

## Insect Management In Forage Crops

(Alfalfa, clovers (sweet, red, alsike), forage grasses (timothy, etc.), pastures and rangelands)

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Last Updated: November 2020

This document is only a guide. Always refer to the product label for application details and precautions before using an insecticide. Labels for any insecticide in this guide can be found on the website of the Pest Management Regulatory Agency at: <https://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>

### Alfalfa Blotch Leafminer

*Agromyza frontella* (Rond.) (Diptera: Agromyzidae)

#### Economic Thresholds

Alfalfa hay crops  
- 40% of leaflets show pinhole feeding (OMAFRA)

Alfalfa seed crops  
- unknown

#### Biological Control -

A species of parasitic wasp, *Dacnusa dryas* (Nixon), has kept the leafminer in check in eastern Canada in most localities and years (1). Chemical control of the pest may decimate populations of this biocontrol agent.

#### Chemical Control –

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	References
<b>dimethoate</b>					-
Cygon 480EC, AG	264	0.55 L	0.223 L	10	
Lagon 480	264	0.55 L	0.223 L	10	
<b>malathion</b>					
Malathion 85E	1143	1.345 L	0.544 L	7	
<b>phosmet</b>					
Imidan 70 WP	1120	1.60 kg	0.65 kg	7	

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Note: Insecticides should be applied no later than the pinhole stage of feeding, usually in mid- to late May.

### Restrictions -

- crop in bloom Do not apply during bloom, or during the 5 day period before blooming. See Section in Guide regarding hazard to bees.
- dimethoate Use a minimum water volume of 200 L/ha with ground equipment. Do not apply more than once per season. Ground and aerial application is permitted.
- malathion Do not apply to alfalfa in bloom. Apply when 75% of foliage shows feeding damage. 2 applications per cut to a maximum of 4 applications per year with a 14 day interval between applications. Greatest efficacy at air temperatures above 20°C. Use a minimum water volume of 275 L/ha. Repeat application may be necessary. Some products are restricted to ground application only; others may be applied by ground or air.
- phosmet Use water volumes of 200-500 L/ha. Apply when first signs of infestation are visible. Do not apply more than once per cutting. Do not make more than three applications per season. Do not apply by air. Restricted entry interval is 5 days.

### References –

- 1) Heimpel and Meloche. 2001. The Great Lakes Entomologist. 34 (1): 17-26.

## Alfalfa Caterpillar

*Colias eurytheme* Boisduval (Lepidoptera: Pieridae)

Various lepidopteran larvae feed on legume and grass forages, usually with little impact because populations are kept low by natural biological controls. Normal forage harvesting disrupts larval life cycles by preventing many larvae from maturing. Alfalfa caterpillar occurs fairly frequently in alfalfa on the prairies but has not been recorded as causing economic harm (1).

**Economic thresholds** – unknown

**Chemical control** – No insecticides registered

### Reference -

1. Beirne, Mem. Entomol. Soc Can. No. 78, 1971.

## Alfalfa Looper

*Autographa californica* (Speyer) (Lepidoptera: Noctuidae)

### Economic Thresholds

No economic thresholds have been established for alfalfa.

**Biological Control -**

The alfalfa looper is usually held in check by its natural parasites and predators, and by viral diseases that kill the larvae before they can pupate.

**Cultural Control -**

Early cutting may give satisfactory control because larvae cannot survive on dried alfalfa forage. Alfalfa should be inspected within 2 to 3 days after cutting to determine if loopers are feeding on regrowth. Insecticide application in alfalfa is rarely warranted.

**Chemical Control –**

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
naled Dibrom	945-1890	1.05-2.1 L	0.42-0.85 L	4	-

**Restrictions**

- crop in bloom Do not apply to crops in bloom. See Section in Guide regarding hazard to bees.
- naled Ground or aerial application. For ground application, dilute with water to 100-300 L/ha unless otherwise stated. For aerial application, dilute with water to 10-30 L/ha unless otherwise stated. When using maximum rate, the area treated is limited to 200 ha/day. Re-entry period is 48 hr. Do not apply when temperatures exceed 32°C.

<b>Alfalfa Weevil</b>	<i>Hypera postica</i> (Gyll.) (Coleoptera: Curculionidae)
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**Economic Thresholds**

- Alfalfa hay crops (6-9)
  - 25-50% of leaves on the upper one-third of the stem show damage (6)
  - 50-70% of terminals show injury (9)
- Alfalfa seed crops (10)
  - 20-25 larvae/sweep (90°=straight sweep)
  - 35-50% of foliage tips show damage

**Biological Control -**

The parasitic wasp *Bathyplectes curculionis* (Thomson) is now found in Alberta and Saskatchewan. Chemical control of the pest may decimate populations of this biocontrol agent.

**Cultural Control -**

Cut the first hay crop early. If damage reappears in new growth, insecticide application may be necessary.

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### Chemical Control –

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	References
<b>chlorantraniliprole</b> Coragen	75-100	0.375 -0.50 L	0.152-0.202 L	0	-
<b>deltamethrin</b> Decis 100 EC Decis 5EC Poleci	10 - 12.5 10 - 12.5 10 – 12.5	100 - 125 ml 200 - 250 ml 400 – 500 ml	40.5 – 50.6 ml 80 – 100 ml 160 – 200 ml	20	11, 12
<b>dimethoate</b> Cygon 480EC, 480AG, Lagon	204	0.425 L	0.172 L	10	-
<b>λ-cyhalothrin</b> Matador 120EC Silencer, labamba	10	83 ml	34 ml	3	-
<b>malathion</b> Malathion 500E Malathion 85E	1000-1500 935-1143	2-3 L 1.1-1.345 L	0.809-1.214 L 0.445-0.544 L	7 7	
<b>phosmet</b> Imidan 70 WP	1120	1.6 kg	0.648 kg	7	-

Forage Crop If application is made to heavy growth, 110-220 L water/ha may be required for adequate coverage.

Seed Crop Chlorantraniliprole, deltamethrin, and λ- cyhalothrin are less toxic to pollinators than other products. Keep leafcutting bees off the crop until the cyhalothrin-λ dries completely or at least 24 hours following deltamethrin application.

### Restrictions -

crop in bloom Do not apply insecticide when bees are pollinating. See Section in Guide regarding hazard to bees.

chlorantraniliprole Suppression only. Do not make more than one application per cutting. Recommended to wait one day between application and feeding to livestock. Not registered specifically for alfalfa seed production. Ground application only.

deltamethrin For use on seed crops only. Avoid application when daytime temperatures are greater than 25°C. One application per year. Apply by ground only. 100-300 L of water per ha

dimethoate	For reduction of alfalfa weevil larvae. Do not apply when alfalfa is in bloom or during the 5 day period before blooming. Remove cattle before spraying. Maximum 2 applications per season with a minimum 7 day interval between applications. Water volume for ground application: 200 L per ha. Ground or aerial application is permitted.
$\lambda$ -cyhalothrin	Do not apply within 3 days of grazing; on unimproved pastures the recommended pre-grazing interval is 7 days. Allow a 7 day interval between treatments. Do not use more than 3 applications per season. Alfalfa seed from treated crops must not be used for production of alfalfa sprouts. Ground or aerial application of Matador is permitted. Do not make more than 1 application of 83 mL/ha of the allowed seasonal total by air. Ground application only for Silencer.
malathion	Some products list control of alfalfa weevil larvae only. Greatest efficacy at air temperatures above 18°C. Apply when 75% of leaves show feeding damage. Do not apply when alfalfa is in bloom. 2 applications per cut to a maximum of 4 applications per year, with a minimum application interval of 14 days. Ground or aerial application.
phosmet	Apply in 200-500L water per ha. Do not apply more than once per cutting. Do not make more than 3 applications per season. Restricted entry interval is 5 days. Consult local agricultural authorities regarding proper time of spray application. Ground application only.

### References -

1. Bass and Knapp, J. Econ. Entomol. 59:648, 1966.
2. Swailes and McDonald, Pest. Res. Rep. 1964:177.
3. Ellis, Pest. Res. Rep. 1976:167.
4. Richards and Charnetski, Pest. Res. Rep. 1976:168.
5. Harper, Can. Entomol. 110:891, 1978.
6. Bereza, Ontario Agdex 121/622. 4 pp., 1977.
7. Hastings and Pepper, J. Econ. Entomol. 46:785, 1953.
8. Hintz et al., J. Econ. Entomol. 69:749, 1976.
9. Carpenter, J. Econ. Entomol. 63: 1602, 1970
10. Johansen, Pacific North West Ext. Publ. No. 128, 1980.
11. Charnetski and Schaber, Pest. Res. Rep. 1980:160.
12. Charnetski, Pest. Res. Rep. 1983:154.

**Armyworms** including armyworm *Mythimna unipuncta*, (Haworth) (Lepidoptera: Noctuidae), fall armyworm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) and others

Armyworms can cause severe damage to cereal and grass crops or pastures in outbreak situations, but such years are often interspersed with several years of little damage. Infestations can be quite localized. Armyworm (*Mythimna unipuncta*) moths are annual migrants to the prairies from the United States.

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**Economic thresholds** – In forage grasses, a nominal threshold is when five or more larvae (smaller than 2.5 cm) per square foot are found. In seedling crops, two to three larvae (smaller than 2.5 cm) per square foot may warrant control.

**Biological control** - Many species of parasitoids and predators, as well as bacterial and fungal diseases and even birds feed on armyworms. The control of such natural enemies may come too late however, to reduce economic damage in high infestations (1)

### Chemical control –

*IPM status of insecticides* – Chlorantraniliprole is not harmful to some beneficial insects, such as parasitic Hymenoptera (2).

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
chlorantraniliprole Coragen	50 - 75	0.25-0.375 L	0.101-0.152 L	0	

### Restrictions -

chlorantraniliprole For grass seed production only. Crop residue is not to be fed to livestock. Do not apply more than four times per year or more than once every 7 days, and do not exceed application of more than 1.125L/ha per season.

### Reference -

1. Beirne, Mem. Entomol. Soc Can. No. 78, 1971.
2. Bruggen *et al.* 2010. Pest Management Science. 66: 1075-1081.

<b>Beet Webworm</b> <i>Loxostege sticticalis</i> (L.) (Lepidoptera: Crambidae) and other webworms
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Beet webworm has a wide host range, often preferring to feed on weeds in a crop than the crops itself. It is a sporadic pest that causes damage only in some years in some locations. Normal forage harvesting disrupts life cycles of Lepidoptera such as beet webworm by preventing many larvae from maturing.

**Economic thresholds** – unknown

**Chemical control** – None registered in forage crops

<b>Blister Beetle</b> <i>Epicauta</i> spp., <i>Lytta</i> spp. (Coleoptera: Meloidae)
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Damage, although usually localized, can occur quickly and mainly in dry situations when grasshoppers are present. Larvae of some species of blister beetles, such as *Epicauta* spp., eat grasshopper eggs, while larvae of *Lytta* feed in the nests of solitary bees.

**Chemical control-** No insecticides registered for blister beetles in forage crops.

**Bromegrass Seed Midge**      *Contarinia bromicola* (Marik & Agaf.) (Diptera: Cecidomyiidae)

**Cultural Control -**

Thorough burning of stubble and trash in early spring or before regrowth in late summer provides some control. (1-2) Parasitism by a species of *Tetrastichus* (Eulophidae) can vary from 30% to 75% (3).

**References -**

1. Knowles, Forage Notes 18(2), 1973; 19(2), 1974.
2. Neuman and Manglitz, Agric. Expt. Sta., Univ. Neb., Res. Bull. 252, 1972.
3. Curry, Knowles and Waddington, Can. Entomol. 115:(1) 75-79, 1983.

**Clover Thrips**      *Haplothrips leucanthemi* Schr. (Thysanoptera: Phlaeothripidae)  
(red clover seed fields)

**Economic Thresholds -**

Damage is insignificant until 50-80 thrips/raceme are present. (1) Threshold levels occur only during years of early spring drought on dryland.

**Reference -**

1. Craig, unpublished data 1987, Agriculture and Agri-Food Canada, Saskatoon.

**European Skipper**      *Thymelicus lineola* (Ochs.) (Lepidoptera: Hesperiiidae)

on timothy

**Chemical control-**

*IPM status of insecticides – Bacillus thuringiensis kurstaki* is specific in killing larvae of Lepidoptera, and will not harm populations of beneficial insects.

Active ingredient	Rate				Preharvest	
Product	(g AI/ha)	Rate /ha	Rate /acre	Interval	(days)	Reference

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<b><i>Bacillus thuringiensis</i></b> Dipel 2X-DF Bioprotec CAF	80-157	0.140-0.275 kg 0.55 – 0.7 L	0.057-0.111 kg 0.22 – 0.28 L	n/a	
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**Restrictions -**

*Bacillus thuringiensis* Apply at first signs of infestation when larvae are small. May be applied up to the day of harvest. Use in a minimum of 300 litres of water per hectare. Use diluted spray mixtures within 12 hr.

**Grasshoppers Orthoptera: Acrididae** on alfalfa, clover, forage grasses, pastures and rangelands

**Economic Thresholds** - See Cereal Crops Section. Unless the forage crops are in their establishment year, economic thresholds should be closer to ETs for roadsides than those for field crops.

**Chemical Control –**

*IPM status of insecticides* – **Eco Bran** Bait will preserve most beneficial insects (9).

**Chlorantraniliprole** is not harmful to some beneficial insects, such as parasitic Hymenoptera (10).

**Reduced Agent and Area Treatments (RAATs):** Grasshoppers on rangelands may be managed by applying certain insecticides in treated swaths, which alternate with untreated swaths. This can reduce the cost of control and amount of insecticide used, while resulting in effective control (7, 8).

Active ingredient Product	Crop	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Refer- ence
<b>carbaryl</b> Sevin XLR	forage grasses, rangeland and pastures	514-1498	1.2-3.5 L	0.49-1.42 L	1-2 (forage grasses)  0-2 (pastures)	-

<p><b>carbaryl bran bait</b> Eco Bran</p>	<p>alfalfa, clovers, forage grasses, rangeland and pastures</p>	<p>40-80</p>	<p>2.0-4.0 kg</p>	<p>0.81 - 1.62 kg</p>	<p>2 (clover and alfalfa) 1-2 (forage grasses) 0-2 (pastures)</p>	<p>-</p>
<p><b>chlorantraniliprole</b> Coragen</p>	<p>alfalfa, clovers, forage grasses, rangeland and pastures</p>	<p>25-50</p>	<p>125 – 250 mL</p>	<p>51 – 101 mL</p>	<p>0</p>	<p>-</p>
<p><b>deltamethrin</b> Decis 100 EC Decis 5 EC</p>	<p>alfalfa (seed production only), rangeland and pastures</p>	<p>Decis 100 EC: 5 – 7.5  Decis 5 EC: 5 - 7.5</p>	<p>Decis 100 EC: 50 – 75 ml  Decis 5 EC:100- 150 mL</p>	<p>Decis 100 EC: 20.2 – 30.4 ml  Decis 5 EC: 40- 61 mL</p>	<p>20 (alfalfa)  N/A (rangeland and pastures)</p>	<p>-</p>
<p>Poleci</p>	<p>rangeland and pastures</p>	<p>Poleci: 5- 7.5</p>	<p>Poleci: 200-300 mL</p>	<p>Poleci: 81-121 mL</p>		

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<p><b>dimethoate</b> Cygon 480EC,</p>	<p>alfalfa, rangeland and pastures</p>	<p>264-480</p>	<p>0.55 L-nymphs 0.85-0.90 L- adults in Alfalfa 0.85-1.0 L- Adults in Pastures</p>	<p>0.22 L (nymphs) 0.34-0.41 L (adults in pastures) 0.34-0.36 L (adults in alfalfa)</p>	<p>10 (alfalfa) 2 (pastures with low rate) 7 (pastures with high rate)</p>	<p>1-4</p>
<p>Cygon 480 AG</p>	<p>alfalfa, forage grasses, rangeland and pastures</p>		<p>Alfalfa: 0.55 L (nymphs) 0.85-0.90 L (adults)  Forage grasses:0.42- 0.55 L (nymphs) 0.85-1.0 L (adults)  Pastures: 0.55 L (nymphs) 0.85-1.0 L (adults)</p>	<p>Alfalfa: 0.22 L (nymphs) 0.34-0.36 L (adults)  Forage grasses: 0.17-0.22 L (nymphs) 0.34-0.40 L (adults)  Pastures: 0.22 L (nymphs) 0.34-0.41 L (adults)</p>	<p>28 (alfalfa) 2-28 (forage grasses) 2 (low rate in pastures) 7-28 (high rate in pastures)</p>	

Lagon	alfalfa, clovers, forage grasses, rangeland and pastures		Alfalfa: 0.55 L (nymphs) 0.85-0.90 L (adults)  Clovers: 0.425-1.0 L  Forage grasses: 0.42-0.55 L (nymphs) 0.85-1.0 L (adults)  Pastures: 0.55 L (nymphs) 0.85-1.0 L (adults)	Alfalfa: 0.22 L (nymphs) 0.34-0.36 L (adults)  Clovers: 0.172-0.405 L  Forage grasses: 0.17-0.22 L (nymphs) 0.34-0.40 L (adults)  Pastures: 0.22 L (nymphs) 0.34-0.41 L (adults)	10 (alfalfa)  2-28 (clovers and forage grasses)  2 (low rate in pastures) 7-28 (high rate in pastures)	
<b>λ -cyhalothrin</b> Matador 120EC, Silencer 120EC, labamba	alfalfa, forage grasses, rangeland and pastures	7.6 - 10 ground 10 aerial	0.063-0.083 L (ground)  0.083 L (aerial)	0.025-0.034 L (ground)  0.034 L (aerial)	3 (alfalfa and pastures)  14 (forage grasses)	-
<b>malathion</b> Malathion, 500 E	alfalfa and forage grasses	100-1500 (alfalfa)  850 (forage grasses)	2-3 L (alfalfa)  1.7 L (forage grasses)	0.81-1.21 L (alfalfa)  0.69 L (forage grasses)	7	-
Malathion 85E	alfalfa, clovers, rangeland and pastures	935 - 1143	1.10- 1.345 L (alfalfa and clovers)  0.83 L (pastures)	0.445 – 0.544 L (alfalfa and clovers)  0.336 L (pastures)	7 (alfalfa and clovers)  N/A (pastures)	-
<b>naled</b> Dibrom	rangeland and pastures	477-738 (nymphs) – 603-864 (adults)	0.53-0.82 L (nymphs)  0.67-0.9 L (adults)	0.21-0.33 L (nymphs)  0.27-0.36 L (adults)	4	-

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<i>Nosema locustae</i> Nolo Bran Bait	alfalfa, forage grasses, rangelands and pastures		minimum 1.12 kg	minimum 0.453 kg	0	-
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Note: Use lower rates on younger grasshoppers. Best control is achieved when product is applied to young grasshoppers. If insect pressure is high spraying a 15 m strip around the field may aid in control.

### Restrictions -

- crop in bloom Do not apply to crops in bloom. See Section in Guide regarding hazard to bees.
- carbaryl Remove cattle from area while spraying. Dilutions of higher than 1:11 are not recommended when residual insect control from the wash-off is desired. Maximum 2 applications per year. Sevin XLR - ground or aerial application.
- carbaryl  
bran bait Apply by ground only. Rain shortly after application will decrease efficacy of product. Repeat applications only as necessary but not more frequently than once a week during periods of heavy infestation and once every two weeks during moderate to low infestation. Presence of product on flowering crops such as alfalfa and clover will not harm foraging honey or leafcutter bees.
- cyhalothrin-λ Do not use more than 3 applications per year. Air or ground application, but do not make more than 1 application by air per year. Do not use alfalfa seed from treated crops for production of alfalfa sprouts. Allow 7 days between applications. Timothy for seed or hay – apply by ground only. Use sufficient water for thorough coverage, 100 to 200 L/ha by ground sprayer. Treated crops may be fed to non-lactating dairy animals and other livestock after a 3 day interval from application to harvest or foraging; **exception** – do not apply within 14 days of timothy harvest. Apply in 100 to 200 L of water per hectare.
- deltamethrin Do not make more than three applications per year, with a maximum of two aerial applications. Use higher rates for older insects and/or dense crop canopy.
- dimethoate Do not apply during bloom. When spraying honey-producing crops (alfalfa, red clover, and alsike) spray at least 5 days before bloom appears and do not introduce hives until full bloom. Follow provincial forecast. Remove cattle before spraying. Ground or aerial application.
- malathion Greatest efficacy at air temperatures above 20°C. Pasture and rangelands treated with malathion may be grazed or harvested on day of treatment. No application within 7 days of harvest or pasturing of alfalfa, clovers. Do not apply to alfalfa in bloom. Apply when 75% of foliage shows feeding damage. Repeat as necessary.

naled Use sufficient water to provide thorough coverage and contact spray. Animals may be present during treatment. Do not apply when temperatures exceed 32°C. Maximum 2 applications per year. Ground or aerial application.

*Nosema lacustae* Grasshopper death will begin in 3-6 weeks; the pathogen will remain in the grasshopper population for several years. Ground or aerial application.

**References -**

1. Holmes et al., J. Econ. Entomol. 58:77, 1965.
2. Banham, Pest. Res. Rep. 1964:134.
3. McDonald and McKinlay, Pest. Res. Rep. 1964:132.
4. Dolinski et al., Pest. Res. Rep. 1973:185.
5. Mukerji et al., Can. Entomol. 1981:707.
6. Johnson et al., Pest. Res. Rep. 1985: 174.
7. Lockwood and Schell. J. Orthoptera Research.1997: 19-32.
8. Lockwood et al., Int. J. Pest Manag. 2000. 29-42.
9. George *et al.* 1992. Environmental Entomology. 21: 1239-1247.
10. Brugger *et al.* 2010. Pest Management Science. 66: 1075-1081.

**Leafhoppers** (Hemiptera: Cicadellidae), including **Potato Leafhopper** *Empoasca fabae* (Harris)

Many species of leafhopper are present in prairie forage crops but damage either by direct feeding or by disease transmission is rare. However, in some areas of the eastern North America leafhoppers are rated among the most serious pests of alfalfa. Potato leafhopper damage symptoms appear as stunting as well as yellowing of the leaves in a v-shaped pattern starting at the tip of a leaflet. Damage is most severe in new seedings and in regrowth in hot, dry weather.

**Economic thresholds** – vary with commodity prices and application costs. Historic thresholds are: if alfalfa is <9 cm in height, the economic threshold for potato leafhoppers is 0.2 adults/sweep, <15 cm=0.5 adult PLH, <25 cm= 1.0 adult PLH, and <36 cm=2.0 adult PLH/sweep. (1)

**Cultural Control –**

Cut the first hay crop early.  
Some alfalfa cultivars have resistance to leafhoppers.

**Chemical Control –**

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
<b>afidopyropen</b> Sefina		0.2 – 0.4 L	0.08 – 0.16 L	0	
<b>flupyradifurone</b> Sivanto Prime		500-750 ml	202-304 ml	7	

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<b>dimethoate</b> Cygon, Lagon	204	0.425 L	0.172 L	10	-
<b>cyhalothrin-λ</b> Matador120EC Silencer 120EC, labamba	10	0.083 L	0.034 L	3	-
<b>malathion</b> Malathion 500 EC Malathion 85E	100- 1500935- 1143	2-3 L 1.1 – 1.345 L	0.809-1.214 L 0.445-0.554 L	7 7	-
<b>naled</b> Dibrom	945-1890	1.05-2.1 L	0.425-0.850 L	4	-

### Restrictions

- crop in bloom Do not apply to crops in bloom. See Section in Guide regarding hazard to bees.
- dimethoate Remove cattle before spraying. Use sufficient water for good coverage. Repeat only if necessary. Ground or aerial application. Do not apply during the blooming period or during the 5-day period before blooming. Maximum 2 applications per year
- λ-cyhalothrin Do not apply within 3 days of grazing; on unimproved pastures the recommended pre-grazing interval is 7 days. Allow a 7 day interval between treatments. Do not use more than 3 applications per season. Alfalfa seed from treated crops must not be used for production of alfalfa sprouts. Matador -ground or aerial application; Silencer – ground application only. Do not make more than 1 application of 83 mL/ha of the allowed seasonal total by air.
- malathion Greatest efficacy at air temperatures above 20°C. Apply when 75% of foliage shows feeding damage. Repeat as necessary – 2 applications maximum per cut, 4 applications per year. Ground or aerial application.

naled Ground or aerial application. For ground application, dilute with water to 100-300 L/ha unless otherwise stated. For aerial application, dilute with water to 10-30 L/ha unless otherwise stated. When using maximum rate, the area treated is limited to 200 ha/day. Re-entry period is 48 hr. Do not apply when temperatures exceed 32°C.

**Reference -**

1. Metcalf and Luckmann. 1994. Introduction to Integrated Pest Management. pp 469-504.

**Lesser Clover Leaf Weevil** *Hypera nigrirostris* (F.) (Coleoptera: curculionidae)

**Economic thresholds**

Red clover

- third and fourth instar larval densities greater than 3 per five shoots could damage up to 50% of buds and flower heads (1)

**Chemical control** - in established red clover fields for seed production only

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
<b>deltamethrin</b>					
Decis 100 EC	12.5	125 ml	51 ml	n/a	-
Decis 5 EC	12.5	250 ml	101 ml	n/a	
Poleci	12.5	500 ml	202 ml	n/a	

**Restrictions**

crop in bloom Do not apply insecticide when bees are pollinating. See Section in Guide regarding hazard to bees.

deltamethrin For suppression. Do not make more than two applications per year. Apply two times at a 14 day interval, at early vegetative and when crop is budding. Do not use treated crop for feed or forage. Restricted entry interval 12 hours. Ground application only. Water volume 100-300 L per ha.

**Reference -**

1. Weiss and Gillott, Can. Entomol. 125:831-837, 1993.

**Pea Aphid** *Acyrtosiphon pisum* Harr. (Hemiptera: Aphididae) and other aphids

**Economic Thresholds -**

1430 aphids/sweep did not reduce the forage yield of irrigated alfalfa. (2)

Caged alfalfa initially infested with 100-200 aphids/plant produced less forage and had lower carotene contents than uninfested plants. (4)

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100 - 200 aphids/ 180° sweep when seed crop is drought-stressed, plants are wilting, and seed is still developing (before mid-August)

### Cultural Control -

On irrigated alfalfa, control may be unnecessary if adequate water is provided to the plants. (2)

### Biological Control -

High winds, heavy rain and hail can cause pea aphid numbers to decline drastically. Predators such as lady beetles (Coccinellidae) and others, parasitic wasps, and entomopathogenic diseases often cause aphid population crashes to occur, especially late in the season.

### Chemical Control –

*IPM status of insecticides* – **Flonicamid** is a systemic insecticide with selective activity as a feeding blocker against sucking insects. It has no harmful effects on natural enemies of aphids such as green lacewings (5), lady beetles (5), minute pirate bugs (6), or parasitoids such as Aphelinidae (7).

**Flupyradifurone** is taken up by plant tissue and mainly translocated in the xylem. Aphids stop feeding shortly after ingesting it and die two days later (8). Flupyradifurone appears to have no adverse effects on honey bee colonies when applied following label directions (9).

In laboratory experiments on **afidopyropen** with natural enemies of aphids, afidopyropen was not toxic to lady beetles or minute pirate bugs, and was only moderately toxic to *Aphelinus certus* (Hymenoptera: Aphelinidae) (10).

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
<b>afidopyropen</b> Sefina	10 g	200 ml	81 ml	0	
<b>flonicamid</b> Beleaf 50 SG	60-80 g	120-160 g	49-65 g	7	-
<b>flupyradifurone</b> Sivanto Prime		0.5-0.75 L	0.202-0.304 L	7	
<b>dimethoate</b> Cygon, Lagon	204	0.425 L	0.172 L	10	1, 3
<b>λ -cyhalothrin</b> Matador, Silencer, labamba	10	0.083 L	0.034 L	3	-
<b>malathion</b> Malathion 500, Malathion 85E	1000-1500 935-1143	2 -3 L 1.1 – 1.345 L	0.809-1.214 L 0.445-0.544 L	7 7	-
<b>naled</b> Dibrom	945-1890	1.05-2.1 L	0.425-0.85 L	4	-

## Insect Management in Forage Crops

Note: Ensure thorough coverage. Treat if population is large enough to stunt plants or if heavily infested hay is to be dehydrated.

### Restrictions -

Do not apply when pollinators are present. See Section in Guide regarding hazard to bees.

dimethoate	Remove cattle before spraying. Maximum number of applications per season - two. Ground or aerial application.
flonicamid	For alfalfa seed production only. Maximum of three applications per season; minimum of 7 day interval between applications. Do not use alfalfa seed from treated crops for human or animal consumption. Minimum water volume of 100 L per ha.
$\lambda$ -cyhalothrin	Maximum of three applications per season; minimum of 7 day interval between applications. Do not use alfalfa seed from treated crops for human consumption. Air or ground application of Matador, but do not make more than 1 application by air per year. Silencer - ground application only.
malathion	Do not apply to alfalfa in bloom. Remove cattle before spraying. Greatest efficacy at air temperatures above 20°C. Application by ground or air.
naled	Ground or aerial application. For ground application, dilute with water to 100-300 L/ha unless otherwise stated. For aerial application, dilute with water to 10-30 L/ha unless otherwise stated. When using maximum rate, the area treated is limited to 200 ha/day. Maximum two applications per season. Re-entry period is 48 hr. Do not apply when temperatures exceed 32°C.

### References -

1. Harper, Can. Entomol. 110:891, 1978.
2. Hobbs et al., Can. Entomol. 93:801, 1961.
3. McDonald and Harper, Can. Entomol. 110:213, 1978.
4. Harper and Lilly, J. Econ. Entomol. 59:1426, 1966.
5. Garzón et al., Chemosphere. 132: 87-93, 2015.
6. Barbosa et al. Ecotoxicology 26: 589-599, 2017.
7. Frewin et al. Pest Manage. Sci. 68: 202-208. 2012.
8. Nauen et al. Pest. Manage. Sci..71: 850–862. 2015.
9. Campbell et al. J. Econ. Entomol. 109: 1967–1972. 2016.
10. Koch et al., Pest Management Science. 76 : 375-383. 2020.

**Plant Bugs (Hemiptera: Miridae) in Alfalfa Seed Fields**

Including: Lygus bugs (*Lygus* spp.), Alfalfa plant bug (*Adelphocoris lineolatus*), Superb plant bug (*Adelphocoris superbus*), and Obscure plant bug (*Plagiognathus obscurus*).

**Economic Thresholds -**

8 lygus bugs/sweep or 4 alfalfa plant bugs/sweep or 5 nymphs/sweep of any or all species of plant bugs, when the alfalfa is in bud or in bloom. (7-9)

Chemical application should be timed so that the majority of nymphs are third instars or older.

**Cultural Control -**

Burning of alfalfa stubble and debris in early spring controls all species except lygus bugs. (3, 5, 15, 16)

**Chemical Control -**

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	References
<b>acetamiprid</b> Assail/Aceta	60-120	0.087-0.170 kg	0.0352-0.0688 kg	1	-
<b>deltamethrin</b> Decis 100 EC Decis 5EC Poleci	10 - 12.5	100 – 125 ml 200 - 250 ml 400 - 500 ml	41 – 51 ml 81 - 101 ml 162 - 202 ml	20 20 20	10-14
<b>dimethoate –</b> forage – Cygon 480  seed - Cygon 480, Lagon	204 – 528	0.425 L  1.1 L	0.172 L  0.445 L	10  28	1, 6
<b>λ-cyhalothrin</b> Matador Silencer, labamba	10	83 ml	34 ml	3	-
<b>malathion</b> Malathion 500 Malathion 85E	1000-1500 935-1143	2.0-3.0 L 1.10-1.345 L	0.809-1.214 L 0.445-0.544 L	7 7	-
<b>naled</b> Dibrom	– 945-1890	1.05-2.1 L	0.425-0.850 L	4	-
<b>novaluron</b> Rimon	90	0.835 L	0.338 L	14	-
<b>flonicamid</b> Beleaf 50 SG		200-299 g	81-121 g	7	
<b>acetamiprid + novaluron</b> Cormoran		0.751-0.900 L	0.304-0.364 L	14	

## Insect Management in Forage Crops

Note: For control of lygus bugs in burned fields, apply dimethoate or deltamethrin just before alfalfa begins to bloom.

When putting out or replacing leafcutting bees on the crop, wait 7 days after applying dimethoate and wait 1 day after applying deltamethrin.

In unburned fields for control of all plant bugs, apply dimethoate no later than the beginning of flower bud formation.

If the alfalfa is in bloom and bees are in the crop, apply cyhalothrin- $\lambda$  in late evening when bees are not foraging.

### Restrictions –

acetamiprid	Seed production only. Control of alfalfa plant bug, suppression of Lygus bug. Apply prior to bloom up to the time when 50% of seed pods are ripe. Begin when adults and/or 4 <sup>th</sup> -5 <sup>th</sup> instar nymphs have reached economic thresholds. Use the higher rate for heavier infestations. Maximum 3 applications per season. Do not apply more than once every 7 days. Do not cut treated fields for hay/forage or graze treated fields. Do not exceed a total of 357 g active ingredient (510 g product) per ha per season. Ground application only.
deltamethrin	Seed production only. Do not feed treated forage within 90 days of harvest. Do not apply more than once annually. Use higher rates when alfalfa weevils are present. Not recommended for alfalfa plant bug control. Apply in 100-300 L/ha water. Ground application only.
dimethoate	Do not graze or harvest for forage within 28 days following treatment. Ground or aerial application. Allow at least 10 days before placing leaf cutting bees in the field. Do not apply more than once per season. Do not apply during blooming, nor during the 5-day period before the crop blooms.
$\lambda$ -cyhalothrin	Do not graze or feed treated forage or pasture to lactating dairy cows. Allow 7 days between application. Do not apply within 3 days of livestock foraging. Do not use more than 3 applications per year. Do not use alfalfa seed from treated crops for production of alfalfa sprouts. Aerial and ground (Matador) or ground (Silencer) application.
malathion	Greatest efficacy at air temperatures above 20°C. Apply when 75% of foliage shows damage. Do not apply to alfalfa in bloom. 2 applications per cut to a maximum of 4 applications per year. Ground or aerial application permitted.
naled	Ground or aerial application. For ground application, dilute with water to 100-300 L/ha unless otherwise stated. For aerial application, dilute with water to 10-30 L/ha unless otherwise stated. When using maximum rate, the area treated is limited to 200 ha/day. Re-entry period is 48 hr. Do not apply when temperatures exceed 32°C. Maximum 2 applications per year.

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nolvaluron For alfalfa seed production only. For control of plant bug nymphs only. Avoid application to crops in bloom if bees are in the area. Use only on pure stands of alfalfa to be harvested for seed. Do not allow livestock to graze treated fields. Do not use treated crops or crop residue for livestock feed. Alfalfa seed from treated fields may not be used for growing sprouts for human or animal consumption. Ground application only. No more than 1670 mL/ha per season. Maximum 2 applications per year.

### References -

1. Craig, Pest. Res. Rep. 1971:167.
2. Kolach and Senkow, Pest. Res. Rep. 1972:151.
3. Lilly and Hobbs, Can. J. Plant Sci. 42:53, 1962.
4. Craig, Pest. Res. Rep. 1973:168.
5. Craig, Agric. Can. Publ. 1935, 1973.
6. Harper, Can. Entomol. 110:891, 1978.
7. Craig and Lasiuk, Pest. Res. Rep. 1971:167.
8. McMahon, Rep. B.C. Agron. Assoc. 1950:58.
9. Sorenson, Utah Agric. Expt. Sta. Bull. 284,1939.
10. Charnetski and Schaber, Pest. Res. Rep. 1980:161.
11. Charnetski, Pest. Res. Rep. 1983:154.
12. Butts, Pest. Res. Rep. 1981:149; 1983:156.
13. Butts and Lippert, Pest. Res. Rep. 1982:166.
14. Cattellier and Wise, Pest. Res. Rep. 1982:167.
15. Schaber and Entz, J. Econ. Entomol. 81:668-672, 1987.
16. Craig, Pest. Res. Rep. 1980:163.

## Plant Bugs (Hemiptera: Miridae) In Grass Fields

Plant bugs such as *Capsus cinctus* Kolenaty, the rice leaf bug (*Trigonotylus caelestialium* (Kirk)), and others (See Silvertop of Grasses below)

### Chemical Control -

Active Ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
<b>dimethoate</b> Cygon 480, Lagon	204	0.425 L	0.172 L	2	1

### Restrictions -

dimethoate Do not graze, forage, or harvest 2 days after treatment. Ground or aerial application.

### References -

1. Okuda, Pest. Res. Rep. 1988 p.134.

## Silvertop of Grasses

Diverse causal agents. Insects associated with silvertop include grass plant bugs (e.g., *Capsus* species, *Trigonotylus* spp., *Irbisia* spp., *Labops* spp., others), thrips such as *Anaphothrips* species, and grain mites such as *Siteroptes graminum*. Diseases such as *Fusarium* have also been implicated.

### Economic Thresholds -

Thresholds will vary according to seed prices, which fluctuate wildly. In general, grass fields exhibiting 10% or more silvertop should have remedial action taken the following year. Silvertop, once evident, cannot be treated or reversed in the current season.

### Cultural Control -

Post-harvest burning or burning in the spring prior to new growth will destroy many plant bug eggs and adults. Do not burn creeping red fescue fields in the Peace River region because of potential damage to the subsequent seed crop. In this region, burn only after the last seed harvest and prior to entering a rejuvenation cycle. Low-mowing (below 3 cm) and removal of straw following harvest also decreases the incidence of silvertop.

### Chemical Control -

At present, certain formulations of dimethoate are registered for control of plant bugs in forage crops (See Plant Bugs in Grass Fields above).

### References -

1. Peterson and Vea, J. Econ. Entomol. 64:247-251, 1971
2. Kamm and Fuxa, J. Range Management 30:385-387, 1977
3. Okuda, Pest. Res. Rep. 1988:134.

**Seed Chalcids** including alfalfa seed chalcid *Bruchophagus roddi* (Guss.), clover seed chalcid *B. gibbis* (Boh.), trefoil seed chalcid *B. platypterus* (Wlkr), and sainfoin seed chalcid *Eurytoma brychidi* (Wlkr.)

Seed chalcids do not affect legume forage production, but can cause up to 50% reduction in seed yield. Dryland crops suffer worse damage than irrigated fields. Likewise, damage is worse following a hot, dry summer.

Shallow cultivation of seed fields in the fall or early spring can bury many chalcid-infested seeds. Combine tailings and screenings should not be left in the field. Sow certified, chalcid-free seed.

### References -

1. Soroka and Spurr, Can. Entomol. 130: 1-11, 1998.

**SPIDER MITES :**  
**Twospotted Spider Mite *Tetranychus urticae* Koch** (Trombidiformes: Tetranychidae) **and others**

Spider mite populations can increase rapidly and cause damage in hot, dry conditions, usually towards the end of summer.

**Economic Thresholds -**

Unknown for Canadian prairies. In clover seed crops in Idaho, mite control is recommended in June or July when 25% of the leaves show feeding injury. (1)

**Biological Control -**

Mite populations are usually kept in check by low temperatures and rain, fungal diseases and predators such as lady beetles, predacious thrips and especially predacious mites.

**Chemical Control** – in alfalfa grown for seed

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
<b>malathion</b> Malathion 85E	935-1143	1.1-1.345 L	0.445-0.544 L	7	-
<b>spiromesifen</b> Oberon	120-240	0.5-1.0 L	0.202-0.405 L	n/a	-

**Restrictions -**

malathion      Greatest efficacy at air temperatures above 20°C. Do not apply to alfalfa in bloom. Apply when 75% of foliage shows feeding damage. Repeat as necessary. Some products are restricted to ground application only; others may be applied by air.

spiromesifen    Three applications may be required for control. Treat at minimum 7 day intervals. Do not apply when pollinators are actively foraging in the treatment area; apply before pollinators are placed in a field or after they have been removed. Ground and aerial application is permitted. Maximum allowed per crop season: 3 L/ha. Minimum application volume: 100 L/ha - ground; 50L/ha – aerial application.

**References -**

1. Baird, Homan and Bolz. 2002.

**Spittlebugs:**  
**Meadow spittlebug**      *Philaenus spumaris* (L.) (Hemiptera: Cercopidae)

Spittlebugs are only an occasional pest of alfalfa, and not normally a cause for concern. Adults do not damage alfalfa. When nymphs hatch they form a spittle mass which is used to prevent desiccation and to protect from predators.

## Insect Management in Forage Crops

### Economic Thresholds -

Unknown for Canadian prairies. In Wisconsin, an average of 1 spittlebug nymph/stem is necessary before control should be considered. (1)

### Chemical Control -

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
<b>malathion</b> Malathion 85E	935-1143	1.1- 1.345 L	0.445-0.544 L	7	-

### Restrictions –

malathion - Greatest efficacy at air temperatures above 20°C. Do not apply to alfalfa in bloom. Apply when 75% of foliage shows feeding damage. Repeat as necessary. Some products are restricted to ground application only; others may be applied by air.

### References -

1. Baird, corn.agronomy.wisc.edu/Management/pdfs/IPMManual\_2\_Alfalfa.pdf page 10

<b>Sweetclover Weevil</b> <i>Sitona cylindricollis</i> Fahr. (Coleoptera: Curculionidae)
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### Economic Thresholds (7) -

#### In seedling sweet clover crops:

1 weevil adult/5 seedlings in cotyledon stage under slow growth conditions.  
1 weevil adult/3 seedlings in cotyledon stage under normal growth conditions.

#### In newly-emerging 2nd year sweet clover:

9-12 weevil adults/plant.

### Cultural Control -

#### Seedling stands:

Locate new seedlings as far as possible from 2nd-year clover.

#### First-year stands in late summer:

Defoliation of 1st-year clover by close-cutting, grazing, or weevil feeding during the critical period of mid-August to mid-September will severely reduce 2nd-year yield. Swath companion grain crops high.

#### Second-year stands:

Second year clover will usually outgrow weevil damage; insecticide application is rarely necessary. Sweet clover silage and hay fields should be cultivated as

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soon as possible after the crop is taken; this kills the new-generation weevil larvae in the soil. (6,7)

### Chemical Control -

In sweet clover seedling crops apply insecticide when very young seedlings are noticeably damaged by weevil feeding. In first-year clover in late summer and fall, apply insecticide to crop margins where weevils are concentrated.

Active ingredient Product	Rate (g AI/ha)	Rate /ha	Rate /acre	Preharvest Interval (days)	Reference
<b>dimethoate</b> Cygon, Lagon	408 - 528	0.850-1.1 L	0.344-0.445 L	28	1-5
<b>malathion</b> Malathion 500E	700-1250	1.4-2.5 L	0.567-1.012 L	7	-
Malathion 85E	625-1037	0.735-1.22 L	0.445-0.544 L	7	-

### Restrictions –

dimethoate	Do not apply within 28 days of grazing or harvesting for forage. Maximum of 2 applications per year. Ground or aerial application.
malathion	Greatest efficacy at air temperatures above 20°C. Spray field margins of first-year clover in late summer or early fall when adult migration is underway. Remove cattle when treating; cattle may be returned immediately after treatment. Maximum of 2 applications per year. Ground or aerial application.

### References -

1. Craig, Pest. Res. Rep. 1971:179.
2. Craig, Pest. Res. Rep. 1964:136.
3. Craig, Pest. Res. Rep. 1965:135.
4. Swailes and McDonald, J. Econ. Entomol. 58:988, 1965.
5. Craig, Pest. Res. Rep. 1968: 150.
6. Bird, 80th Annual Rep., Entomol. Soc. Ont., 1949.
7. Craig, Can. Entomol. 110:883, 1978.