

FORAGE INSECTS

Other Resources Available Through NDSU Extension Service:

Publications	E1676	Integrated Pest Management of Alfalfa Weevil in North Dakota (2018)
	E830	The Armyworm and the Army Cutworm (revised 2018)

ALFALFA BLOTCH LEAFMINER

Alfalfa acreage in the upper Midwest was recently invaded by the alfalfa blotch leafminer (ABL). ABL is a gnatlike fly (Diptera) from Europe that was first detected in North America, in Massachusetts, in 1968. By 1994, populations of ABL reached northern Minnesota and by 1997 could be found throughout Wisconsin, the northern 2/3 of Minnesota, and the northeastern corner of Illinois. By October 1998, ABL was distributed throughout Minnesota, Wisconsin, northern Illinois, and eastern North Dakota. Observations suggest that this insect may reduce alfalfa yields by 7% to 20% and protein content by 10% to 20%. Both adults and larvae damage the plant. Females feed by puncturing leaves with their ovipositors, creating characteristic "pinholes," and consuming plant juices. A single female creates an average of 3,769 pinholes during her lifetime. Larvae emerging from eggs create distinctive mines as they feed. Within a field, it is not uncommon for 70% or more of the leaflets to be attacked. The wounds also increase the susceptibility of alfalfa to diseases, especially spring black stem. Still unclear is the economic impact of damage caused by ABL, but the visible damage caused by even low numbers of flies can be disturbing. In the northeastern United States, populations have been suppressed by parasitic wasps and control is not recommended.

Severe infestations appear one year after initial colonization by the leafminer. Infestations have spread to central North Dakota. The first generation in May-June causes the most visible damage. Infested fields take on a whitish cast due to the larval mines in the leaves. The same appearance can be confused with alfalfa weevil feeding; however, leafminers do not skeletonize the leaves.

Thresholds: Treatment is suggested if 30% to 40% of the plants exhibit pinhole feeding injury. Though several insecticides are available for ABL control in alfalfa, insecticide efficacy trials in Minnesota have not demonstrated significant economic return. If insecticides are used, they must be applied during the "pinhole" stage.

ALFALFA WEEVIL

Historically, alfalfa weevil larvae are not a widespread concern in North Dakota, occurring mainly in the southern counties when they are a problem. The light green larvae have a white stripe down the center of the back. They feed in the terminal buds of the growing alfalfa. They may be found in rolled up leaves at the growing tip of the plant. Feeding injury appears as small, circular holes in leaves. As larvae increase in size, feeding injury is more evident. Severely damaged fields take on a silvery appearance due to defoliation.

Alfalfa Weevil Management: If alfalfa weevil infestations are observed, one of the best strategies is to cut fields for hay early. After cutting, monitor carefully for signs of damage or delayed regrowth, particularly in the swath area where larvae may be concentrated. When early cutting of the crop is not possible, treatment should be considered when 30% of the plants show feeding damage and larvae are still present. The second cutting should be scouted for feeding injury. Treat if 50% of the crowns have weevil feeding, and re-growth is delayed 3-6 days. Feeding injury is often concentrated underneath the windrows. To sample, inspect 20 stems from each of 5 sites in the field, recording the percent of damaged plants and whether larvae were found.

A more detailed **economic threshold for the number of alfalfa weevil larvae per stem** is shown in the Table 1, which is based on the plant growth stage (height), treatment cost and crop market value. See E1676 Integrated Pest Management of Alfalfa Weevil in North Dakota (2013) for more information.

Plant Growth Stage (Height)	Treatment Cost	Crop Value (\$/ton)						Management Decision
		\$50	\$75	\$100	\$125	\$150	\$175	
50% bud or greater								Cut early
Early bud (>20 inches)	\$7/acre	4.0	2.7	2.0	1.6	1.3	1.2	Cut early, or use a short PHI/PGI product
	\$8/acre	4.6	3.1	2.3	1.8	1.5	1.3	
	\$9/acre	5.2	3.5	2.6	2.1	1.7	1.5	
	\$10/acre	5.8	3.8	2.9	2.3	1.9	1.6	
	\$11/acre	6.3	4.2	3.2	2.5	2.1	1.8	
Late vegetative (16-20 inches)	\$12/acre	6.9	4.6	3.5	2.8	2.3	2.0	Use a short to mid-PHI/PGI product
	\$7/acre	3.8	2.4	1.8	1.4	1.1	0.9	
	\$8/acre	4.4	2.8	2.1	1.6	1.3	1.1	
	\$9/acre	4.9	3.2	2.4	1.8	1.5	1.2	
	\$10/acre	5.5	3.6	2.6	2.1	1.7	1.4	
Mid-vegetative (10-15 inches)	\$11/acre	6.1	4.0	2.9	2.3	1.9	1.6	Use a long-residual product
	\$12/acre	6.7	4.4	3.2	2.5	2.1	1.7	
	\$7/acre	3.6	2.2	1.5	1.1	0.9	0.7	
	\$8/acre	4.1	2.6	1.8	1.4	1.1	0.8	
	\$9/acre	4.7	3.0	2.1	1.6	1.2	1.0	
	\$10/acre	5.3	3.4	2.4	1.8	1.4	1.2	
	\$11/acre	5.9	3.7	2.7	2.1	1.6	1.3	
	\$12/acre	6.4	4.1	3.0	2.3	1.8	1.5	

BLISTER BEETLES

Several blister beetle species feed on forage crops, including *Lytta nuttalli*, a large purplish green beetle; *Epicauta fabricii* or the ash-gray blister beetle; and *Epicauta ferruginea*, a smaller rusty-colored, pubescent beetle. Most blister beetle species have one generation per year. Adults become active in early to mid-summer and lay eggs in the soil. Eggs hatch in about two weeks into larvae called triangulins, which actively prey on grasshopper egg pods (*Epicauta* spp.) or bee nests (*Lytta* spp.). Blister beetles overwinter as larvae. Adult blister beetles are attracted to blooming alfalfa fields, where they are ravenous feeders, devouring leaves, stems and flowers. Blister beetles are mobile and gregarious, and often congregate in certain spots in a field. In some instances, blister beetles feed for a short period of time and then migrate to other crops or fields.

Effects on Livestock: All species of blister beetles produce a toxic substance called cantharidin. This toxin is a well-known vesicant (blister-causing substance) that is quickly absorbed upon contact and causes inflammation and blistering of internal and external body tissues. The amount of toxin produced varies considerably between species. Livestock come in contact with blister beetles when they consume infested alfalfa hay. Horses are most susceptible to the toxin, while sheep and cattle are more tolerant. The reaction to the toxin depends upon the relative dose; enough ingested beetles can be lethal to any animal. Symptoms of sublethal poisoning include depression, diarrhea, elevated temperatures, increased pulse and breathing rates, and dehydration. There is also frequent urination, especially after the first 24 hours. If cantharid poisoning is suspected, a veterinarian should be contacted immediately.

Management Strategies: Several management options are available, which can reduce the number of blister beetles found in forage crops but none will eliminate the problem.

- Adjust harvest dates and maintain weed free alfalfa. Since blister beetles are readily attracted to flowering plants, controlling the number of flowering weeds in the field and cutting alfalfa prior to bloom stage will reduce the potential for infestation.
- Check hay for blister beetles prior to cutting. Blister beetles are gregarious and are often found in high numbers in localized areas of the field. Prior to harvest, growers should be aware of potential infestations, and if blister beetles are present in the field, the harvest should be delayed for several days. In many instances, the beetles will move. However, they may move to another part of the field, so a careful inspection is necessary.
- If beetles are present in the field at the time of harvest, avoid using hay conditioners or crimpers. These implements may kill the beetles and prevent them from moving out of the hay as it dries. A self-propelled harvester which has wide-set wheels and no conditioner or crimping equipment can be used to windrow the hay, resulting in fewer dead blister beetles in the hay.
- Apply an insecticide for beetle control prior to harvest. Fields suspected of being infested should be thoroughly scouted (concentrating near the field edges) prior to harvest, and if blister beetles are present, an insecticide may be applied for control. Beetles killed by the insecticide will most likely fall to the ground and should not be picked up by the harvesting equipment. Fields should be rechecked 24 hours prior to cutting to ensure that new swarms of blister beetles have not reinfested the fields. Observe label directions for rates, pre-harvest intervals, restrictions and precautions. Fields should not be treated at peak bloom to avoid bee kill.
- In all cases, hay suspected of being infested with blister beetles should be checked for beetles prior to feeding. Contaminated hay should not be fed to horses or other livestock; removal of the beetles from the hay will not make it safe.
- It is to the grower's advantage to minimize harvest operations, which kill blister beetles, thereby minimizing the possibility of feed contamination. Management practices can only reduce the number of blister beetles present and the potential risk of cantharidin poisoning.

CUTWORMS

The variegated cutworm is an occasional pest of alfalfa and sweetclover in North Dakota. These larvae are about 2 inches long when full grown. Their color ranges from black to light greenish-yellow or tan. They have a distinctive row of pale yellow spots down the middle of their backs. Generally, the most serious damage from this cutworm would be on the stubble following the first cutting. Larvae may concentrate beneath windrows, causing severe damage to these areas.

Threshold: Treatments would be justified when more than 2 worms per square foot are present after the hay has been cut - if larvae are not expected to pupate in the next 3 to 4 days. Another management strategy is to delay cutting if larvae are close to full size and about to pupate. By delaying cutting, the feeding is distributed through the dense canopy of an established stand which is less detrimental than concentrated feeding on the young regrowth.

GRASSHOPPERS

In the Northern Plains, grasshopper egg hatch normally begins in late April to early May. Most grasshoppers emerge from eggs deposited in uncultivated ground or where plant cover attracted adults the previous season. Infestations could occur any time after emergence begins. Later infestations may develop when grasshopper adults migrate from harvested fields.

Thresholds: Threatening is considered the action threshold for grasshoppers. Since it is difficult to estimate the number of grasshoppers per square yard when population densities are high, pest managers can use four 180-degree sweeps with a 15-inch sweep net, which is equivalent to the number of adult (or nymph) grasshoppers per square yard.

Rating	Nymphs		Adults	
	per square yard	per square yard	per square yard	per square yard
	<u>Margin</u>	<u>Field</u>	<u>Margin</u>	<u>Field</u>
Light	25-35	15-25	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+

LEAFHOPPERS

The potato leafhopper is wedge-shaped and pale green in color. It is only 1/8 inch long. Adults are very active, jumping or flying when disturbed. Both adults and nymphs will run backwards or sideways rapidly. Damage by leafhoppers is referred to as 'hopperburn.' Foliage becomes dwarfed, crinkled and curled. Small triangular brown areas appear at the tips of leaves, gradually spreading around the entire leaf margin. Both nymphs (immatures) and adults cause damage and should be counted when sampling with a sweep net. A minimum of 100 sweeps per field is recommended.

Thresholds: Suggested treatment guidelines are presented below. Thresholds are based on the number of nymph/adult leafhoppers per sweep when swinging a sweep net in a pendulum-like motion through the tops of the plants.

Stem Length (inches)	Average no. Leafhoppers/Sweep	Average no. Leafhoppers/100 Sweeps
3 or less	0.2	20
3-8	0.5	50
8 -12	1.0	100
12 - 14	2.0	200

LYGUS OR PLANT BUGS

Lygus bugs are a serious pest of alfalfa seed production. These insects are 1/4 inch long and range in color from pale green to light brown to reddish-brown. There is a light-colored, heart-shaped spot on the back. The nymphs are pale green and look similar to aphids, but are much more active movers. Lygus bugs feed on foliage, but the most serious feeding is on the flower buds, flowers, and developing seeds. Feeding injury causes blossoms to drop, and seeds to shrivel, turn brown and then fail to germinate.

Threshold: Treatments are justified when sweep net samples collect an average of 3 to 5 lygus bugs (adults and nymphs) per pendulum sweep. If insecticides are considered, attempt to time treatments for the control of nymphs prior to the onset of bloom. Protecting insect pollinators in seed production fields is very important.

PEA APHID

The pea aphid is light green and about 1/4 inch long. Alfalfa infested by pea aphids may appear wilted and have a bronze color. When present, pea aphids will crowd together on the terminal shoot, leaves or stems. Monitor fields closely during periods of slow plant growth.

Thresholds: Many aphids per plant are required before the vigor of that plant is reduced. Light populations may be beneficial by providing a food source for predatory and parasitic insects. On 10-inch tall alfalfa, treatment would not be needed until aphids exceed 50 per stem. Taller alfalfa will tolerate greater numbers.

INSECTICIDES REGISTERED FOR USE IN ALFALFA AND GRASS FORAGE CROPS

NOTE: When spraying legume fields, apply insecticides between 8 p.m. and 8 a.m. to protect the local bee population. Never spray fields in bloom.

INSECTICIDE	PRODUCT PER ACRE	PHI	Alfalfa Blotch Leafminer	Alfalfa Weevil	Blister Beetles	Cutworms	Grasshoppers	Leafhoppers	Lygus or Plant Bugs	Pea Aphid
alpha-cypermethrin ALFALFA ONLY Fastac CS Fastac EC <i>RUP</i>	2.2 - 3.8 fl oz	3 days cutting or grazing 7 days for seed		●	●	●	●	●	●	†
beta-cyfluthrin Baythroid XL <i>RUP</i>	0.8 - 2.8 fl oz	7 days for hay or grazing	●	●	●	●	●	●	●	†
carbaryl Sevin 4F Sevin XLR Plus	1 - 1.5 qts 1 - 1.5 qts	Alfalfa: 7 days for hay or grazing Grasses: 14 days for hay or grazing	●	●	●	●		●	●	
chlorantraniliprole Prevathon*	14 - 20 fl oz	None								
chlorantraniliprole + lambda-cyhalothrin Besiege <i>RUP</i>	Alfalfa: 5 - 9 fl oz Pasture, rangeland, hay: 5 - 10 fl oz	Alfalfa: 1 day for forage, 7 days for hay Pasture and Rangeland: 0 days Grass grown for seed: 7 days	●	●	●	●	●	●	●	●
chlorpyrifos ALFALFA ONLY Lorsban 15G	In-furrow or PPI at stand establishment: 6.7 lbs per acre	None				●				
chlorpyrifos ALFALFA ONLY Chlorpyrifos 4E AG Govern 4E Hatchet Lorsban 4E Lorsban Advanced Nufos 4E Vulcan Warhawk Whirlwind Yuma 4E <i>RUP</i>	0.5 - 2 pts	7 days for hay or grazing for 0.5 pt 14 days for 1 pt 21 days for > 1 pt	●	●		●	●	●	●	●
chlorpyrifos + lambda-cyhalothrin ALFALFA ONLY Cobalt Advanced <i>RUP</i>	6 - 38 fl oz	7 days for hay or grazing for 6-13 fl oz 14 days for 13-26 fl oz 21 days for > 26 fl oz	●	●	●	●	●	●	●	●
chlorpyrifos + zeta-cypermethrin ALFALFA ONLY Stallion <i>RUP</i>	2.5 - 11.75 fl oz	7 days for hay, grazing or seed		●	●	●	●	●	●	●

Forage

INSECTICIDE	PRODUCT PER ACRE	PHI	Alfalfa Blotch Leafminer	Alfalfa Weevil	Blister Beetles	Cutworms	Grasshoppers	Leafhoppers	Lygus or Plant Bugs	Pea Aphid
cyfluthrin Tombstone Tombstone Helios <i>RUP</i>	0.8 - 2.8 fl oz	7 days for hay or grazing	●	●	●	●	●	●	●	†
Diflubenzuron Dimilin 2L <i>RUP</i>	1 - 2 fl oz Target early instar nymphs	1 day before cutting					●			
dimethoate ALFALFA ONLY Dimate 4E Dimethoate 4E Dimethoate 4EC Dimethoate 400	0.5 - 1 pt	10 days for hay or grazing		†			●	●	●	●
flupyradifurone ALFALFA AND CLOVER ONLY Sivanto Prime	7 - 10.5 fl oz 14 fl oz (Lygus bugs)	Alfalfa: 7 days Clover: 14 days						●	†	●
gamma-cyhalothrin Declare <i>RUP</i>	0.77 - 1.54 fl oz	7 days for hay 1 day for grazing	●	●	●	●	●	●	●	●
indoxacarb Steward EC	4.6 - 11.3 fl oz	7 days		●				†		
lambda-cyhalothrin Grizzly Too Kendo Lambda-Cy Lambda-T LambdaStar Lamcap Nufarm Lambda Cyhalothrin 1EC Paradigm VC Province Silencer Silencer VXXN Warrior II <i>RUP</i>	0.96 - 1.92 fl oz 1.92 - 3.84 fl oz 0.96 - 1.92 fl oz	Alfalfa: 7 days for hay, 1 day for grazing Grasses: 7 days for hay, 0 days for grazing	●	●	●	●	●	●	●	●
malathion Cheminova Malathion 57% Malathion 5 Malathion 57EC	1.5 - 2 pts 1.5 - 2 pts 1.5 - 2 pts	0 days		†			●	●	●	●
malathion Fyfanon ULV AG	6 - 8 fl oz	0 days	●	†			●	●	●	●
methomyl ALFALFA ONLY Lannate LV <i>RUP</i>	0.75 - 3 pts	7 days for hay or grazing	●	●		●			●	●
permethrin ALFALFA ONLY Ambush 25W Ambush Arctic 3.2EC PermaStar Permethrin 3.2EC Perm-Up 3.2EC <i>RUP</i>	3.2 - 12.8 oz 6.4 - 12.8 fl oz 4 - 8 fl oz 4 - 8 fl oz 4 - 8 fl oz 4 - 8 fl oz	14 days		●		●		●	●	●
phosmet Imidan 70W	1 - 1.33 lbs	7 days for hay and grazing		●			●	●		
sulfoxaflor ALFALFA ONLY Transform WG	0.75 - 2.75 oz	7 days for grazing, forage, fodder, or hay							●	●

INSECTICIDE	PRODUCT PER ACRE	PHI	Alfalfa Blotch Leafminer	Alfalfa Weevil	Blister Beetles	Cutworms	Grasshoppers	Leafhoppers	Lygus or Plant Bugs	Pea Aphid
zeta-cypermethrin Mustang Maxx <i>RUP</i>	2.24 - 4 fl oz	Alfalfa: 3 days for hay or grazing, 7 days for seed Pasture and Rangeland: 0 days for forage and hay, 7 days for straw and seed screenings		●	●	●	●	●	●	●

RUP = Restricted Use Pesticide

● = Control

† = Suppression only

‡ = Not effective against alfalfa weevil adults

* = Prevathon will control aboveground lepidopterous pests, such as alfalfa looper and armyworms