See restrictions above [illegible]

bug.

None of the above materials have given consistent mite control in the Trans-Pecos area and some areas of High Plains.					**Ethion** — see restrictions under sorghum midge. Has been effective only in South Texas and Gulf Coast areas. **Carbophenothion** — up to 2 applications per season. **Supracide** — up to 3 applications per season at 10 to 14 day intervals. Slight temporary phytotoxicity may occur.
Sugarcane borer Southwestern corn borer and Other stalk borers					Fall stalk destruction reduces number of larvae overwintering in old stalks. This cultural practice is the most effective means of control. Early planted sorghum commonly escapes damage; late season planting encourages borer infestations. No insecticides are currently labeled for the control of sugarcane borer and southwestern corn borer on grain sorghum.
Lesser corn-stalk borer	A. Diazinon (14.3% G)	7-8 lbs.	See remarks		Apply granules in a band 10 inches wide over seed furrow or seedling plants. Simultaneous with planting, apply just after seed drop and seed press wheel, and in front of covering shovels, press wheel or chain drag. Soil coverage is important.
Fall armyworm Corn earworm	A. Carbaryl (Sevin) (80% WP)	1.25-1.8 lbs.	21	0	Only on rare occasions do these two pests cause economic loss to whorl stage plants. Refer to *Corn Earworm* and *Fall Armyworm,* page 11. Control of corn earworm is difficult. Larval counts averaging two per head are required for economic damage.
	B. Methomyl (Lannate)* (1.8 lbs.)	1-2 pts.	14	14	
	(90% SP)	¼-½ lb.	14	14	
	C. Parathion (4 lbs.)	12-25 oz.	12	12	
	D. Toxaphene (6 lbs.)	1 qt.	28	See remarks	*Methomyl — not labeled for control of fall armyworm.

Pest	Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to Harvest	Grazing	Remarks
					Toxaphene — apply only once after heads start to form. Do not graze dairy animals or animals being finished for slaughter in treated fields. Do not ensile treated forage. Do not substitute **methyl parathion** for **parathion.**
FIELD CORN					
Wireworm Seedcorn maggot Seedcorn beetle	Seed treatment with heptachlor or lindane is generally effective in controlling these soil pests. See *Seed Treatment,* page 5, for procedures. Where large populations of wireworms are present, follow the recommendations for rootworm control. Producers are encouraged to check soil closely during land preparation to determine the need for seed treatment or soil applications.				
Southern corn rootworm Northern corn rootworm Western corn rootworm	**Row Band, at planting**				
	A. Counter (15% G)	6.5 lbs.	At planting only		**Counter** — rate shown is for 40" row spacing. Do not feed green fodder or use for silage prior to 130 days after planting. Dry fodder may be fed except where corn has been furrow irrigated. These restrictions do not apply to banded applications. For all band applications, apply in 6- to 7-inch band just behind seed drop or seed press wheel and in front of covering shovels and press wheel or chain drag. Soil incorporation to a depth of about 1 inch is important. Apply at time
	B. Dasanit (15% G)	5-6.7 lbs.	See remarks At planting only		
	C. Dyfonate (10% G)	7.5-10 lbs.	At planting only		
	D. Furadan (10% G)	7.5-10 lbs.	At planting only		
	E. Phorate (Thimet) (15% G)	6.5 lbs.	At planting only		

					of planting only; at Lower Farm, is important. Apply at time of planting only. **Dyfonate** — not labeled for control of southern corn rootworm. See *Soil Pest Control,* page 3. Seed treatments also have proved effective in reducing these pests where populations are light and control is required only during seedling stage. See *Seed Treatment,* page 5. Granular formulations or emulsifiable concentrates are equally effective at the same rates.
Cutworms	A. Toxaphene (6 lbs.)	1⅓-2 qts.	0	See remarks	Apply thoroughly to soil and seedling plants when cutworms are causing damage.
	B. Toxaphene + parathion (6 lbs. + 4 lbs.)	1 qt. + ⅔ pt.	12	See remarks	**Toxaphene** — do not feed treated forage or ensilage to dairy animals or animals being finished for slaughter.
	C. Toxaphene + methyl parathion (6 lbs. + 4 lbs.)	1 qt. + ½ pt.	12	See remarks	**Trichlorfon** — apply only once per season. For hard-to-control soil insects, use heptachlor as broadcast or band applications.
	D. Trichlorfon (Dylox)				
	(4.0 lbs.)	1-2 pts.	1	0	
	(80% SP)	1¼ lbs.	1	0	
	(5% bait)	20 lbs.	1	0	
Lesser corn-stalk borer	A. Diazinon (14.3% G)	3½-7 lbs.	0	10	Damage is more severe in seedling corn. Base treatments on plant damage. Check 10 plants for each 5 acres in a field for the presence of larvae. Apply granules in a band 10 inches wide over the plant row, then incorporate.
Fall armyworm	A. Carbaryl (Sevin) (80% WP)	2 lbs.	0	0	**Toxaphene** — do not graze dairy animals or animals being finished for slaughter in treated fields. Do not ensile treated forage.
	B. Trichlorfon (Dylox)				
	(80% SP)	1¼	1	0	
	(4 lbs.)	1-2 pts.	1	0	

Pest	Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to Harvest	Days from last application to Grazing	Remarks
	C. Methyl parathion (4 lbs.)	½ pt.	12	12	
	D. Parathion (4 lbs.)	½ pt.	12	12	
	E. Toxaphene (8 lbs.)	2-6 pts.			
Flea beetle	A. Carbaryl (Sevin) (80% WP)	2-2½ lbs.	0	0	
	B. Methyl parathion (4 lbs.)	½ pt.	12	12	
Chinch bug	A. Parathion (4 lbs.)	1 pt.	12	12	Apply thoroughly to the lower parts of plants where chinch bugs congregate.
	B. Toxaphene + parathion (6 lbs. + 4 lbs.)	⅓ gal. + 1 pt. or	See remarks		**Toxaphene** — do not feed treated forage or ensilage to dairy animals or animals being finished for slaughter.
		½ gal. + ½ pt.	See remarks		
			12		
Southwestern corn borer and Other borers	A. Carbaryl (Sevimol-4)	1½ qts.	0	0	Topical application. Broadcast by air or direct granules or spray into whorl and/or leaf sheath area with ground equipment. Apply when second generation eggs begin to hatch.
	B. Carbofuran (Furadan) (10% G)	10 lbs.	0	0	**Carbaryl** — application to the tassel area of the plants during the pollen shed period will seriously reduce bee populations.
	C. Diazinon (14.3% G)	7-14 lbs.	0	10	**Carbofuran** — do not make foliage application if plants are [illegible]

1.0 lb. actual carbofuran was applied at planting. Do not

					Carbofuran — do not make foliage applications. 1.0 lb. actual carbofuran was applied at planting. Do not make more than two foliage applications per season. **Diazinon** — temporary spotting of foliage may occur following application.
Spider mites	A. Carbophenothion (Trithion) (8 lbs.)	½-1 pt.	21	21 See remarks	Mite populations and plant size and maturity will dictate the need for application. See *Spider Mites,* page 12. Research has shown no yield increase or reduced lodging following treatments in the hard dough or later stages of plant growth. Erratic control with all recommended material has been experienced in some areas of Texas. Thorough application is required.
	B. Comite (6.75 lbs.)	1½-2 pts.	30	0	
	C. Disulfoton (Di-Syston) (6 lbs.)	⅔-1⅓ pts.	28	28	
	(15% G)	3½-6.7 lbs.	40	40	
	D. Ethion (4 lbs.)	½-1 pt.	50	See remarks	
	E. MSR (Meta Systox R) (2 lbs.)	1½-2 pts.	7	7	
	F. Phorate (Thimet) (15% G)	6.5 lbs.	30	30	

None of the above materials have given consistent mite control in the Trans-Pecos area and some areas of the High Plains.

Carbophenothion — apply only once per season.
Disulfoton — do not apply more than twice per season. Use granular formulation as whorl application only.
Phorate — apply only once per season.
Comite — apply only once per season.
MSR — do not apply more than once per season.
Ethion — do not apply more than once after ears form. Do not feed treated forage to livestock. Has been effective only in South Texas and Gulf Coast areas.

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