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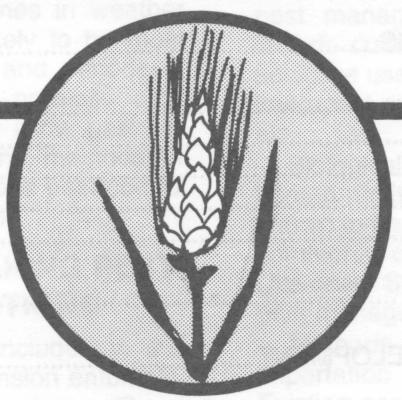
Managing Insect and Mite Pests of Texas Small Grains



Texas Agricultural Extension Service • Zerle L. Carpenter, Director • The Texas A&M University System • College Station, Texas

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Acknowledgement

The authors of this publication appreciate the assistance of entomologists of the Texas Agricultural Extension Service and the Texas Agricultural Experiment Station, The Texas A&M University System. For further information, contact your county Extension agent, county Extension entomologist or the Extension entomologist of The Texas A&M University System, College Station, TX 77843.

Managing Insect and Mite Pests of Texas Small Grains

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Wheat, oats, barley and rye are important small grain crops and are often used for fall and winter grazing by livestock. The potential economic value and multiple use of these crops make pest control an important factor in efficient production.

Insect and mite pests that attack small grains may reach damaging levels throughout Texas. Producers should be aware of the probable seasonal occurrence of various pests (see Figure 9, page 12), be able to correctly identify pests and understand the various methods which are effective in preventing economic damage. Crop production planning, seedbed preparation and in-season field monitoring for detecting pest problems are important. Plant damage does not always relate directly to insect numbers. Other factors such as plant vigor and stage of growth, moisture conditions and crop rotation practices influence crop damage. Pest relationships to crops grown primarily during winter months are complicated by extremes in weather conditions. For example, pests are likely to be most severe during early fall, early spring and periods of warmer temperatures. Cold weather normally suppresses beneficial insects, which may allow pests to reach damaging levels. Pest descriptions, methods for monitoring insects and mites, and various pest control methods are included in this publication.

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. These 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 for 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.

BIOLOGICAL CONTROL

Insect and mite infestations are often held below damaging levels by weather, inadequate food and natural enemies such as predators, parasites and pathogens. It is important to recognize the impact of these natural control factors and, where possible, to encourage their action.

Biological control is the use of living organisms (parasites, predators and pathogens) to control pests. Important natural enemies of insect and mite pests attacking wheat include several kinds of parasitic wasps, lacewing flies and lady beetles.

Biological control is most effective when used with other compatible pest control practices in an integrated pest management (IPM) program. These practices include cultural control, host plant resistance and the selective use of insecticides when other practices fail to keep pest numbers below acceptable or economic levels.

Biological control agents present little or no risk to human health or the environment. Also, few pests are known to have become resistant to natural enemies as commonly occurs with insecticides. The Texas A&M University System is committed to the development of pest management tactics which use biological control.

Methods of biological control are conservation, importation and augmentation of natural enemies. Existing populations of natural enemies are conserved by avoiding the use of insecticides until they are needed to prevent the development of economically damaging pest infestations. Insecticide impact also can be minimized by using insecticides that are more toxic to the target pest than to the natural enemy. Certain cultural practices also can encourage natural enemies.

Importation is the identification, collection and release of natural enemies into areas where they do not occur naturally. This method has been effective where an exotic pest has entered Texas without the natural enemies that help control the pest in its native country. Several species of natural enemies have been imported into Texas to control the Russian wheat aphid.

Augmentation is the purchase and periodic release of natural enemies that do not naturally occur in sufficient numbers to provide pest control. Green lacewing flies and convergent lady beetles are sometimes sold for release in wheat. Because definitive information on augmentation (when to apply, how many to release, etc.) is lacking, entomologists with the Texas Agricul-

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tural Extension Service cannot provide guidelines for augmentation as a management tool in wheat.

Refer to publication B-5044, "Biological Control of Insect Pests of Wheat," available from your county Extension office, for detailed information on natural enemies of insect pests of wheat and their use in biological control.

SOIL PESTS OF SMALL GRAINS

White grubs, wireworms, false wireworms and cutworms are the most common soil insect pests of Texas small grain crops. Noncrop plant materials are important food sources for soil pests. Summer fallowing and/or the use of herbicides that reduce crop residues and provide weed-free fields are important in reducing soil pests.

Control Techniques. Proper seedbed preparation and preplant soil inspection for the presence of soil pests are important. Presently, there are no effective soil pest insecticide application methods that can be used once the crop has been planted and seedlings have emerged. Additionally, no insecticide is currently labeled for preplant soil application to fields to be planted in small grains. If damaging numbers of soil pests are detected, approved insecticides may be applied to the seed prior to planting. Preplant seed treatment or planter box treatment is generally effective in controlling wireworms and false wireworms.

Seed Treatment

On-farm seed treatment can be accomplished by using a concrete mixer, custom designed seed treatment equipment or other similar seed treatment devices. 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 insecticide label and mix thoroughly.

Insecticides applied to seed to prevent damage while seed is in storage will not control soil pests.

Planter Box Treatment

Lindane is specifically formulated to be used as a planter box seed treatment for control of seed feeding wireworms and fire ants. This soil insect control technique should be used in strict accordance with current label instructions.

Wireworms and False Wireworms

Wireworms are the immature stages of click beetles. Wireworms are shiny, slender, cylindrical and usually hard-bodied. The larvae range in color from white to yellow to brown.

False wireworms are the immature stages of darkling beetles.

Wireworms and false wireworms damage small grains by destroying planted seed and by feeding on seedling roots. Stand establishment and plant vigor may be reduced. Fields should be sampled for the presence of wireworms prior to planting. False wireworms tend to occur more commonly during years of little rainfall.

Practices that reduce weeds in fields and/or rotation to warm season crops that are unfavorable for wireworm development are important cultural control methods. Rotation to crops that can be treated with a broadcast application of approved pesticides prior to planting, or seed treatment of small grains, will reduce wireworm damage.

Certain species of wireworms are abundant only in poorly drained soils. The proper drainage of such soils will help prevent damage.

Red Imported Fire Ant

Imported fire ants feed on wheat seeds along field margins where colonies are concentrated. Feeding may result in stand loss extending 10 to 15 feet into the field. Damage is most common during dry, warm weather as germination is delayed, allowing more time for ant feeding. Also, loose, dry soil permits ants easy access to the seed.

Control Techniques. Lindane used in strict accordance with the label as a planter box treatment is suggested for control of imported fire ants, wireworms or false wireworms. This insecticide is also available as an insecticide - fungicide mix. Surplus treated seed must not be used for feed or food.

White Grubs

White grubs are the larval stage of May or June beetles. Larvae are characteristically "C-shaped" with a white body and tan to brown head. The last abdominal segment is transparent, allowing dark, digested material to be seen. Larvae vary in size according to age and species.

Damage to plants results from larvae feeding on the roots. Small seedlings are often killed, resulting in stand loss. Severely pruned roots of larger plants result in stunting and increased susceptibility to drought conditions.

Control Techniques. As soil temperatures decrease in the fall, white grub feeding decreases and larvae migrate deeper into soil. Where white grubs are a problem, delayed planting may improve stand establishment. Seed and planter box insecticide treatments are not effective in controlling white grubs. There currently are no registered insecticides for white grub control in wheat.

Cutworms

Several species of cutworms can damage small grains. Cutworms are the immature stages of drab, brownish moths that are active at night. Grassy and weedy fields are attractive to moths for egg laying. Newly hatched cutworms are brown to black and feed on small grain seedlings. They clip the above ground portion of the plant from the root system at or below the soil surface. Cutworm-infested fields have the appearance of being closely grazed, and damage may be "clumped" or occur in spots in the field.

Control Techniques. Cultural practices that reduce weeds and crop residues in fallowed fields are important control methods. Delayed planting of small grains

after clean plowing fields may reduce cutworm numbers through starvation.

Aerial or ground applications of approved pesticides are effective in controlling cutworms in established small grain stands.

SUGGESTED INSECTICIDES FOR CONTROLLING CUTWORMS*

Insecticide	Amount per acre	Waiting period (days) to: Harvest	Grazing
Methyl parathion			
(4 lb.)	12-16 oz.	15	15
(7.5 lb.)	6-8 oz.	15	15

Remarks

*Late afternoon or evening insecticide applications may improve control.

ABOVEGROUND PESTS OF SMALL GRAINS

Armyworms and Fall Armyworms

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

Armyworm outbreaks are favored by cool, damp weather. Caterpillars are attracted to green, lush-growing small grains. True to their common name, armyworms may attack small grain fields in large numbers, devouring all plant material in their path. In taller, more mature plants, armyworms may feed on leaves within the crop canopy, causing extensive damage before being detected. Periodic inspection of small grain fields is strongly advised. Early armyworm detection is also important because small larvae are more easily controlled with insecticides, but small armyworms are often difficult to find. When inspecting, search the ground for these small green worms. **Control measures are recommended when four to five larvae per square foot are found in combination with seedling stand loss or with foliage loss on older plants.**

Control Techniques. Approved insecticides, applied by aerial or ground methods, effectively control most species of armyworms. Application volume should be sufficient to penetrate the crop canopy in small grains.

SUGGESTED INSECTICIDES FOR CONTROLLING ARMYWORMS AND FALL ARMYWORMS

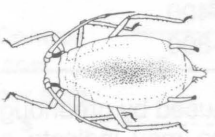
Insecticide	Amount per acre	Waiting period (days) to: Harvest	Grazing
Carbyl			
(Sevin® XLR Plus)	1-1.5 qts.	21	0
(Sevin® 4-Oil)	1-1.5 qts.	21	0
(Sevin® 80S)	1.25-1.875 lbs.	21	0
Ethyl parathion		See remarks	
(4 lb.)	0.75-1 pt.	15	15
(8 lb.)	4 oz.	15	15
Methomyl (Lannate®)			
(90% SP)	0.25-0.5 lbs.	7	10
(2.4 lb. LV)	0.75-1.5 pts.	7	10
Methyl parathion			
(4 lb.)	0.75-1 pt	15	15
(7.5 lb.)	6-13 oz.	15	15

Remarks

Ethyl parathion. Not cleared for use on oats and rye. No ground application. Application only by certified commercial aerial applicator with closed mixing-loading system.

Greenbug

Figure 1. Greenbug



Nature of Damage. Greenbugs are aphids that suck plant juices and inject toxins into the plants. These aphids are pale green, approximately 1/16-inch long, with a characteristic dark green stripe on the back. Greenbugs develop in large numbers under favorable conditions and may cause economic losses. Greenbugs reproduce rapidly at temperatures between 55 and 95 degrees F. 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. The average temperature must be below 20 degrees F for at least a week to kill 99 percent of the greenbugs. The population also must be without protection from snow cover. 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 a mild winter and a cool spring. Greenbug damage may be confused with moisture stress, nitrogen deficiency or foot rot.

Sampling for Greenbugs. While walking diagonally across the field, make a minimum of five random counts per 20 acres of field area, each consisting of one linear foot of row. Greenbugs can be counted on small 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 parts of the plants. During periods of cool, dry weather, greenbugs may congregate in loose soil at the bases of plants, making detection and chemical control difficult.

When to Treat. The need to apply insecticide depends on the number of greenbugs present, the size and vigor of plants, the temperature, time of year, moisture conditions, stage of plant growth and effectiveness of parasites and predators. Irrigated small grains can withstand larger greenbug populations than dryland small grains.

Greenbug populations may be reduced by predators and parasites, including lady beetles, parasitic wasps, spiders, damsel bugs, lacewing larvae and syrphid fly larvae. However, cool conditions greatly limit the activity of these beneficial insects. The convergent lady beetle and the parasitic wasp Lysiphlebus testaceipes are the most important beneficials. They are able to reproduce during warmer periods of the growing season, and under conditions favorable for their development they can suppress greenbug infestations.

It is impractical to outline specifically all conditions under which insecticides should be applied for greenbug control. However, the following information may serve as a general 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 may indicate a need for treatment. **Occasionally, populations of 25 to 50 greenbugs per foot of drill row in very young, small grain plants may warrant treatment.**

Heavy, rapidly increasing greenbug infestations can cause excessive damage; however, lady beetles and parasitic wasps, under favorable weather conditions, can reduce greenbug populations to below the treatment levels given above. Where there are one to two lady beetles (adults and larvae) per foot of row or 15 to 20 percent of the greenbugs have been parasitized, control measures should be delayed until it can be determined if the greenbug population is continuing to increase. When weather conditions remain favorable for a high level of activity by these beneficials, they will significantly reduce the greenbug populations during the following week.

Insecticide Resistant Greenbugs. Greenbug resistance to registered insecticides has created problems for small grain producers in the Texas High Plains. An extensive 1992 survey in Texas High Plains sorghum found insecticide resistant greenbugs in 14 counties, especially north of Amarillo. Insecticide resistant greenbugs are known to overwinter in small grains. Insecticide resistant greenbugs are also known to develop following an insecticide treatment for Russian wheat aphids. Every effort should be made to limit insecticide applications to fields where economic thresholds have been exceeded. Producers have no choice but to begin to settle for a lower degree of control. In most situations, the most one can now accomplish is to lower the infestation pressure until weather or other natural factors intervene.

Control Techniques. Low temperatures will slow the activity and effectiveness of most insecticides. It may take twice as long for an insecticide to kill at 45 degrees F as it would at 70 degrees F. For best results, apply insecticides when temperatures are above 50 degrees F. If temperatures are below 50 degrees F, apply the highest rate recommended.

SUGGESTED INSECTICIDES FOR CONTROLLING GREENBUGS*

Insecticide	Amount per acre	Waiting period (days) to: Harvest	Grazing
Chlorpyrifos		See remarks	
(Lorsban 4E-SG)	0.5-1 pt.	28	14
Dimethoate		See remarks	
(2.67 lb.)	0.75-1 pt.	35	14
(4 lb.)	0.5-0.75 pt.	35	14
Disulfoton		See remarks	
(Di-Syston® 8 lb.)	0.25-0.75 pt.	30	
Ethyl parathion		See remarks	
(4 lb.)	0.5-1.5 pts.	15	15
(8 lb.)	4 oz.	15	15
Malathion			
(5 lb.)	0.5-1.5 pts.	7	7
Methyl parathion			
(4 lb.)	0.5-1.5 pts.	15	15
(7.5 lb.)	4-12 oz.	15	15
Encapsulated			
(Penncap-M®)			
(2 lb.)	1-1.5 pts.	15	15

Remarks

*Greenbug control with chemicals is more effective when temperature is above 50 degrees F. Use the highest recommended rate on the label when temperature is below 50 degrees F.

Chlorpyrifos. Labeled for use on wheat only. Do not make more than two applications per crop.

Dimethoate. Labeled for use on wheat only.

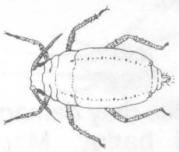
Disulfoton. Labeled as foliar spray only on barley and wheat. Do not graze treated fields. Do not repeat application within 30 days. Do not harvest grain within 30 days of application.

Ethyl parathion. Not labeled for use on oats and rye. No ground application. Application only by certified commercial aerial applicator with closed mixing-loading system.

Malathion. Not as effective as disulfoton or methyl parathion, but may be used where a less toxic material is preferred for ground applications.

Russian Wheat Aphid

Figure 2. Russian wheat aphid



The first appearance of the Russian wheat aphid in the U.S. was in March 1986 in the Texas High Plains. It has since extended its range throughout the Great Plains, into Canada and west to the coast.

The Russian wheat aphid is approximately 1/16 inch long, lime green in color and spindle-shaped. It has short antennae and no prominent cornicles, but a projection above the cauda (tail) gives it a "double tail" appearance.

Russian wheat aphids inject a toxin while feeding, causing white and purple longitudinal streaks on leaves. Heavily infested plants will appear flattened and leaf edges will roll inward, giving the entire leaf a tube-like appearance. Russian wheat aphids prefer feeding on the younger, uppermost leaves of a plant. They may be vectors of viral diseases.

Russian wheat aphids exist in higher numbers and cause more damage in small grains that are stressed. Cultural practices that reduce crop stress should be emphasized. Destroying volunteer wheat and planting later are important cultural practices that delay initial aphid infestation.

Recent research has shown that predators and parasites play an important role in suppressing the Russian wheat aphid population. Many of the predators and parasites that attack the greenbug also attack the Russian wheat aphid. Wheat should be managed in such a manner as to conserve these natural enemies.

Wheat and barley are preferred Russian wheat aphid hosts, while triticale, rye and oats are less preferred. They are occasionally observed on corn and sorghum, but are not known to cause any damage. Wild hosts include cool season grasses such as jointed goat grass, various brome grasses and several species of wheat grasses. In the Texas High Plains, the aphid can oversummer on warm season grasses such as green sprangletop, buffalo grass and several species of grama grass. This aphid does not oversummer in the Rolling Plains.

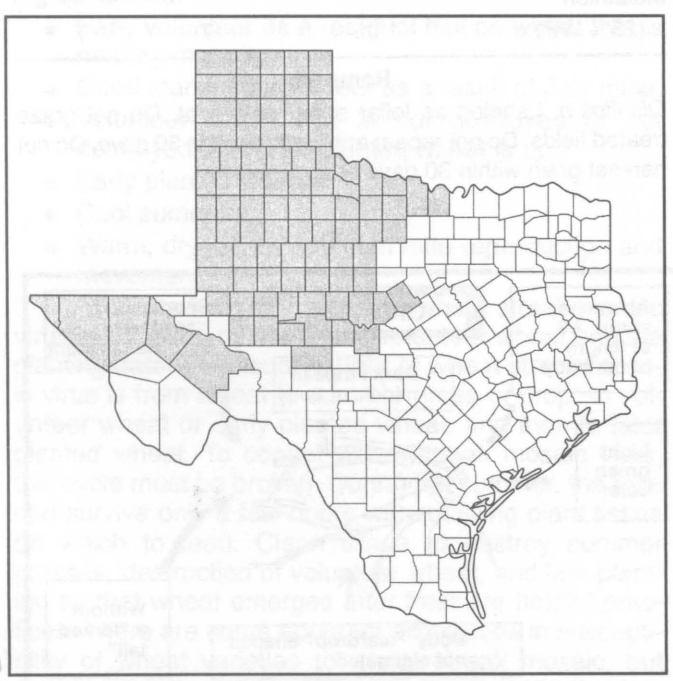


Figure 3. Texas counties infested with Russian wheat aphid.

Texas Agricultural Experiment Station scientists have developed economic thresholds for Russian wheat aphids infesting wheat in late winter and spring. The thresholds are based upon the cost of control and market value of the wheat. For every one percent of the tillers infested, there is a 0.5 percent yield loss.

Sampling and Economic Thresholds for Russian Wheat Aphid. While walking across a field, randomly select 100 tillers each from a different site. In order to prevent bias, select tillers without looking at them. Carefully examine each tiller and record the number infested. Consider any tiller with one or more Russian wheat aphids as infested. Determine the percent infested tillers and use the following table to decide if treatment is justified.

For example, assume the market value of the crop is projected to be $100 per acre and control costs are $6 per acre; then the treatment threshold is 12 percent infested tillers.

Russian Wheat Aphid Economic Threshold Using Percent Infested Wheat Tillers as the Sampling Unit.*

Control cost per acre $	Market value of crop ($) per acre					
	50	100	150	200	250	300
	Percent infested tillers					
4	16	8	5	4	3	3
5	20	10	7	5	4	3
6	24	12	8	6	5	4
7	28	14	9	7	6	5
8	32	16	11	8	6	5
9	36	18	12	9	7	6
10	40	20	13	10	8	7
11	44	22	15	11	9	7
12	48	24	16	12	10	8

*The data are from a single year's research and are subject to adjustment as additional information becomes available.

SUGGESTED INSECTICIDES FOR CONTROLLING RUSSIAN WHEAT APHIDS

Insecticide	Amount per acre	Waiting period (days) to: Harvest	Grazing
Chlorpyrifos		See remarks	
(Lorsban 4E-SG)	0.5-1 pt.	28	14
Dimethoate		See remarks	
(2.67 lb.)	1 pt.	60	14
(4 lb.)	0.75 pt.	60	14
Disulfoton		See remarks	
(Di-Syston® 8 lb.)	0.25-0.5 pt.	30	
Methyl parathion			
(4 lb.)	1-1.5 pts.	15	15
(7.5 lb.)	6-13 oz.	15	15

Remarks

Chlorpyrifos. Labeled for use on wheat only. Do not make more than two applications per crop.

Dimethoate. Labeled for use on wheat only.

Disulfoton. Labeled as foliar spray only on barley and wheat. Do not graze treated fields. Do not repeat application within 30 days.

English Grain Aphid

English grain aphids are green to bright green in color, with black legs and antennae. Damage to small grains infested with this aphid resembles that of the greenbug. English grain aphids cluster on the developing heads of small grain plants, and their feeding may result in shrunken, shriveled seeds.

This aphid is normally controlled by many of the same beneficial insects that aid in the control of the greenbug, and yield losses seldom can be attributed to the English grain aphid.

Bird Cherry-Oat Aphid

This aphid spends almost its entire feeding period on various grains and grasses and is particularly abundant on small grains in Texas. Bird cherry-oat aphids are yellowish-green to dark green to black and are characterized by a reddish-orange spot on the back end. This aphid is often present with the greenbug. It is an important vector of barley yellow dwarf virus. Control of the bird cherry-oat aphid is seldom required.

Winter Grain Mite

Figure 5. Winter grain mite

The winter grain mite may damage oats, wheat and barley. 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. Mite damage is generally more severe on grain growing on land planted in small grains in previous years. Crop rotation with crops other than small grains reduces infestations.

This pest feeds primarily at night, remaining around the base of the plant during the day. The mite's activity is retarded during periods of hot, dry weather, and greatest damage occurs during winter and early spring. Mites cause leaf tips to turn brown and plants to become stunted with a silvery-gray appearance. These symptoms and the presence of mites indicate the need for control.

SUGGESTED INSECTICIDES FOR CONTROLLING WINTER GRAIN MITES

Insecticide	Amount per acre	Waiting period (days) to: Harvest	Grazing
Disulfoton			
(Di-Syston® 8 lb.)	0.25-0.5 pt.	See remarks	
Methyl parathion			
(4 lb.)	0.5 pt.	15	15
(7.5 lb.)	4-12 oz.	15	15
Malathion			
(25% WP)	1 lb.	7	7

Remarks

Disulfoton. Labeled as foliar spray on wheat. Do not graze treated fields. Do not repeat application within 30 days. Do not harvest grain within 30 days of application.

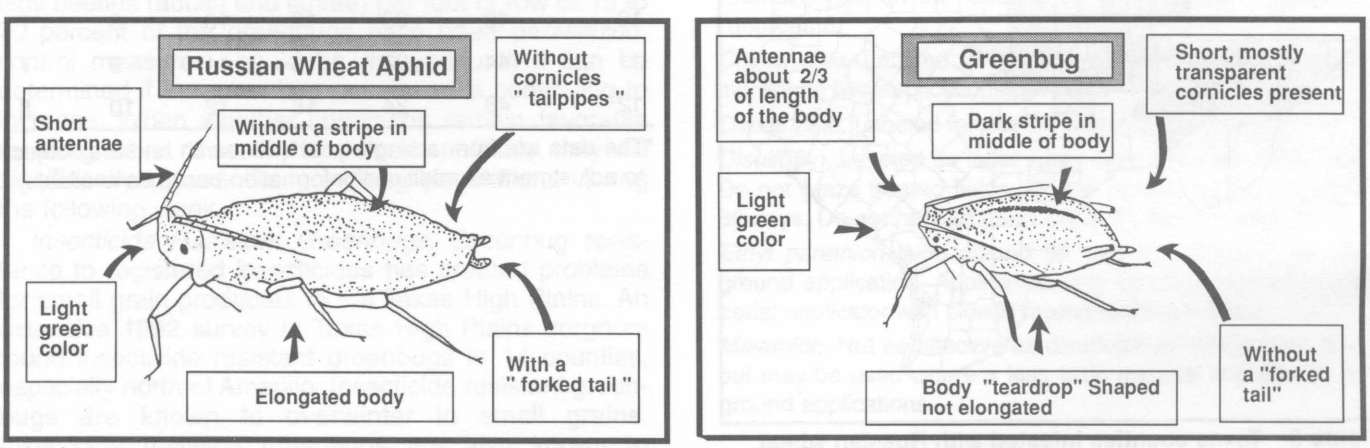
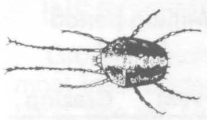


Figure 4. Comparison of greenbug and Russian wheat aphid.

Brown Wheat Mite

Figure 6. Brown wheat mite



The brown wheat mite is about the size of a period in newsprint and is considerably smaller than the winter grain mite. Its rounded body is metallic, dark brown or blackish, with a few short hairs on the back. The front legs are about twice as long as the other three pairs of legs. This species is most prevalent in dry weather, and the population increases on wheat suffering from deficient moisture. It occurs throughout the High Plains and Rolling Plains. Insecticides may not economically control this pest because the crop is unable to respond due to dry conditions.

Wheat Curl Mite

The wheat curl mite is approximately 1/100-inch long, white, sausage-shaped, and has four small legs on the front. It carries and spreads the virus that causes wheat streak mosaic. The mite does very little damage without the virus. Mite feeding alone causes leaves to roll, taking on an onion-leaf appearance, but if virus is present, yellow streaking and mottling of leaves will occur.

Mites reproduce most rapidly at temperatures between 75 and 80 degrees F. They crawl very slowly and depend almost entirely on wind for dispersal. The mite is most active during warm weather. It moves mostly on warm, southwesterly winds; consequently, most wheat streak mosaic virus symptoms develop from southwest to northeast across a field. Mites survive the summer on volunteer wheat and grass; volunteer wheat is the most important host for the mite as well as the disease. The potential for wheat curl mite and wheat streak mosaic virus is highest in the following conditions:

- Early volunteer as a result of hail on wheat that is nearing maturity.
- Good stands of volunteer as a result of July rains.
- Volunteer wheat that is not destroyed or not destroyed until after planted wheat is up.
- Early planted wheat.
- Cool summers.
- Warm, dry fall for optimum mite reproduction and movement.

Control of wheat curl mite and wheat streak mosaic virus is achieved by managing volunteer wheat and the planting date. The usual pattern of wheat streak mosaic virus is from wheat to summer grass or crop, to volunteer wheat or early planted wheat, and then to later planted wheat. To control wheat streak mosaic virus, this cycle must be broken. During the summer, the mite can survive only a few hours without living plant tissue on which to feed. Clean tillage to destroy summer grasses, destruction of volunteer wheat, and late planting so that wheat emerges after frost are helpful practices. There are some apparent differences in susceptibility of wheat varieties to wheat streak mosaic, but none are totally resistant. Chemical control of mites has not proven to be effective.

Hessian Fly

The Hessian fly is a pest of small grains in 51 Texas counties. It attacks wheat, barley and rye, but prefers wheat. This pest can have two generations in the fall and two in the spring if weather is favorable. Early planted fields and volunteer plants will be attacked more severely.

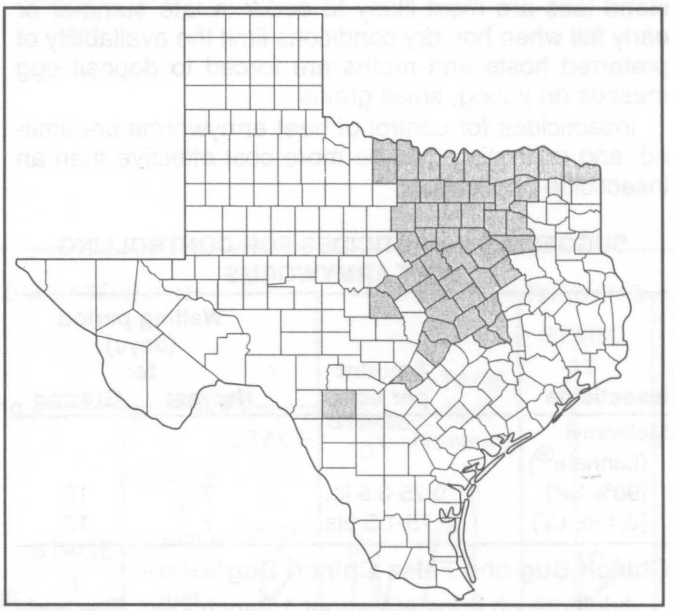


Figure 7. Texas counties infested with Hessian fly.

Biology. Eggs are deposited on the leaf by fragile, brown, two-winged, gnat-like females. The abdomen is a distinct orange-red color, and the Hessian fly resembles a sorghum midge in overall appearance. A single female can deposit from 250 to 300 eggs in clusters of 5 to 12 eggs laid end to end. Eggs hatch in 3 to 10 days. The larvae are white or greenish-white, shiny and legless. The maggots work their way down the grooves of the leaf and in behind the leaf sheath. They feed by rasping plant tissue and sucking the sap which oozes from the irritated surface. Grain loss occurs from plant stunting, reduced grain weight and lodging of weakened stalks. Mature larvae are 3/16-inch long and transform into a brown puparium commonly called the "flaxseed" stage. The Hessian fly overwinters and oversummers in this resting stage as a mature larva.

Management Strategies. Management practices farmers can use to reduce economic losses include:

- Grow adapted wheat varieties that have genetic Hessian fly resistance. Check with the county Extension agent for resistant varieties adapted for your area.
- Plant wheat later in the fall (mid-November) to avoid fall generations.
- Deeply bury crop residue to reduce population numbers.
- Rotate crop types in individual fields to help reduce pest numbers.
- Do not move infested straw from an infested area to an uninfested area.

Under Texas conditions, insecticide treatments may not give economical or practical control of the Hessian fly.

OCCASIONAL PESTS OF SMALL GRAINS

Beet Armyworm

Beet armyworms range from 1/16-inch to 1 1/4-inch long. They are light green with two conspicuous black spots, one on each side of the thorax above the second pair of thoracic legs. Populations capable of causing stand loss are most likely to occur in late summer or early fall when hot, dry conditions limit the availability of preferred hosts and moths are forced to deposit egg masses on young, small grains.

Insecticides for control of beet armyworms are limited, and replanting may be more cost effective than an insecticide application.

SUGGESTED INSECTICIDES FOR CONTROLLING BEET ARMYWORMS

Insecticide	Amount per acre	Waiting period (days) to: Harvest	Grazing
Methomyl (Lannate®)			
(90% SP)	0.25-0.5 lb.	7	10
(2.4 lb. LV)	0.75-1.5 pts.	7	10

Chinch Bug and False Chinch Bug

Adult chinch bugs are about 1/8-inch long. The body is black, but the wings are mostly white with black triangular spots at the middle of the outer margin. The young chinch bugs are shaped like the adults. Initially they are red, but turn darker as they mature. There is a white band across the abdomens of immature chinch bugs.

In early spring, chinch bugs move into small grain fields from bunchgrass where they overwintered. Both young and adult chinch bugs feed on small grains. Very heavily infested plants may be stunted or killed. Infestations are usually confined to small, well-defined spots. When a damaging infestation occurs on the field border, prompt treatment may prevent infestation of the entire field.

Adult false chinch bugs are 1/8-inch long, narrow and dull yellowish-gray. The wing tips are transparent and extend beyond the end of the abdomen. These bugs often migrate in large numbers. Small grains are not preferred hosts. By sucking sap from the stems and heads of small grains, false chinch bugs may cause poorly filled heads and shriveled grain, but the extent of their damage is not well documented. Before applying insecticides, consider the percentage of the field infested and make sure that these bugs are feeding on the small grain and are not just migrating through the field.

SUGGESTED INSECTICIDES FOR CONTROLLING CHINCH BUGS AND FALSE CHINCH BUGS

Insecticide	Amount per acre	Waiting period (days) to: Harvest	Grazing
Methyl parathion			
(4 lb.)	1.5 pts.	15	15
(7.5 lb.)	12 oz.	15	15

Grasshoppers

Grasshoppers are an occasional problem in Texas small grains. Most damage occurs in the fall when grasshoppers migrate into the fields. Check areas around wheat fields prior to planting in order to locate and spot treat heavy infestations before planted wheat emerges.

SUGGESTED INSECTICIDES FOR CONTROLLING GRASSHOPPERS

Insecticide	Amount per acre	Waiting period (days) to: Harvest	Grazing
Chlorpyrifos		See remarks	
(Lorsban 4E-SG)	0.5-1 pt.	28	14
Carbaryl			
(Sevin® 4 lb.)	1 qt.	21	0
(Sevin® XLR Plus)	1-1.5 qts.	21	0
(Sevin® 4-Oil)	0.5-1.5 qts.	21	0
(Sevin® 4F)	0.5-1.5 qts.	21	0
Ethyl parathion		See remarks	
(4 lb.)	0.5-1.5 pts.	15	15
(8 lb.)	8 oz.	15	15
Malathion			
(5 lb.)	2 pts.	7	7
(91% ULV 9.33 lb.)	8 oz.	7	7

Remarks

Chlorpyrifos. Labeled for use on wheat only. Do not make more than two applications per crop.

Ethyl parathion. Not cleared for use on oats and rye. No ground application. Application only by certified commercial aerial applicator with closed mixing-loading system.

Flea Beetles

Flea beetles are shiny, black beetles about the size of the head on a straight pin. Flea beetles jump readily when approached. During the fall, beetles may infest the borders of small grain fields. Beetles gradually move across fields, feeding on and killing plants as they go. Leaves are skeletonized, giving injured plants a bleached appearance before they wilt and die. Fields and field borders which have been kept clean of weeds the previous season are less subject to flea beetle damage.

Wheat Stem Maggot

Adult flies of the wheat stem maggot emerge in the spring and lay eggs on the leaves of wheat and other grass hosts. The developing larvae, or maggots, feed on the stem just above the last stem joint. Infested plants produce heads which are white in color.

Infestations seldom exceed 1 percent, and chemical control of this insect is not recommended.

INSECTICIDE APPLICATION METHODS

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

Spray applications are most effective when wind velocity does not exceed 15 miles per hour. Avoid spraying when plants are wet from dew or rain. For broadcast applications, 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 ensure application of recommended rates.

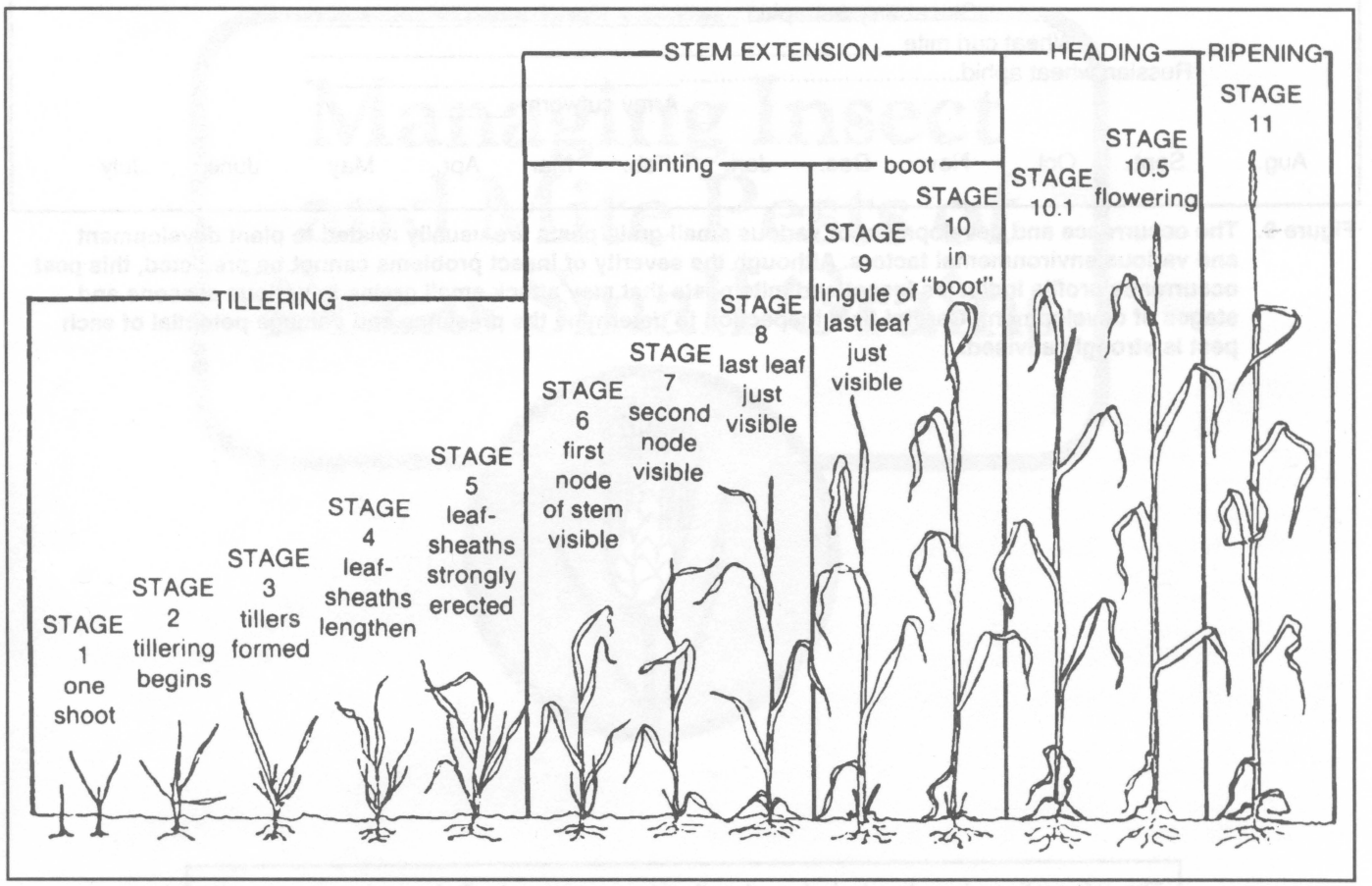


Figure 8. Feekes scale of small grain development.

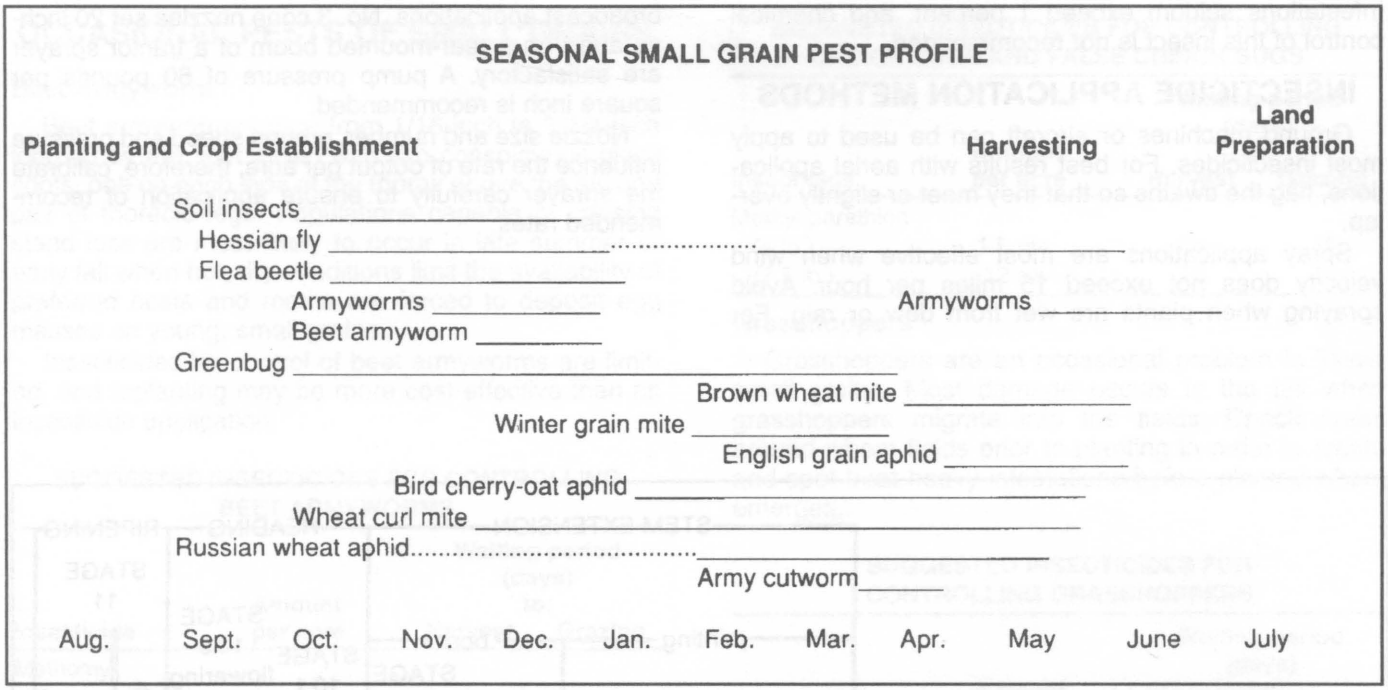


Figure 9. The occurrence and development of various small grain pests are usually related to plant development and various environmental factors. Although the severity of insect problems cannot be predicted, this pest occurrence profile indicates insect and mite pests that may attack small grains in various seasons and stages of development. Careful field inspection to determine the presence and damage potential of each pest is strongly advised.

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.

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