

BARLEY INSECTS

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

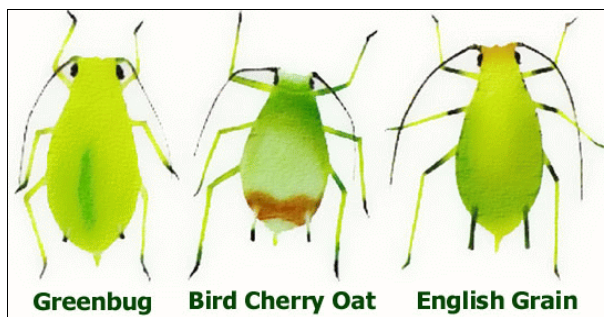
Small Grain Aphid descriptions:

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 more than one aphid present or 12-15 aphid per stem, 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 '90s. 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
carbofuran Furadan 4F (Greenbug and RWA only) <i>RUP</i>	0.25	8 fl oz	Apply prior to heads emerging from the boot. Minimum gals required are 10 GPA by ground and 2 GPA by air.
fenprothrin Danitol 2.4 EC PENDING 2009 <i>RUP</i>	0.2	10 2/3 fl oz	PHI = 14 days. Apply as a ground application in a minimum of 5 gallons of water per acre. Make a single application in the pre-boot stage. Do not exceed 0.2 lb ai per acre per season. PHI = 14 days.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
imidacloprid Attendant 600 Dyna-Shield Imidacloprid 5 Senator 600	refer to recommended label rate	0.8 - 2.4 fl oz per cwt of seed	Apply as a seed treatment or for end-use at agricultural establishments (total slurry treater, farmer applied seed treater). Do not graze or feed livestock on treated area for 45 days after planting. Follow all applicable directions, restrictions and precautions on the EPA registered label.
imidacloprid Enhance AW	refer to recommended label rate	4 oz per 100 lbs of seed	Apply as an on-farm seed treatment at planting time. Do not graze or feed livestock on treated area for 45 days after planting. Follow all applicable directions, restrictions and precautions on the EPA registered label.
lambda-cyhalothrin Warrior II <i>RUP</i>	0.02 - 0.03	1.28 - 1.92 fl oz	PHI = 30 days. Do not allow livestock to graze in treated areas or harvest treated forage as feed for meat or dairy animals within 7 days of treatment. Do not feed treated straw to meat or dairy animals within 30 days after the last treatment. Do not apply more than 0.06 lb ai per acre per season.
malathion Malathion 5	0.9	1.5 pts	PHI = 7 days. Do not apply below 60° F.
malathion Malathion 57EC	0.9 - 1.25	1.5 - 2 pts	
methomyl Lannate LV <i>RUP</i>	0.225 - 0.45	12 - 24 fl oz	PHI = 7 days or feed treated forage within 10 days of application. Do not apply more than 6 pints (96 fl oz) per acre per season. Do not make more than 4 applications per crop per season.
methomyl Lannate SP <i>RUP</i>	N/A	0.25 - 0.5 lb	PHI = 7 days or feed treated forage within 10 days of application. Do not apply more than 2 lbs per acre per season. Do not make more than 4 applications per crop per season.
methyl parathion Cheminova Methyl 4EC <i>RUP</i>	0.25 - 0.75	8 - 24 fl oz	PHI = 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.
methyl parathion PennCap-M <i>RUP</i>	0.5 - 0.75	32 - 48 fl oz	
thiamethoxam Actara	0.06	4 oz	PHI = 21 days. Use minimum of 10 GPA by ground and 5 GPA by air. Minimum interval between applications = 7 days. Do not apply more than 0.12 lb ai (8 oz) per acre per season.

RUP - Restricted use pesticide

ARMYWORMS

Amyworm 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 is 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
lambda-cyhalothrin Warrior II <i>RUP</i>	0.02 - 0.03	1.28 - 1.92 fl oz	PHI = 30 days. Do not allow livestock to graze in treated areas or harvest treated forage as feed for meat or dairy animals within 7 days of treatment. Do not feed treated straw to meat or dairy animals within 30 days after the last treatment. Do not apply more than 0.06 lb ai per acre per season.
malathion Malathion 57EC	1.25	2 pts	PHI = 7 days. Do not apply below 60° F.
malathion Malathion 5	1.25	2 pts	
methomyl Lannate LV <i>RUP</i>	0.225 - 0.45	12 - 24 fl oz	PHI = 7 days or feed treated forage within 10 days of application. Do not apply more than 6 pts (96 fl oz) per acre per season. Do not make more than 4 applications per crop per season.
methomyl Lannate SP <i>RUP</i>	N/A	0.25 - 0.5 lb	PHI = 7 days or feed treated forage within 10 days of application. Do not apply more than 2 lbs per acre per season. Do not make more than 4 applications per crop per season.
methyl parathion Cheminova Methyl 4EC <i>RUP</i>	0.25	8 fl oz	PHI = 15 days. Do not enter treated fields within 48 hours after methyl parathion application.
methyl parathion Methyl parathion 8EC <i>RUP</i>	0.5	8 fl oz	
methyl parathion PennCap-M <i>RUP</i>	0.5 - 0.75	2 - 3 pts	
spinosad (microbial) Entrust	0.05 - 0.1	1 - 2 oz	Do not apply more than 5.6 oz (0.28 lb a.i.) per acre per season. PHI = 21 days for grain and straw harvest or within 14 days of forage or hay harvest.
spinosad (microbial) Success	0.047 - 0.094	3 - 6 fl oz	PHI = 21 days of grain or straw harvest or within 14 days of forage or hay harvest. Do not apply more than a total of 19 fl oz per acre per season. Treat when pests appear, targeting eggs at hatch or small larvae. Use a higher rate in the rate range for larger larvae or moderate to severe infestations.
spinosad (microbial) Tracer	0.031 - 0.094	1 - 3 fl oz	PHI = 21 days of grain or straw harvest or within 14 days of forage or hay harvest.

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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
fenprothrin Danitol 2.4 EC PENDING 2009 <i>RUP</i>	0.2	10 2/3 fl oz	PHI = 14 days. Apply as a ground application in a minimum of 5 gallons of water per acre. Make a single application in the pre-boot stage. Do not exceed 0.2 lb ai per acre per season.
methyl parathion Cheminova Methyl 4EC <i>RUP</i>	0.25 - 0.375	8 - 12 fl oz	PHI = 15 days. Do not enter treated fields within 48 hours after methyl parathion application.

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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: three 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
carbofuran Furadan 4F <i>RUP</i>	0.25	8 fl oz	Apply prior to heads emerging from the boot. Minimum gals required are 10 GPA by ground and 2 GPA by air.
diflubenzuron Dimilin 2L <i>RUP</i>	0.0625	4 fl oz	PHI = 50 days for grain or straw, 15 days for hay, or 3 days for forage. Apply at egg laying. For use only west of US highway 281. Do not apply within 25 feet by ground or 150 feet by air of bodies of water. Applications must include a 25 foot vegetative buffer strip to limit runoff. Use 5 to 15 GPA total volume by ground, 3 to 5 GPA total volume by air. Do not exceed 4 fl oz per acre per season. Do not make more than 1 application per season.
fenprothrin Danitol 2.4 EC PENDING 2009 <i>RUP</i>	0.2	10 2/3 fl oz	PHI = 14 days. Apply as a ground application in a minimum of 5 gallons of water per acre. Make a single application in the pre-boot stage. Do not exceed 0.2 lb ai per acre per season.
lambda-cyhalothrin Warrior II <i>RUP</i>	0.02 - 0.03	1.28 - 1.92 fl oz	PHI = 30 days. Do not allow livestock to graze in treated areas or harvest treated forage as feed for meat or dairy animals within 7 days of treatment. Do not feed treated straw to meat or dairy animals within 30 days after the last treatment. Do not apply more than 0.06 lb ai per acre per season.
malathion Malathion 5EC	0.6-1.25	1 - 2 pt	PHI = 7 days. Treatment is most effective at temperatures over 70° F.
malathion Fyfanon ULV	0.3-0.6	4 - 8 oz	
methomyl Lannate LV <i>RUP</i>	0.225-0.45	0.75 - 1.5 pt 0.25 - 0.5 lbs	PHI = 7 days, or 10 day to graze. There is a 24-hour re-entry interval.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
methomyl Lannate SP <i>RUP</i>	N/A	0.25 - 0.5 lb	PHI = 7 days or feed treated forage within 10 days of application. Do not apply more than 2 lbs per acre per season. Do not make more than 4 applications per crop per season.
spinosad (microbial) Entrust	0.025 - 0.1	0.5 - 2 oz	Do not apply more than 5.6 oz (0.28 lb a.i.) per acre per season. PHI = 21 days for grain and straw harvest or within 14 days of forage or hay harvest.
spinosad (microbial) Success	0.031 - 0.094	2 - 6 fl oz	PHI = 21 days of grain or straw harvest or within 14 days of forage or hay harvest. Do not apply more than a total of 19 fl oz per acre per season.. Treat when pests appear, targeting eggs at hatch or small larvae. Use a higher rate in the rate range for larger larvae or moderate to severe infestations.
spinosad (microbial) Tracer	0.031 - 0.094	1 - 3 fl oz	PHI = 21 days of grain or straw harvest or within 14 days of forage or hay harvest.

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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 Dingy 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 dingy 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
lambda-cyhalothrin Warrior II <i>RUP</i>	0.015 - 0.025	0.96 - 1.60 fl oz	PHI = 30 days. Do not allow livestock to graze in treated areas or harvest treated forage as feed for meat or dairy animals within 7 days of treatment. Do not feed treated straw to meat or dairy animals within 30 days after the last treatment. Do not apply more than 0.06 lb ai per acre per season.
methyl parathion Cheminova Methyl 4EC <i>RUP</i>	0.375 - 0.5	12 - 16 fl oz	PHI = 15 days

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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
carbofuran Furadan 4F <i>RUP</i>	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 to waterfowl nesting or feeding areas.
diflubenzuron Dimilin 2L <i>RUP</i>	0.031	2 fl oz	PHI = 50 days for grain or straw, 15 days for hay, or 3 days for forage harvest. For best results, apply when grasshoppers reach the 2 nd to 3 rd nymphal stage of development (not effective on adult grasshoppers). For use only west of US highway 281. Do not apply within 25 feet by ground or 150 feet by air of bodies of water. Applications must include a 25 foot vegetative buffer strip to limit runoff. Use 5 to 15 GPA total volume by ground, 3 to 5 GPA total volume by air. Do not exceed 4 fl oz per acre per season. Do not make more than 1 application per season.
fenprothrin Danitol 2.4 EC PENDING 2009 <i>RUP</i>	0.2	10 2/3 fl oz	PHI = 14 days. Apply as a ground application in a minimum of 5 gallons of water per acre. Make a single application in the pre-boot stage. Do not exceed 0.2 lb ai per acre per season.
imidacloprid Attendant 600 Dyna-Shield Imidacloprid 5 Senator 600	refer to recommended label rate	1.2 - 2.4 fl oz per cwt of seed	Apply as a seed treatment or for end-use at agricultural establishments (total slurry treater, farmer applied seed treater). Do not graze or feed livestock on treated area for 45 days after planting. Follow all applicable directions, restrictions and precautions on the EPA registered label.
lambda-cyhalothrin Warrior II <i>RUP</i>	0.02 - 0.03	1.28 - 1.92 fl oz	PHI = 30 days. Do not allow livestock to graze in treated areas or harvest treated forage as feed for meat or dairy animals within 7 days of treatment. Do not feed treated straw to meat or dairy animals within 30 days after the last treatment. Do not apply more than 0.06 lb ai per acre per season.
malathion (ULV)	0.48	8 fl oz/acre (95% concentrate)	Commercial aerial applicators only. PHI = 7 days.
malathion Malathion 57EC	0.9 - 25	1.5 - 2 pts	PHI = 7 days. No time limitation on grazing or straw for dairy or slaughter animals.
malathion Fyfanon ULV	0.6	8 oz	PHI = 7 days. Treatment is most effective at temperatures over 70° F.
methyl parathion Cheminova Methyl 4EC <i>RUP</i>	0.5	1 pt	PHI = 15 days. Do not enter fields for 48 hrs after application.
methyl parathion PennCap-M <i>RUP</i>	0.5 - 0.75	2 - 3 pts	

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
spinosad (microbial) Entrust (suppression only)	0.05 - 0.1	1 - 2 oz	Do not apply more than 5.6 oz (0.28 lb a.i.) per acre per season. PHI = 21 days for grain and straw harvest or within 3 days of forage or hay harvest.
spinosad (microbial) Tracer (suppression only)	0.047 - 0.094	1.5 - 3 fl oz	Do not apply more than 9 fl oz (0.28 lb ai) per acre per season. PHI = 21 days of grain or straw harvest or within 3 days of forage or hay harvest.

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WIREWORMS

Imidacloprid and thiamethoxam are now labeled as active ingredients for application to barley planting seed for wireworm management. Please refer to the seed treatment section in the introduction 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.

INSECTICIDE	DOSAGE IN LB AI/ACRE	PRODUCT PER ACRE	RESTRICTIONS ON USE
imidacloprid Gaucho 600	refer to recommended label rate	0.13 - 0.26 fl oz per cwt of seed	Follow all applicable directions, restrictions and precautions on the EPA registered label. Do not graze or feed livestock on treated areas for 45 days after planting.
imidacloprid Attendant 600 Dyna-Shield Imidacloprid 5 Senator 600	refer to recommended label rate	0.13 - 0.26 fl oz per cwt of seed	Apply as a seed treatment or for end-use at agricultural establishments (total slurry treater, farmer applied seed treater). Do not graze or feed livestock on treated area for 45 days after planting. Follow all applicable directions, restrictions and precautions on the EPA registered label.
imidacloprid Enhance AW	refer to recommended label rate	4 oz per 100 lbs of seed	Apply as an on-farm seed treatment at planting time. Do not graze or feed livestock on treated area for 45 days after planting. Follow all applicable directions, restrictions and precautions on the EPA registered label.
thiamethoxam Cruiser 5FS, Cruiser MAXX Cereals	refer to recommended label rate		Follow all applicable directions, restrictions and precautions on the EPA registered label.