

SMALL GRAIN INSECTS

Wheat, Barley, and Oats

Other Resources Available Through NDSU Extension Service:

Publications	E493	Aphid Management in Small Grains, Corn and Sorghum (1993)
	E830	The Armyworm and the Army Cutworm (2000)
	E1230	Cereal Leaf Beetle Management (2002)
	PP680	Wheat Stem Infesting Insects in North Dakota (1989)
	E1007	Biology and Management of Barley Thrips (1991)
	E272	Grasshopper Management (1997)
	E188	Wireworm Control (2001)

APHID

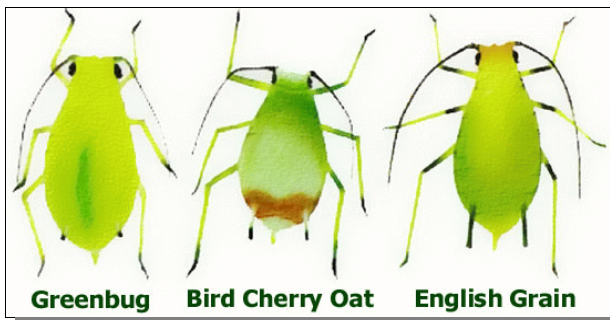
Small Grain Aphid descriptions:

Greenbug - pale green with darker stripe down back.

Bird Cherry Oat Aphid - olive green, brownish patch at the base of cornicles.

English Grain Aphid - bright green with long black cornicles.

The greenbug, English grain aphid, and bird cherry oat aphids are the principle species that cause problems in North Dakota small grains. None of these aphids are known to overwinter in North Dakota; they migrate to the region from the south in late spring. The greenbug is the most injurious because it injects a toxin with its saliva during feeding. The English grain aphid is the most common aphid seen in small grains. Its population grows rapidly when feeding on wheat heads. The bird cherry oat aphid feeds primarily on leaves in the lower part of the small grain plant. These aphids transmit barley yellow dwarf virus. When aphid populations are high, the disease can spread through small grain fields. At greatest risk are later planted fields which attract migrating aphids that are moving from more mature fields.



Thresholds for Small Grains: *English Grain, Bird Cherry Oat, Greenbug*

To protect small grains from yield loss due to aphid feeding, the treatment threshold is 85% stems with at least one aphid present, prior to complete heading. Field scouting should begin at stem elongation and continue up to the heading stage of wheat. Aphid populations, at or above the thresholds, during these growth stages will result in economic injury to plants.

The greatest risk of yield loss from aphids feeding on grains is in the vegetative to boot stages. Significant yield reductions after the onset of flowering could not be demonstrated in research published from South Dakota in 1997 (Voss et al., 1997. *J of Economic Entomology* 90: 1346-1350). Reasons for these conclusions were that: after heading the only major yield component aphids can affect is seed weight; aphids are unable to sustain the very large populations necessary to achieve significant impact on this factor. Other components of yield are determined earlier (number of spikelets - determined at jointing; number of seeds - determined at flowering).

Russian Wheat Aphid (RWA):

15 to 20% of tillers infested up to flowering; 20+% infested tillers from flowering to early milk stage

Note: A tiller is infested whether it has one or several RWA present. RWA have only been found in southwest North Dakota during late summer; no economic damage has been reported. No RWA have been reported in North Dakota since the early 90's. Occasionally, RWA have overwintered during mild winters in Montana.

Natural Controls:

Lady beetles, Aphid lions, Syrphid fly, and parasitic wasps play a major role in reducing aphid populations. When natural enemies are present in large numbers, and the crop is well developed, farmers are discouraged from spraying fields.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
Dimethoate (Digon 400, Dimethoate 400) (wheat only)	0.25 - 0.5	0.5 - 0.75 pt	Do not harvest grain within 35 days, or graze within 14 days of last application. Do not make more than two applications per season.
Di-Syston (wheat and barley) <i>RUP</i>	0.5 - 1	0.5 - 1 pt	Aerial application only. Do not apply within 30 days of grain harvest. Use lower rate on plants up to tillering and higher rate after tillering.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
Lorsban 4E (wheat only) <i>RUP</i>	0.25 - 0.5	0.5 - 1 pt	Do not apply within 28 days of wheat harvest or allow livestock to graze or feed within 14 days of application. Do not make more than 2 applications per season.
Malathion 57EC	0.9 - 1.25	1.5 - 2 pts	Do not apply within 7 days of harvest on wheat, oats, rye, and barley. Do not apply below 60°F.
Lannate LV Lannate SP <i>RUP</i>	0.225 - 0.45	12 - 24 fl oz 0.25 - 0.5 lbs	Do not harvest within 7 days or feed treated forage within 10 days of application.
Methyl parathion 4EC <i>RUP</i>	0.25 - 1.5	0.5 - 1.5 pt	Do not use within 15 days of small grain harvest. Do not enter treated fields within 48 hours after application. Fields must be posted.
Pennncap-M <i>RUP</i>	0.5 - 0.75	2 - 3 pts	Do not apply within 15 days of harvest or grazing. To avoid injury to bees, do not apply during pollen shed if bees are visiting the areas to be treated during foraging hours. Do not enter treated fields within 48 hours after application. Fields must be posted.

RUP - Restricted use pesticide

ARMYWORMS

Armyworm outbreaks in North Dakota can occur when large migrations of moths from southern states occur in late spring and early summer. Moths prefer to lay eggs in moist, shady areas where small grains or grasses have lodged or been damaged by hail or wind. Armyworms feed at night and hide under vegetation or in loose soil during the day. To scout for armyworms in grains, part the plants and inspect the soil for fecal pellets. If pellets or feeding damage are found, look for larvae under plant trash, soil clods or in soil cracks.

Threshold for Small Grains:

Treat when 4 to 5 or more worms per square foot are present.

Migrating Armyworms:

Treat a couple of swaths ahead of the infestation in the direction of movement to form a barrier strip.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
carbaryl (Sevin) (wheat only) <i>RUP</i>	1 - 1.5	rate varies by formulation	Do not apply within 21 days of harvest. Do not make more than two applications after the boot stage.
Lannate LV Lannate SP <i>RUP</i>	0.225 - 0.45	12 - 24 fl oz 0.25 - 0.5 lbs	Do not harvest within 7 days or feed treated forage within 10 days of application.
Lorsban 4E (wheat only) <i>RUP</i>	0.5 - 1	1 - 2 pts	Do not apply within 28 days of wheat harvest or allow livestock to graze or feed within 14 days of application. Do not make more than two applications per season.
Malathion 57EC	1.25	2 pts	Do not harvest for 7 days.
Methyl parathion 8EC <i>RUP</i>	0.5	8 fl oz	Do not apply within 15 days of small grains harvest. Do not enter treated fields within 48 hours or application. Fields must be posted.
Mustang (wheat only) <i>RUP</i>	0.022 - 0.05	1.9 - 4.3 fl oz	Do not apply within 14 days of grain, forage, or hay harvest.
Pennncap-M <i>RUP</i>	0.5 - 0.75	2 - 3 pts	Do not apply within 15 days of harvest. Do not enter treated fields within 48 hours after application. Fields must be posted.
Tracer	0.031 - 0.094	1 - 3 fl oz	Do not apply within 21 days of grain or straw harvest or within 14 days of forage or hay harvest.
Warrior (wheat only) <i>RUP</i>	0.02 - 0.03	2.56 - 3.84 fl oz	Do not apply within 30 days of wheat harvest. When applying by air, apply in a minimum of 2 gallons of water per acre.

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BARLEY THRIPS

Female barley thrips fly to barley from overwintering sites during mid to late May. Sampling for thrips should begin when the flag leaf is first visible and continue until the head is completely emerged from the boot. Sample at least 50 feet in from field margins. Most thrips can be found under the top two leaf sheaths. The dark brown to black thrips can be found by unrolling the leaf sheaths away from the stem. Insecticide treatments are only effective when applied before heading is complete.

Threshold For Thrips: *Treat when thrips are equal to or greater than the number calculated by*

$$\text{Threshold (Thrips/stem)} = \frac{\text{Cost of Control} \div \text{Expected \$ value per bushel}}{0.4}$$

Sampling plans based on this number can be prepared with the help of E-1007, **Biology and Management of Barley Thrips.**

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
methyl parathion 4EC	0.25 - 0.375	4 - 6 fl oz	Do not apply within 15 days of harvest. Do not enter treated fields within 48 hours after methyl parathion application. Fields must be posted.

RUP

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CEREAL LEAF BEETLE

The cereal leaf beetle is an imported insect pest from Europe. This insect has just been found in **Williams and McKenzie Counties of North Dakota**. It was first detected in Michigan in 1962, Utah in 1984, and Montana in 1989. The cereal leaf beetle is a serious pest of barley and wheat in Montana. Both adults and larvae of the cereal leaf beetle damage grain crops through their foliar feeding. The larvae are the most damaging stage and the target of control measures. Generally, the newer plant tissue is preferred with feeding occurring on the upper leaf surface causing characteristic elongated slits.

Monitoring and Treatment Threshold:

The first sign of CLB activity in the spring is adult feeding damage on the plant foliage. While this is the first sign of adult activity, adults are not the target of control. Eggs and larvae are monitored by plant inspection since thresholds are expressed as egg and larvae numbers per plant or per stem. Examine 10 plants per location and select 1 location for every 10 acres of field. Count number of eggs and larvae per plant (small plants) or per stem (larger plants) and get an average number of eggs and larvae, based on the samples you have taken.

Boot stage is a critical point in plant development and impact of cereal leaf beetle feeding damage can be felt on both yield and grain quality. **Before boot stage**, the threshold is: 3 eggs and larvae or more per plant (including all the tillers present before the emergence of the flag leaf). Larvae feeding in early growth stages can have a general impact on plant vigor. When the flag leaf emerges, feeding is generally restricted to the flag leaf which can significantly impact grain yield and quality. The threshold is decreased **at the boot stage** to: 1 larvae or more per flag leaf.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
<i>For Wheat, Barley, and Oats</i>			
Furadan 4F	0.25	0.5 pt	Apply prior to heads emerging from the boot. Minimum gallons required are 10 GPA by ground and 2 GPA by air.
<i>RUP</i>			
Lannate LV Lannate SP	0.225-0.45	0.75 - 1.5 pt 0.25 - 0.5 lbs	There is a 24 hour re-entry interval. Do not harvest within 7 days for grain or 10 days to graze.
<i>RUP</i>			
Malathion 5EC	0.6-1.25	1 - 2 pt	Do not harvest within 7 days for grain or to graze
Malathion ULV	0.3-0.6	4 - 8 oz	Do not harvest within 7 days for grain. Treatment is most effective at temperatures over 70F.
Tracer (spinosad)	0.031 - 0.094	1 - 3 fl oz	Do not apply within 21 days of grain or straw harvest or within 14 days of forage or hay harvest.
<i>Wheat Only</i>			
Mustang	0.022 - 0.05	1.9 - 4.3 fl oz	Do not apply within 14 days of grain, forage, or hay harvest.
<i>RUP</i>			
Sevin (XLR Plus, 4F, 4-Oil)	1.0	2 pt	Do not harvest within 21 days for grain or within 7 days of grazing.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
Sevin 80S	1.0	1.25 pt	Do not harvest within 21 days for grain or within 7 days of grazing.
Warrior 1EC <i>RUP</i>	0.02-0.03	2.6 - 3.8 oz	Do not harvest within 30 days for grain. Do not apply more than 0.06 lb ai (7.6 oz) per season.

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CUTWORMS

Several cutworm species affect regional crops. In western North Dakota, the pale western and the army cutworms are important pests of small grains. Eggs of pale western hatch in the spring and larvae feed underground. Eggs of the army cutworm hatch in the fall and spring feeding is above ground. In eastern North Dakota, the Dingo cutworm, *Feltia jaculifera*, overwinters as a partially grown larva and is one of the first cutworm species to cause problems during crop emergence from early to mid-May. The moth of the dingo cutworm is known to lay her eggs on sunflower heads from mid-July through September. Crops following sunflowers in rotation are at greatest risk of injury by this cutworm. Other cutworms, the red-backed, *Exoa ochregaster*, and the darksided, *Exoa messoria*, overwinter as eggs which hatch in mid to late May. Eggs are laid in the fall and survive in weedy, wet, and reduced tillage areas. Feeding injury by these cutworms normally occurs in late May to early June.

Management and Thresholds in Small Grains:

Treatment is recommended when cutworms number 4 to 5 per square foot.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
Lorsban 4E (wheat only) <i>RUP</i>	0.5 - 1.0	1 - 2 pts	Do not apply within 28 days of wheat harvest or allow livestock to graze or feed within 14 days of application. Do not make more than two applications per season.
Mustang (wheat only) <i>RUP</i>	0.022 - 0.05	1.9 - 4.3 fl oz	Do not apply within 14 days of grain, forage, or hay harvest.
Warrior (wheat only) <i>RUP</i>	0.015 - 0.025	1.92 - 3.2 fl oz	Do not apply within 30 days of wheat harvest. When applying by air, apply in a minimum of 2 gal/A.

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GRASSHOPPERS

In the northern plains, grasshopper egg hatch normally begins in late April to early May. Peak hatch occurs about mid-June. Heavy infestations typically occur in areas of low rainfall or during drought years. Outbreaks are usually preceded by several years of hot, dry summers and warm falls. Cool, wet weather increases disease occurrence and delays development of grasshoppers, reducing the overall population.

Cultural Control Methods:

Early seeding - Allows for early establishment and vigorous growth of plants.

Crop rotation - Avoid planting in areas of high egg deposits. Fields with late maturing crops or green plant cover attract adults which then lay eggs.

Tillage - Summer fallow will act as a trap crop, attracting females for egg laying. Spring tillage of these sites will reduce successful emergence of nymphs.

Grasshopper Thresholds: Infestation Ratings

Rating	Nymphs (Young hoppers) per square yard		Adults per square yard	
	Margin	Field	Margin	Field
Light	25-35	15-23	10-20	3-7
Threatening	50-75	30-45	21-40	8-14
Severe	100-150	60-90	41-80	15-28
Very Severe	200+	120	80+	28+

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
Dimethoate (Digon 400, Dimethoate 400) (wheat only)	0.38	0.75 pt	Do not harvest grain within 35 days, or graze within 14 days of last application. Do not make more than two applications per season.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
carbaryl (Sevin) (wheat only)	0.5 - 1.5	rate varies by formulation	Do not apply within 21 days of grain harvest. Do not make more than 2 applications after the boot stage. No limitations on forage. The lower rate (0.5 lb) is suggested for nymphs on small plants or sparse vegetation. The higher rate is suggested for mature grasshoppers or when material is applied to crops requiring greater coverage.
Furadan 4F	0.125 - 0.25	0.25 - 0.5 pt	Apply before heads emerge from boot. Do not make more than 2 applications/season. Use a minimum of 10 gal of finished spray/acre with ground equipment and 2 gal/acre with aerial equipment. Do not feed treated forage to livestock. Do not apply in proximity of waterfowl nesting or feeding areas.
	<i>RUP</i>		
Lorsban 4E (wheat only)	0.25 - 0.5	0.5 - 1 pt	Do not apply within 28 days of wheat harvest or allow livestock to graze or feed within 14 days of application. Do not make more than two applications per season.
	<i>RUP</i>		
Malathion 57EC	0.9 - 25	1.5 - 2 pts	Wait 7 days before grain harvest. No time limitation on grazing or straw for dairy or slaughter animals.
Malathion (ULV)	0.48	8 fl oz/acre (95% concentrate)	Commercial aerial applicators only. Do not harvest for 7 days.
Methyl parathion 4EC	0.375 - 0.5	0.75 - 1 pt	Do not apply within 15 days of small grains harvest. Do not enter treated fields for 48 hours after application. Fields must be posted.
	<i>RUP</i>		
Mustang (wheat only)	0.022 - 0.05	1.9 - 4.3 fl oz	Do not apply within 14 days of grain, forage, or hay harvest.
	<i>RUP</i>		
Pennacap-M	0.5 - 0.75	2 - 3 pts	Do not apply within 15 days of harvest. Do not enter treated fields within 48 hours after application. Fields must be posted.
	<i>RUP</i>		
Warrior (wheat only)	0.02 - 0.03	2.56 - 3.84 fl oz	Do not apply within 21 days of harvest. When applying by air, apply in a minimum of 2 gallons of water per acre. Warrior may be used in bordering, non-crop areas not hayed or grazed (24 c label).
	<i>RUP</i>		

GRASSHOPPERS - Winter Wheat field border treatment

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
Thimet 20 G	0.24 oz AI/1,000 ft of row	1.2 oz/1,000 ft of row - any row spacing (min. 8 in. spacing) at planting	Apply at planting time in seed furrow with granular applicator or grass seeder attachment. Do not graze or feed forage within 45 days of treatment.
	<i>RUP</i>		

RUP - Restricted use pesticide

HESSIAN FLY

The Hessian fly overwinters as a maggot or pupa in winter wheat, volunteer grain, and wheat stubble. Overwintered maggots pupate and emerge as adults from April to May, infesting winter and spring planted wheat. By June, maggots pupate (flaxseed stage), emerging as adults in August to lay eggs for the overwintering generation.

Managing Hessian Fly:

Winter wheat planting date . . . Winter wheat will act as a bridge to get Hessian fly from one season to the next. Delaying planting in the fall should reduce the risk of infestations. Suggested planting dates for ND are: North - August 25 to September 15; South - September 1 to 20.

Tillage . . . Burying stubble and destroying volunteer grain after the first killing frost or early in the spring before fly emergence helps suppress adult populations.

Rotation . . . Rotate wheat with nonsusceptible crops (oats, corn, soybean, sunflower, flax).

Resistant varieties . . . Two South Dakota releases, Guard and Shield, are hard red spring wheats. They are semi-dwarf varieties. Guard is reported to be prone to shattering.

Chemical control . . . Thimet and Cruiser are registered as a planting time and a seed treatment for wheat, respectively. Population levels of this pest would rarely warrant the need for such treatments in North Dakota, however.

ORANGE WHEAT BLOSSOM MIDGE

Though infestation pressure from this insect has declined, it remains an economic concern in North Dakota. Since 1996, wheat midge have been detected in all areas east and north of the Missouri River. A contributing factor to the recent outbreaks was delayed planting of wheat due to excessively wet soils in the spring. Any factor which results in having heading wheat present in the fields during midge emergence will put a wheat crop at risk to infestation.

The adult midge is active from late June to early August. Peak activity is from late June to mid-July. A model using daily temperatures to calculate degree day accumulations allows for a more accurate prediction of local adult emergence. Wheat is attractive for egg laying by midge from the time the head emerges from the boot through flowering. Insecticides for the control of midge are effective on the adult and impact the egg stage; however, control of the orange larvae, which feed on the developing kernels, has not been demonstrated due to protection within the glume.

Degree Days as a tool for Wheat Midge Management

Based on data from Canada, the threshold temperature for wheat midge development is 40° F. Observations indicate the following DD accumulations for events in the midge population.

DD	Biological Event
450	the midge breaks the larval cocoon and moves close to soil surface to form the pupal cocoon
1300	10% of the females will have emerged
1475	about 50% of the females will have emerged
1600	about 90% of the females will have emerged

Identifying Wheat Fields at Risk to Midge Infestation

Based on North Dakota field observations, midge larval infestations were the greatest when heading occurred during peak female emergence (1475 DD). When using 40° degrees as a threshold for wheat development (*normally wheat development is monitored with 32 degrees*), heading occurs around 1000 - 1100 DD. Using this information, the following midge activity is expected based on degree day accumulations at time of wheat planting. There is a wheat growth and midge emergence model available through the North Dakota Agricultural Weather Network (NDAWN) internet site and can be found at:

<http://ndawn.ndsu.nodak.edu/index.html>

Wheat Midge Degree Days Used as a Guideline for HRSW Risk Assessment
HRSW planted PRIOR to accumulating 200 DD will head before wheat midge emerge.
HRSW planted FROM 200 to 600 DD will be heading at the time wheat midge are emerging.
HRSW planted AFTER 600 DD will head after peak emergence and should be at low risk to midge infestation (higher risk of frost, however).

Thresholds for Wheat:

Examine wheat heads at dusk (9 pm and later when temperatures are above 60°F and wind speed less than 6 mph). The orange-colored adult midge can be seen laying eggs on the wheat heads. Plants are susceptible as the head emerges from the boot. In general, **Hard Red Spring Wheat** treatment is warranted when 1 or more midge are observed for every 4 or 5 heads. **Durum Wheat** treatment is warranted when 1 or more midge are observed for every 7 or 8 wheat heads. Treatments after 50% of the first heads have flowered are not recommended due to reduced levels of efficacy and for the protection of a parasitic wasp that attacks the midge eggs.

Detecting adult midge:

Sticky traps may be used to capture adult midges active in wheat fields. A simple trap design would be a white styrofoam plate, attached to the top and bottom of a surveyors flag. The trapping surface can be coated with Tanglefoot® or vegetable oil. The trap can alert an individual to the presence of midge and their identity, but it does not provide information about the need to treat.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
Lorsban 4E <i>RUP</i>	0.5	1 pt	Treat when 75% of the wheat heads have emerged from the boot. Apply product in the late afternoon in a minimum of 2 gallons of water per acre. Do not apply within 28 days of harvest.
PennCap-M <i>RUP</i>	0.5 - 0.75	2 - 3 pts	Do not apply within 15 days of harvest. Do not enter treated fields within 48 hours after application. Fields must be posted.

RUP - Restricted use pesticide

WHEAT STEM MAGGOT

The maggot tunnels in stems of wheat resulting in a white head that can be easily pulled out of the boot. This damage becomes evident after flowering. Infestations rarely exceed 2% and fail to become an economic concern. Crop rotation and destruction of volunteer grain are the most effective methods of reducing maggot populations. No chemical control is recommended or available.

WHEAT STEM SAWFLY

Sawfly damage occurs annually in ND. This insect primarily affects wheat in the central and western areas of the state. The larvae tunnel in the stem, reducing grain yield by 10-14%. Additional loss occurs when infested stems lodge, rendering the grain unharvestable. Larvae overwinter in the wheat stubble making infested sites the source of next year's problems.

Managing Wheat Stem Sawfly:

Chemical control . . . None is currently recommended.

Harvesting . . . Swath the most heavily infested fields at 30-35% moisture before significant lodging occurs. This requires field surveys to determine infestation levels. Infested stems have a reddish-brown spot below the 2nd or 3rd node. Examine 50 consecutive stems in a drill row from at least two sites (one near the field margin, another near the center). Determine the percent of stems infested at each site. If >6% of the stems are infested, swath to reduce lodging losses within infested sites.

Fall tillage . . . A shallow fall tillage to dislodge stubble and leave it on the soil surface can result in 90% mortality of overwintering larvae. Tillage can be limited to areas where surveys indicated infestations within the field or strip.

Crop rotation . . non-host crops are oats, flax, sunflower, legumes, and to a lesser extent barley, rye, durum or winter wheat.

Resistant wheat varieties . . . Resistant wheats have a solid stem trait which is unsuitable for sawfly development.

Wheat Stem Sawfly Resistant Hard Red Spring Wheat Variety Descriptions

Variety	Height	Straw Strength	Maturity	Stem Rust*	Leaf Rust*	Test Weight	Protein	Yield**
Ernest	standard	med	med	R	R	high	high	High
Lew	standard	med	med	R	MS	high	low	High
Leader	standard	med	med	R	MS	high	high	Med
Tioga	standard	med	med	R	MS	high	avg	Low
AC Eatonia	standard	med	med	MR	MR	high	high	High
Cutless	semidwarf	med	med early	R	R	high	avg	Med
Rambo	semidwarf	very strong	med early	R	R	high	avg	High
Glenman	semidwarf	strong	med	R	MS	avg	low	High

* R = resistant; MS = moderately susceptible; MR = moderately resistance

**Yields are relative to sawfly resistant varieties.

WIREWORMS

The most commonly used insecticide for wireworm control in small grains is lindane. This insecticide can be purchased as a dry automatic drill box treatment in combination with fungicides (Maneb or Captan) and is also available in liquid (flowable) formulation to be applied alone or with fungicides such as Vitavax, Captan or Thiram. In addition, Gaucho (imidacloprid) and Cruiser (thiamethoxam) are labeled for application to wheat seed for wireworm management. *See the seed treatment section beginning on page 7 for more information.*

Caution: Do not use treated seed for feed or food purposes. Prevent the contamination of commercial grain by thoroughly cleaning bins, grain augers, and trucks that have been used to store, handle and/or home treat seed.