

# Legume, Grass, and Field Seed Crops

**Protect pollinators:** See How to Reduce  
Bee Poisoning from Pesticides.

**Note:** Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

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## Pests of Alfalfa Grown for Seed

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In all cases, follow the instructions on the pesticide label. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making *any* pesticide applications.

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**Important notice** Several pesticides registered for use on alfalfa seed lack legal tolerances established for residues that may be on the seed, screenings, or hay. Therefore, certain alfalfa seed grower associations in Washington, Oregon, Idaho, Wyoming Montana, and Nevada have declared, through their respective state departments of agriculture, that alfalfa produced for seed in those states is a nonfood-nonfeed crop. This declaration means that none of the seed, screenings, or hay will be available for human or animal consumption when special nonfood pesticides registered via 24C Special Local Need have been applied.

EPA and Washington Department of Agriculture have classified most, but not all, small-seeded vegetable seed crops grown in Washington as nonfood/nonfeed crops for pesticide registration purposes.

Alfalfa seed producers should verify the legality of using the products in this section with both a current label indicating that a product is registered for use on alfalfa grown for seed, and the appropriate state department of agriculture.

### Alfalfa seed—Alfalfa weevil

*Hypera postica*

**Pest description and crop damage** Larvae are about 0.375 inch long, yellow to green, with a white stripe down the back. They feed in and on the buds of alfalfa.

**Sampling and thresholds** Treat when 20 to 30% of plant terminals show feeding damage - or - when larval populations reach 20 or more per half-circle (180° sweep). These thresholds are simply guidelines to help growers determine when to treat. Weather, plant vigor, irrigation schedules, history of weevils in the area, and a complex of factors may determine whether treatment is justified. In specific geographic areas we have been observing resistance to pyrethroid insecticides, specifically lambda-cyhalothrin. We have also observed increase tolerance to chlorpyrifos and pyrethroids, specifically lambda-cyhalothrin in alfalfa weevil populations in select geographic areas, but we have no populations that can survive exposure to labeled rates of chlorpyrifos. Resistance management strategies detailed in insecticide labels should be followed to help reduce the risk of further insecticide resistance development.

#### **Management—chemical control**

- *Beauveria bassiana* strain GHA (BotaniGard, BoteGHA) at 0.11 to 0.44 lb ai/A. PHI 0 days. This product is potentially pathogenic to honeybees. Avoid applying to areas where honeybees are actively foraging or around beehives. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Typically, it takes 7 to 10 days after the first spray to see control. Apply at 5- to 10-day intervals for low to normal pest pressure. For high pest pressure, especially aphids, apply at 2- to 5-day intervals. Repeat applications for as long as pest pressure persists. There is no limit on the number of applications or total amount of product that can be applied in one season.
- carbaryl (Carbaryl 4L) at 1 to 1.5 lb ai/A. Not effective against adult alfalfa weevil. REI 12 hr. On dense growth, apply in 25 to 40 gal water per acre with ground equipment to ensure adequate coverage. Extremely toxic to aquatic invertebrates and bees. Notify beekeepers within 1 mile of treatment area. PHI 7 days. Do not exceed 1.5 qt per acre per cutting. It may cause temporary bleaching of tender alfalfa foliage. Labeled for Idaho.
- chlorpyrifos (Chlorpyrifos 4E-AG) at 0.5 to 1 lb ai/A. REI 24 hr. Application rates will vary depending on the nozzle droplet type. Toxic to fish, aquatic invertebrates, small mammals and birds. Highly toxic to bees. Buffer zones must be utilized for aquatic areas when using ground boom (25 ft), chemigation (25 ft), orchard airblast (50 ft), and aerial (150 ft). Do not cut or graze alfalfa within 7 days after application of 0.5 pint/A, 14 days after application of 1 pint, and 21 days after application of > 1 pint/A. Labeled for Idaho.
- dimethoate (400EC, Dimate 4E) at 0.25 to 0.5 lb ai/A. PHI 10 days. REI 48 hr. For suppression only. Do not apply if crop or weeds are in bloom. Effective only on cutting to which chemical is applied. Do not feed or graze livestock. Do not apply more than once per cutting cycle and more than three times per year. Minimum retreatment intervals of 30 days.
- gamma-cyhalothrin (Drexel L-C) at 0.01 to 0.015 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.06 lb ai/A per season or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV. Toxic for bees.
- indoxacarb (Steward EC) at 0.065 to 0.11 lb ai/A. PHI 7 days. REI 12 hr. This is a broad-spectrum insecticide so it should be applied with caution. Make no more than one application per season. Do not apply more than 11.3 fl oz per cutting and more than 45 fl oz per crop season. Do not apply when bees are in the area. Chemigation applications through center pivot is permitted. Labeled for Oregon only.
- lambda-cyhalothrin + chlorantraniliprole (Besiege) at 0.03 to 0.06 lb ai/A. PHI 1 day for forage and 7 days for hay. Do not exceed a total of 31.0 fl oz per year. Do not apply more than 10.0 fl oz/A per cutting and no more than 1 application per cutting. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours. It may be advisable to remove bee shelters during and for 2 to 3 days following application. Avoid direct application to bee shelters.
- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.02-0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- permethrin (Arctic) at 0.1 to 0.2 lb ai/A. PHI 0 days at rates equal to or less than 0.1 lb ai/A, 30 days for rates greater than 0.1 lb ai/A or more. REI 12 hr. Do not exceed 0.2 lb ai/A per cutting. If used during bloom, remove bees from field for 3 days. Do not apply on ground within 25 ft of aquatic habitat, 100 ft if applied by air, or 450 ft if applied from ULV.
- zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between applications. Do not exceed 0.05 lb ai/A per cutting or 0.15 lb ai/A per year. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.

#### **Alfalfa seed—Alfalfa seed chalcid**

*Bruchophagus roddi*

**Pest description and crop damage** The adult is a small, shiny black wasp. Larvae feed within a single seed and eventually destroy it.

To help reduce chalcids after fall harvest, cultivate at least 1 inch deep with a springtooth harrow, to bury infested seed. Follow with irrigation. “Setting back” the hay by cutting or clipping the stand in May reduces populations. Destroy or burn any chaff stacks and screenings by April 1. Remove volunteer and waste-area alfalfa plants.

## Management—chemical control

Insecticides do *not* provide effective control for this pest.

## Alfalfa seed—Aphid

### Includes

Alfalfa aphid (*Macrosiphum creelii*)

Blue alfalfa aphid (*Acyrtosiphon kondoi*)

Pea aphid (*Acyrtosiphon pisum*)

Spotted alfalfa aphid (*Therioaphis maculata*)

**Pest description and crop damage** Pea and alfalfa aphids are the common light-green aphids found on stems in the upper canopy. Aphids feed on plant sap. Large numbers can stress and yellow alfalfa. Blue alfalfa aphid causes less damage than pea aphid. Spotted alfalfa aphid is small and yellow to brown with red bumps on its back. It secretes much honeydew and injects toxins that injure some varieties. It is a hot weather aphid population that typically increases as other aphids decline and is very difficult to control. Spray at ground with at least 25 gal/A water. Damage is most severe on seedling stands.

**Sampling and thresholds** Control the pea aphid in alfalfa grown for seed if populations approach 100 per sweep, the plants are less than 1 foot high, the field is under water stress, and aphid populations show no sign of leveling off. If blue alfalfa aphid has been confirmed in the area and fields have been damaged, treat when numbers reach 30 per sweep. Begin scouting for spotted alfalfa aphid in late June or early July. In established stands, treat when spotted aphids average 20 to 30 per stem, or 50 per sweep, and the population is increasing.

### Management—chemical control

- *Beauveria bassiana* strain GHA (BotaniGard WP) at 0.11 to 0.22 lb ai/A in 100 gal. PHI 0 days. This product is potentially pathogenic to honeybees. Avoid applying to areas where honeybees are actively foraging or around beehives. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Typically, it takes 7 to 10 days after the first spray to see control. Apply at 5- to 10-day intervals for low to normal pest pressure. For high pest pressure, especially aphids, apply at 2- to 5-day intervals. Repeat applications for as long as pest pressure persists. There is no limit on the number of applications or total amount of product that can be applied in one season.
- chlorpyrifos (Chlorpyrifos 4E-AG) at 0.5 to 1 lb ai/A. REI 24 hr. Application rates will vary depending on the nozzle droplet type. Toxic to fish, aquatic invertebrates, small mammals and birds. Highly toxic to bees. Buffer zones must be utilized for aquatic areas when using ground boom (25 ft), chemigation (25 ft), orchard airblast (50 ft), and aerial (150 ft). Do not cut or graze alfalfa within 7 days after application of 0.5 pint/A, 14 days after application of 1 pint, and 21 days after application of > 1 pint/A. Labeled for Idaho.
- dimethoate (400EC, Dimate 4E) at 0.25 to 0.5 lb ai/A. PHI 10 days. REI 48 hr. For suppression only. Do not apply if crop or weeds are in bloom. Effective only on cutting to which chemical is applied. Do not feed or graze livestock. Do not apply more than once per cutting cycle and more than three times per year. Minimum retreatment intervals of 30 days.
- flonicamid (Beleaf) at 0.089 lb ai/A. REI 0 hr. Do not apply more than twice a season. Apply in a minimum of 3 gpa by air or 10 gpa by ground. This is the preferred insecticide during the bloom period due to safety for pollinators.
- gamma-cyhalothrin (Proaxis, Declare) at 0.01 to 0.015 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.06 lb ai/A per season or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.
- lambda-cyhalothrin + chlorantraniliprole (Besiege) at 0.03 to 0.06 lb ai/A. PHI 1 day for forage and 7 days for hay. Do not exceed a total of 31.0 fl oz per year. Do not apply more than 10.0 fl oz per acre per cutting and no more than 1 application per cutting. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours. It may be advisable to remove bee shelters during and for 2-3 days following application. Avoid direct application to bee shelters.
- lambda-cyhalothrin (Serpent 1EC, Warrior II) at 0.02 to 0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl. oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- malathion 8EC at 0.75 to 1 lb ai/A. PHI 0 days. REI 12 hr. Not effective below 65°F. WA only.
- permethrin at 0.05 to 0.2 lb ai/A. PHI 0 days at rates equal to or less than 0.1 lb ai/A, 30 days at rates greater than 0.1 lb ai/A. REI 12 hr. Do not reapply at less than 7-day intervals or exceed 0.2 lb ai/A per cutting. If used during bloom, remove bees from field for 3 days. Do not apply on ground within 25 ft of aquatic habitat, 100 ft if applied by air, or 450 ft if applied from ULV.
- pymetrozine (Fulfill) at 0.086 lb ai/A when aphids first appear. PHI 14 days. Do not exceed 0.086 lb ai/A per cutting or 0.17 lb ai/A per season. Can be toxic to bees. SLN ID000010; WA000016; OR040005.
- sulfoxaflor (Transform WG) at 0.023 to 0.031 lb ai/A. PHI 7 days for harvest. Do not make applications less than 7 days apart. Do not make

more than 2 applications per season. Follow all pollinator safety guidelines for applications made during bloom.

- zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between applications. Do not exceed 0.05 lb ai/A per cutting or 0.15 lb ai/A per year. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.

## Alfalfa seed—Armyworm

### Includes

Bertha armyworm (*Mamestra configurata*)

Western yellowstriped armyworm (*Spodoptera praefica*)

**Pest description and crop damage** Caterpillars are 1.5 to 2 inches long when mature. Color varies within a species and within larvae in a field. They may be velvety black—with two prominent and several fine, bright yellow stripes on the sides—to plain green. Both species may be found on foliage during the day as well as night.

### Management—chemical control

- *Bacillus thuringiensis kurstaki* (Deliver) at 0.25 to 1.5 lb product/A. PHI 0 days. REI 4 hr. Most effective on small caterpillars; use highest recommended rate for fully developed ones. A spreader-sticker may improve performance.
- chlorantraniliprole (Coragen) at 0.045 to 0.098 lb ai/A. PHI 0 days. REI 4 hr. Make no more than 4 applications per acre per crop. Do not make more than one application per cutting. Do not apply more than 15.4 fl oz Coragen or 0.2 lb ai of chlorantraniliprole per acre per crop.
- chlorpyrifos (Chlorpyrifos 4E-AG) at 0.5 to 1 lb ai/A. REI 24 hr. Application rates will vary depending on the nozzle droplet type. Toxic to fish, aquatic invertebrates, small mammals and birds. Highly toxic to bees. Buffer zones must be utilized for aquatic areas when using ground boom (25 ft), chemigation (25 ft), orchard airblast (50 ft), and aerial (150 ft). Do not cut or graze alfalfa within 7 days after application of 0.5 pint/acre, 14 days after application of 1 pint, and 21 days after application of > 1 pint/A. Labeled for Idaho.
- gamma-cyhalothrin (Proaxis, Declare) at 0.01 to 0.015 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.06 lb ai/A per cutting or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.
- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.02 to 0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- lambda-cyhalothrin + chlorantraniliprole (Besiege) at 0.03 to 0.06 lb ai/A. PHI 1 day for forage and 7 days for hay. Do not exceed a total of 31.0 fl oz per year. Do not apply more than 10.0 fl oz per acre per cutting and no more than 1 application per cutting. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours. It may be advisable to remove bee shelters during and for 2 to 3 days following application. Avoid direct application to bee shelters.
- malathion 8EC at 1.0 to 1.25 lb ai/A. PHI 0 days. REI 12 hr. Not effective below 65°F. Not recommended for fields pollinated with leafcutting bees. WA only.
- permethrin at 0.05 to 0.2 lb ai/A. PHI 0 days at rates equal to or less than 0.1 lb ai/A, 30 days at rates greater than 0.1 lb ai/A. REI 12 hr. Do not reapply at less than 7-day intervals or exceed 0.2 lb ai/A per cutting. If used during bloom, remove bees from field for 3 days. Do not apply on ground within 25 ft of aquatic habitat, 100 ft if applied by air, or 450 ft if applied from ULV.
- zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between applications. Do not exceed 0.05 lb ai/A per cutting or 0.15 lb ai/A per year. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.

## Alfalfa seed—Clover root curculio

*Sitona hispidula*

**Pest description and crop damage** Adults are small grayish weevils 0.16 inch long. Larvae feed on fibrous roots and chew cavities in main roots but usually do not cause economic damage to alfalfa.

### Management—chemical control

- gamma-cyhalothrin (Proaxis, Declare) at 0.01 to 0.015 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. For adult control only. Do not exceed 0.06 lb ai/A per cutting or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.
- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.02 to 0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.

## Alfalfa seed—Cutworm

### Most common species:

Army cutworm (*Euxoa auxiliaris*)

Clover cutworm (*Anarta trifolii*)

Redbacked cutworm (*Euxoa ochrogaster*)

Variegated cutworm (*Peridroma saucia*)

**Pest description and crop damage** Cutworm larvae color ranges from dull gray, black, or brown to green; they may be striped or spotted. They often curl up when disturbed. Cutworms usually feed at night. They cut off young plants or feed on the foliage of older plants. If alfalfa fields do not “green up” in the spring, they may have cutworms (particularly redbacked or army cutworms). By day, larvae are in the soil usually at the moisture line or under surface litter. Some growers say that irrigating fields before treating gives better control.

### Management—chemical control

- *Bacillus thuringiensis kurstaki* (Deliver) at 0.25 to 1.5 lb product/A. PHI 0 days. REI 4 hr. Most effective on small caterpillars; use highest recommended rate for fully developed ones. A spreader-sticker may improve performance.
- chlorpyrifos (Chlorpyrifos 4E-AG) at 0.5 to 1 lb ai/A. REI 24 hr. Application rates will vary depending on the nozzle droplet type. Toxic to fish, aquatic invertebrates, small mammals and birds. Highly toxic to bees. Buffer zones must be utilized for aquatic areas when using ground boom (25 ft), chemigation (25 ft), orchard airblast (50 ft), and aerial (150 ft). Do not cut or graze alfalfa within 7 days after application of 0.5 pint/acre, 14 days after application of 1 pint, and 21 days after application of > 1 pint/acre. Labeled for Idaho.
- chlorantraniliprole (Coragen) at 0.045 to 0.065 lb ai/A. REI 4 hr. PHI 0 days. Make no more than 4 applications per acre per crop. Do not make more than one application per cutting. Do not apply more than 15.4 fl oz Coragen or 0.2 lb ai of chlorantraniliprole per acre per crop.
- gamma-cyhalothrin (Proaxis, Declare) at 0.0075 to 0.0125 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.06 lb ai/A per season or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.
- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.015 to 0.025 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- lambda-cyhalothrin + chlorantraniliprole (Besiege) at 0.03 to 0.05 lb ai/A. PHI 1 day for forage and 7 days for hay. Do not exceed a total of 31.0 fl oz per year. Do not apply more than 10.0 fl oz per acre per cutting and no more than 1 application per cutting. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours. It may be advisable to remove bee shelters during and for 2 to 3 days following application. Avoid direct application to bee shelters. permethrin at 0.05 to 0.2 lb ai/A. PHI 0 days at rates equal to or less than 0.1 lb ai/A, 30 days at rates greater than 0.1 lb ai/A. REI 12 hr. Do not reapply at less than 7-day intervals or exceed 0.2 lb ai/A per cutting. If used during bloom, remove bees from field for 3 days. Do not apply on ground within 25 ft of aquatic habitat, 100 ft if applied by air, or 450 ft if applied from ULV.
- zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between applications. Do not exceed 0.05 lb ai/A per cutting or 0.15 lb ai/A per year. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.

## Alfalfa seed—Grasshopper

**Includes** several species, especially *Melanoplus* spp.

**Pest description and crop damage** Both nymphs and adult grasshoppers can cause plant damage. In addition to foliage injury, feeding on blossoms prevents seed formation.

### Management—chemical control

- *Beauveria bassiana* strain GHA (BotaniGard) at 0.11 to 0.44 lb ai/A in 100 gal. PHI 0 days. This product is potentially pathogenic to honeybees. Avoid applying to areas where honeybees are actively foraging or around beehives. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Typically, it takes 7 to 10 days after the first spray to see control. Apply at 5- to 10-day intervals for low to normal pest pressure. For high pest pressure, especially aphids, apply at 2- to 5-day intervals. Repeat applications for as long as pest pressure persists. There is no limit on the number of applications or total amount of product that can be applied in one season.
- chlorpyrifos (Chlorpyrifos 4E-AG) at 0.5 to 1 lb ai/A. REI 24 hr. Application rates will vary depending on the nozzle droplet type. Toxic to fish, aquatic invertebrates, small mammals and birds. Highly toxic to bees. Buffer zones must be utilized for aquatic areas when using ground boom (25 ft), chemigation (25 ft), orchard airblast (50 ft), and aerial (150 ft). Do not cut or graze alfalfa within 7 days after application of 0.5 pint/A, 14 days after application of 1 pint, and 21 days after application of > 1 pint/A. Labeled for Idaho.
- diflubenzuron (Dimilin 2L) at 0.031 lb ai/A. PHI 0 days. REI 12 hr. For nymph control only. Do not feed, graze, or cut hay for forage. Not for human consumption. Do not apply at ground level within 25 ft of aquatic habitat, 150 ft if applied by air. SLN ID-000013; OR-

0800032; WA-000024.

- dimethoate (400EC, Dimate 4E) at 0.25 to 0.5 lb ai/A. PHI 10 days. REI 48 hr. For suppression only. Do not apply if crop or weeds are in bloom. Effective only on cutting to which chemical is applied. Do not feed or graze livestock. Do not apply more than once per cutting cycle and more than three times per year. Minimum retreatment intervals of 30 days.
- gamma-cyhalothrin (Proaxis, Declare) at 0.01 to 0.015 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.06 lb ai/A per season or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.
- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.02 to 0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- lambda-cyhalothrin + chlorantraniliprole (Besiege) at 0.03-0.05 lb ai/A. PHI 1 day for forage and 7 days for hay. Do not exceed a total of 31.0 fl oz per year. Do not apply more than 10.0 fl oz per acre per cutting and no more than 1 application per cutting. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours. It may be advisable to remove bee shelters during and for 2 to 3 days following application. Avoid direct application to bee shelters.
- malathion 8EC at 0.75 to 1.25 lb ai/A. PHI 0 days. REI 12 hr. Not effective below 65°F. Not recommended for fields pollinated with leafcutters. WA only.
- *Nosema locustae* (Nolo Bait)—PHI 0 days. Use as directed.
- zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between applications. Do not exceed 0.05 lb ai/A per cutting or 0.15 lb ai/A per year. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.

## Alfalfa seed—Looper

### Includes

Alfalfa looper (*Autographa californica*)

Cabbage looper (*Trichoplusia ni*)

**Pest description and crop damage** Moths of both species are grayish to light brown; front wings have a single white “teardrop” marking. Mature larvae are about 1 inch long, light green to olive-green, with a pale head. Three pair of abdominal prolegs distinguish loopers from other pest “worms.” They move in a looping fashion. Field populations of larvae in eastern Oregon are usually controlled biologically by native parasitoids or naturally occurring disease.

### Management—chemical control

- *Bacillus thuringiensis kurstaki* (Deliver) at 0.25 to 1.5 lb product/A. PHI 0 days. REI 4 hr. Most effective on small caterpillars; use highest recommended rate for fully developed ones. A spreader-sticker may improve performance.
- *Beauveria bassiana* strain GHA (BotaniGard WP) at 0.11 to 0.44 lb ai/A in 100 gal. 50 to 870 gal/A by ground. PHI 0 days. This product is potentially pathogenic to honeybees. Avoid applying to areas where honeybees are actively foraging or around beehives. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Typically, it takes 7 to 10 days after the first spray to see control. Apply at 5- to 10-day intervals for low to normal pest pressure. For high pest pressure, especially aphids, apply at 2- to 5-day intervals. Repeat applications for as long as pest pressure persists. There is no limit on the number of applications or total amount of product that can be applied in one season.
- chlorpyrifos (Chlorpyrifos 4E-AG) at 0.5 to 1 lb ai/A. REI 24 hr. Application rates will vary depending on the nozzle droplet type. Toxic to fish, aquatic invertebrates, small mammals and birds. Highly toxic to bees. Buffer zones must be utilized for aquatic areas when using ground boom (25 ft), chemigation (25 ft), orchard airblast (50 ft), and aerial (150 ft). Do not cut or graze alfalfa within 7 days after application of 0.5 pint/acre, 14 days after application of 1 pint, and 21 days after application of > 1 pint/acre. Labeled for Idaho.
- chlorantraniliprole (Coragen) at 0.045 to 0.065 lb ai/A. PHI 0 days. REI 4 hr. Make no more than 4 applications per acre per crop. Do not make more than one application per cutting. Do not apply more than 15.4 fl oz Coragen or 0.2 lb ai of chlorantraniliprole per acre per crop.
- gamma-cyhalothrin (Proaxis, Declare) at 0.0075 to 0.0125 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.06 lb ai/A per season or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air or 450 ft if applied from ULV.
- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.02 to 0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- lambda-cyhalothrin + chlorantraniliprole (Besiege) at 0.03 to 0.05 lb ai/A. PHI 1 day for forage and 7 days for hay. Do not exceed a total of 31.0 fl oz per year. Do not apply more than 10.0 fl oz per acre per cutting and no more than 1 application per cutting. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours. It may be advisable to remove bee shelters during and for 2-3 days following application. Avoid direct application to bee shelters.
- permethrin at 0.05 to 0.2 lb ai/A. PHI 0 days at rates equal to or less than 0.1 lb ai/A, 30 days at rates greater than 0.1 lb ai/A. REI 12 hr. Do

not reapply at less than 7-day intervals or exceed 0.2 lb ai/A per cutting. If used during bloom, remove bees from field for 3 days. Do not apply on ground within 25 ft of aquatic habitat, 100 ft if applied by air, or 450 ft if applied from ULV.

- zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between applications. Do not exceed 0.05 lb ai/A per cutting or 0.15 lb ai/A per year. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.

## Alfalfa seed—Lygus bug

**Includes** *Lygus* spp.

**Pest description and crop damage** Adults are 0.18 inch long and have a light yellow V on the back.

Lygus bugs pierce buds and suck sap, injuring both vegetative and reproductive buds. Damage includes blasted buds, blossom drop, and shriveled seed.

### Management—chemical control

**First application**—Apply insecticides on warm days in late May as populations approach three per sweep and appear to be increasing. Use at least 10 gal/A spray in aerial applications.

**Second application**—May need to reapply during bloom if lygus bugs (adults plus nymphs) reach three to four per 180° sweep of a 15-inch net but before most of the nymph field population reach fourth instar.

- *Beauveria bassiana* strain GHA (BotaniGard WP) at 0.11 to 0.44 lb ai/A in 100 gal. PHI 0 days. This product is potentially pathogenic to honeybees. Avoid applying to areas where honeybees are actively foraging or around beehives. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Typically, it takes 7-10 days after the first spray to see control. Apply at 5- to 10-day intervals for low to normal pest pressure. For high pest pressure, especially aphids, apply at 2- to 5-day intervals. Repeat applications for as long as pest pressure persists. There is no limit on the number of applications or total amount of product that can be applied in one season.
- carbaryl (Carbaryl 4L) at 1 to 1.5 lb ai/A. REI 12 hr. On dense growth, apply in 25 to 40 gallons of water per acre with ground equipment to ensure adequate coverage. Extremely toxic to aquatic invertebrates and bees. Notify beekeepers within 1 mile of treatment area. PHI 7 days. Do not exceed 1.5 qts. per acre per cutting. It may cause temporary bleaching of tender alfalfa foliage. Labeled for Idaho.
- dimethoate (400EC, Dimate 4E) at 0.25 to 0.5 lb ai/A. PHI 10 days. REI 48 hr. For suppression only. Do not apply if crop or weeds are in bloom. Effective only on cutting to which chemical is applied. Do not feed or graze livestock. Do not apply more than once per cutting cycle and more than three times per year. Minimum retreatment intervals of 30 days.
- *Isaria fumosorosea* Apopka strain 97 (ANCORA) at 14 to 28 oz ai/100 gal water. Repeat applications at 3- to 10-day intervals over 2 to 3 weeks or as needed to maintain control. Formerly *Paecilomyces fumosoroseus*. More frequent application at low rates (e.g., 14 to 16 oz/100 gal every 3 to 5 days) is more likely to improve results than using higher rates at low frequency (e.g., 28 oz/100 gal every 10 days). ID EPA Reg. No. 70051-19-59807.
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. PHI 1 day for forage and 7 days for hay. REI 24 hr. Minimum 2 gal/A by air or 10 gal/A by ground. Remove bee shelters during and for 2 to 3 days following application. Do not apply more than 0.015 lb ai/A per cutting or more than 0.06 lb ai/A per season.
- flonicamid (Beleaf) at 0.0875 lb ai/A. PHI not given on label. REI 12 hr. This product will also suppress aphids. Do not apply more than 2 applications at this rate closer than 7 days apart per crop year. 30-day plant back restriction. SLN OR-070023; ID 070014; WA-070013b; NV-070007; UT-07-0007; WY-080009.
- formetanate hydrochloride (Carzol SP) at 0.46 to 0.92 lb ai/A. PHI 21 days. REI 4 days. Do not apply during bloom and do not exceed 0.92 lb ai/A per season. Do not use any crop part as feed. Treated fields must be cleared after harvest by burning or disking.
- gamma-cyhalothrin (Proaxis, Declare) at 0.01 to 0.015 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.06 lb ai/A per season or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air or 450 ft if applied from ULV.
- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.02 to 0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- lambda-cyhalothrin + chlorantraniliprole (Besiege) at 0.03-0.06 lb ai/A. PHI 1 day for forage and 7 days for hay. Do not exceed a total of 31.0 fl oz per year. Do not apply more than 10.0 fl oz per acre per cutting and no more than 1 application per cutting. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours. It may be advisable to remove bee shelters during and for 2 to 3 days following application. Avoid direct application to bee shelters.
- naled (Dibrom 8E) 1.0 to 1.5 lb ai/A. PHI not given. REI 48 hr for 1 lb ai/A or less, 72 hr for rates greater than 1 lb ai/A. Allow at least 7 days between applications. Do not apply during bloom nor exceed three applications per season. No part of treated field may be used as feed. SLN ID-010017; OR-990032; WA-990028.
- permethrin at 0.1 to 0.2 lb ai/A. PHI 0 days at rates equal to or less than 0.1 lb ai/A, 30 days at rates greater than 0.1 lb ai/A. REI 12 hr. Do not reapply at less than 7-day intervals or exceed 0.2 lb ai/A per cutting. If used during bloom, remove bees from field for 3 days. Do not apply on ground within 25 ft of aquatic habitat, 100 ft if applied by air, or 450 ft if applied from ULV.
- zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7

days between applications. Do not exceed 0.05 lb ai/A per cutting or 0.15 lb ai/A per year. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.

**Resistance management** Growers are advised strongly to rotate insecticide families (i.e., organophosphates, carbamates, and synthetic pyrethroids) in their lygus control programs to help prevent developing insecticide resistance.

## Alfalfa seed—Pea leaf weevil

*Sitona lineatus*

**Pest description and crop damage** Adults are grayish brown, slender weevils about 0.2 inch long, with a short snout and three parallel lines on the thorax. Adults notch leaf margins. They occasionally defoliate new seedlings, causing serious stand loss.

### Management—chemical control

No products are registered specifically to control this pest. However, most products applied to control alfalfa weevil, cutworms, and armyworms also control this pest.

## Alfalfa seed—Spider mite

### Includes

Pacific spider mite (*Tetranychus pacificus*)

Strawberry spider mite (*T. turkesani*)

Twospotted spider mite (*T. urticae*)

**Pest description and crop damage** Not insects, mites are eight-legged animals less than 0.03 inch long. Mites pierce the epidermis of the leaf's underside and suck juices, causing yellowing, bronzing, and even leaf death. Canopies of silk covering plants accompany large populations of twospotted mite, and serious plant injury and yield loss result. (Chemical controls should be applied much earlier to prevent this damage.)

**Sampling and thresholds** Late-season infestations may not affect seed production seriously (after seed has been set and harvest is less than 2 weeks away). Treatment may be justified when 25% of leaves show damage in early summer, 50% in midsummer. Treatment actually may not be justified with 75 to 100% leaf damage after August 15, as seed usually has been set and fields are drying before harvest.

### Management—chemical control

- abamectin (Agri-Mek, Abba Ultra) at 0.01 to 0.02 lb ai/A via ground application; 0.014 to 0.02 lb ai/A via air application. PHI 12 hr. Do not retreat within 21 days. Do not exceed two applications or 0.04 lb ai/A per season. No part of crop may be used as feed. Do not apply at ground level within 25 ft of aquatic habitat, 150 ft if applied by air.
- azadirachtin + pyrethrins (Azera) at 0.01 to 0.05 lb ai/A. Apply in early morning or late evening hours to avoid harming honey bees. It can be used up to and including the day of harvest. Do not apply more than 1 time per day and more than 10 times per season. Do not reapply within 3 days except under extreme pest pressure. ID EPA Reg. No. 1021-1872.
- *Beauveria bassiana* strain GHA (BotaniGard WP) at 0.11 to 0.44 lb ai/A in 100 gal. PHI 0 days. This product is potentially pathogenic to honeybees. Avoid applying to areas where honeybees are actively foraging or around beehives. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Typically, it takes 7 to 10 days after the first spray to see control. Apply at 5- to 10-day intervals for low to normal pest pressure. For high pest pressure, especially aphids, apply at 2- to 5-day intervals. Repeat applications for as long as pest pressure persists. There is no limit on the number of applications or total amount of product that can be applied in one season.
- bifenazate (Acramite 4 SC, Vigilant 4 SC) at 0.5 to 0.75 lb ai/A. PHI 14 days. REI 12 hr. Make only one application per year. SLN OR-080031; WA 070008; ID-070006; NV-070003; UT-070003; WY-070004.
- bifenthrin (Sniper) at 0.06 to 0.1 lb ai/A. REI 12 hr. Apply in a minimum of 5 gal water per acre by air equipment or in a minimum of 20 gal water by ground equipment. When applying by air, 1 to 2 quarts emulsified oil may be substituted for 1 to 2 quarts water in the finished spray. Do not apply by ground equipment within 500 feet, or by air within 0.25 miles, of water bodies containing fish or aquatic invertebrates, including lakes, reservoirs, rivers, permanent streams, marshes, or natural ponds, estuaries, and commercial fish farm ponds. Maintain a minimum of 21 days between applications. Rotational crops may be planted no sooner than 30 days after last application.
- hexythiazox (Onager) at 0.09 to 0.13 lb ai/A. PHI 28 days. REI 12 hr. One application per season. Do not graze or cut crop for hay or forage. Effective on immature motile mite stages.
- *Isaria fumosorosea* Apopka strain 97 (ANCORA) at 14 to 28 oz ai/100 gal water. Repeat applications at 3- to 10-day intervals over 2 to 3



weeks or as needed to maintain control. Formerly *Paecilomyces fumosoroseus*. More frequent application at low rates (e.g., 14 to 16 oz/100 gal every 3 to 5 days) is more likely to improve results than using higher rates at low frequency (e.g., 28 oz/100 gal every 10 days). ID EPA Reg. No. 70051-19-59807.

- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.02 to 0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- mineral oil (Damoil, 440 Superior Spray Oil) at 0.25 gal (1 quart) of this product per acre in a minimum of 10 to 30 gal water per acre by ground application or minimum of 10 gal per acre by air. REI 12 hr.
- sulfur (Sulfur DF) at 2.4 to 4 lb ai/A. PHI 0 days. REI 24 hr. Repeat every 14 days as necessary.

## Alfalfa seed—Thrips

*Frankliniella* spp.

**Pest description and crop damage** Small, slender, quick-moving insects about 0.1 inch long. The insect's economic impact in alfalfa seed production is unknown.

### Management—chemical control

Most programs using insecticides to control other injurious insects will reduce thrips populations. Chemical control generally is not recommended solely for thrips because populations rebound dramatically to pretreatment levels.

- *Beauveria bassiana* strain GHA (BotaniGard WP) at 0.22 to 0.44 lb ai/A in 100 gal. PHI 0 days. This product is potentially pathogenic to honeybees. Avoid applying to areas where honeybees are actively foraging or around beehives. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Typically, it takes 7 to 10 days after the first spray to see control. Apply at 5- to 10-day intervals for low to normal pest pressure. For high pest pressure, especially aphids, apply at 2- to 5-day intervals. Repeat applications for as long as pest pressure persists. There is no limit on the number of applications or total amount of product that can be applied in one season.

## Alfalfa seed—Webworm

**Includes** beet webworm (*Loxostege sticticalis*)

**Pest description and crop damage** Caterpillars vary from light to dark with three white longitudinal stripes and many black and white tubercles.

### Management—chemical control

- chlorantraniprole (Coragen) at 0.045 to 0.065 lb ai/A. PHI 0 days. REI 4 hr. Make no more than 4 applications per acre per crop. Do not make more than one application per cutting. Do not apply more than 15.4 fl oz Coragen or 0.2 lb ai of chlorantraniliprole per acre per crop.
- chlorpyrifos (Chlorpyrifos 4E-AG) at 0.75 lb ai/A. REI 24 hr. Application rates will vary depending on the nozzle droplet type. Toxic to fish, aquatic invertebrates, small mammals and birds. Highly toxic to bees. Buffer zones must be utilized for aquatic areas when using ground boom (25 ft), chemigation (25 ft), orchard airblast (50 ft), and aerial (150 ft). Do not cut or graze alfalfa within 7 days after application of 0.5 pint/acre, 14 days after application of 1 pint, and 21 days after application of > 1 pint/A. Labeled for Idaho.
- gamma-cyhalothrin (Proaxis, Declare) at 0.0075 to 0.0125 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.06 lb ai/A per season or 0.015 lb ai/A per cutting. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air or 450 ft if applied from ULV.
- indoxacarb (Steward EC) at 0.065 to 0.11 lb ai/A. REI 12 hr. PHI 7 days. Make no more than one application per season. Do not apply when bees are in the area. Chemigation applications through center pivot is permitted.
- lambda-cyhalothrin (Serpent IEC, Warrior II) at 0.02 to 0.03 lb ai/A. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply more than 0.03 lb ai (3.84 fl oz or 0.24 pint of product) per acre per cutting, or more than 0.12 lb ai (15.36 fl oz or 0.96 pint of product) per acre per season. Do not apply on ground within 25 ft of aquatic habitat (groundboom, overhead chemigation, or airblast), 150 ft if applied by air, or 450 ft if applied from ULV. Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application. Avoid application when bees are actively foraging by applying during the early morning or during the evening hours.
- permethrin at 0.05 to 0.2 lb ai/A. PHI 0 days at rates equal to or less than 0.1 lb ai/A, 30 days at rates greater than 0.1 lb ai/A. REI 12 hr. Do not reapply at less than 7-day intervals or exceed 0.2 lb ai/A per cutting. If used during bloom, remove bees from field for 3 days. Do not apply on ground within 25 ft of aquatic habitat, 100 ft if applied by air, or 450 ft if applied from ULV.
- zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between applications. Do not exceed 0.05 lb ai/A per cutting or 0.15 lb ai/A per year. Do not apply on ground within 25 ft of aquatic habitat, 150 ft if applied by air, or 450 ft if applied from ULV.

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# Canola Pests

Tiziana Oppedisano and Dale Whaley

*Latest revision—March 2025*

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In all cases, **follow the instructions on the pesticide label**. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

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**Protect pollinators:** See How to Reduce Bee Poisoning from Pesticides.

**Note:** Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

## Canola—Aphid

Cabbage aphid (*Brevicoryne brassicae*)

**Pest description and crop damage** Cabbage aphids are green, gray with a white, waxy coating. They commonly occur in dense colonies, often covered with waxy droplets. They have piercing-sucking mouthparts and prefer to feed on the newest plant growth. Large colonies can stunt or kill small plants. The cabbage aphid appears much earlier than the turnip aphid.

### Management—chemical control

#### *Foliar Treatment:*

- azadirachtin (Azasol) spray at 6 oz in 50 gal water/A when pests first appear. For optimum results, 2 to 3 applications made at 7 to 10 intervals is recommended. Foliar applications should be made to both sides of leaves. OMRI-listed for organic use.
- *Beauveria bassiana* GHA (Mycotrol ESO, Mycotrol ES, BotaniGard ES and BoteGHA ES) at 0.50 to 1 quart/100 gal of spray volume. Apply at 5- to 10-day intervals. High insect populations may require 2- to 5-day intervals. This product may be applied up to the day of harvest. REI 4 hr. Mycotrol ESO contains live spores of the naturally occurring fungus *Beauveria bassiana* strain GHA. Spores are alive and may be harmed by storage at high temperatures or contact with water for more than 24 hr. OMRI-listed for organic use.
- bifenthrin (Tundra EC, others) at 0.033 to 0.04 lb ai/A or 2.1 to 2.6 fl oz/A. Do not exceed 0.08 lb ai/A or 5.12 ounces formulated product per acre per season. Apply minimum 10 gal/A by ground or 2 gal minimum by air. Do not apply within 35 days of harvest. Do not apply less than 14 days apart.
- bifenthrin; zeta-cypermethrin (Hero Insecticide, others) at 4.0 to 5.5 oz/A. Do not exceed 5.5 oz per application. Do not apply more than 11 oz of product per season. Do not apply within 35 days of harvest. Do not make applications less than 14 days apart. Apply at a minimum of 10 gal water by ground and 2 gal by air.
- chlorantraniliprole, lambda-cyhalothrin (Besiege) at 10.0 fl oz/A. PHI 21 days. Do not exceed a total of 28.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year. Make no more than 4 applications per acre per crop. Only use non-ionic surfactant (NIS).
- flonicamid (Beleaf 50 SG) at 2.8 oz/A or 0.089 lb ai/A. Do not apply more than 2.8 oz per acre per application or 8.4 oz/A per acre per year. Do not apply more than 3 applications per year. Allow a minimum of 7 days between applications.
- gamma-cyhalothrin (Declare) at 0.015 lb ai/A or 1.54 fl oz/A. PHI 7 days. Minimum interval between applications 5 days. Do not apply more than 0.045 lb ai per acre per season. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre.
- lambda-cyhalothrin (LambdaStar Plus) at 0.03 lb ai/A or 1.92 fl oz/A. Do not apply within 7 days of harvest. Do not apply more than 0.09 lb ai (0.36 pint) per acre per year. Apply in a minimum of 10 gal per acre for ground applications or 2 gal per acre for air applications.
- potassium salts of fatty acid (M-Pede) at 4 pints in 3 to 25 gal water per acre as a stand-alone rate. When applying with other insecticides, use 0.75 to 4 pints in 3 to 25 gal water per acre. OMRI-listed for organic use.
- pyrethrins, piperonyl butoxide (Pyronyl Crop Spray) at 0.004 to 0.050 lb ai/A or 1 to 12 fl oz/A. Designed as a pre-harvest spray when other materials cannot be used to PHI restrictions.

- sulfoxaflor (Transform WG) at 0.5 to 0.75 oz/A or 0.016 to 0.023 lb ai/A. Do not make applications less than 14 days apart. Do not exceed more than two applications per season. Do not apply more than a total of 1.5 oz (0.046 lb ai/A) per year. Do not apply this product at any time between 3 days prior to bloom and until after petal fall.
- zeta-cypermethrin (Mustang Maxx) at 4 fl oz/A or 0.025 lb ai/A. PHI 7 days. Do not apply more than 24 oz of product or 0.15 lb of active ingredient per acre per season. Do not make applications less than 7 days apart.

### Seed Treatment:

- imidacloprid (Attendant 600) at 10.24 to 25.6 fl oz per hundredweight of seed. In areas where foliar insects are in high numbers, the higher application rate is recommended. Do not graze within 45 days of planting.
- thiamethoxam, difenoconazole, mefenoxam, fludioxonil and sedaxane (Helix Vibrance) at 23.0 fl oz per 100 lb of seed. Do not graze for feed on treated areas for 45 days after planting.

## Canola—Cabbage and striped flea beetle

*Phyllotreta cruciferae* and *P. striolata*

**Pest description and crop damage** Adults are blue-black jumping beetles. They attack seedlings, damaging apical meristem, reducing stand, and deforming plants. Larvae feed on roots. Adult beetles are the damaging stage. They also can attack developing pods, resulting in shatter loss of seed. Insecticidal seed treatments are necessary at planting time to control flea beetles because of the difficulty in predicting their populations. A foliar application of insecticide may still be required should adult activity continue and reach threshold after the seed treatments are no longer effective.

### Management—chemical control (Foliar Treatment)

- azadirachtin (Azasol) spray at 6 oz in 50 gal water/A when pests first appear. Repeat application 5 to 7 days if required. Do not use with oil. OMRI-listed for organic use.
- *Beauveria bassiana* GHA (Mycotrol ESO) at 0.50 to 2 quarts/100 gal of spray volume. Apply at 5- to 10-day intervals. High insect populations may require 2- to 5-day intervals. This product may be applied up to the day of harvest. REI 4 hr. Mycotrol ESO contains live spores of the naturally occurring fungus *Beauveria bassiana* strain GHA. Spores are alive and may be harmed by storage at high temperatures or contact with water for more than 24 hr. OMRI-listed for organic use.
- bifenthrin (Tundra EC, others) at 0.033 to 0.04 lb ai/A or 2.1 to 2.6 fl oz/A. Do not exceed 0.08 lb ai/A or 5.12 oz formulated product per acre per season. Apply minimum 10 gal/A by ground or 2 gal minimum by air. Do not apply within 35 days of harvest. Do not apply less than 14 days apart.
- bifenthrin; zeta-cypermethrin (Hero Insecticide, others) at 2.6 to 5.5 oz per acre. Do not exceed 5.5 oz per application. Do not apply more than 11 oz of product per season. Do not apply within 35 days of harvest. Do not make applications less than 14 days apart. Apply at a minimum of 10 gal water by ground and 2 gal by air.
- chlorantraniliprole, lambda-cyhalothrin (Besiege) at 5.0 to 10.0 fl oz/A. PHI 21 days. Do not exceed a total of 28.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year. Make no more than 4 applications per acre per crop. Only use non-ionic surfactant (NIS).
- cyantraniliprole (Exirel) at 0.045 to 0.11 lb ai/A or 7 to 17 fluid oz/A. PHI 7 days. REI 12 hr. Minimum application interval between treatments is 7 days. Do not apply a total of more than 0.4 lb ai/A per calendar year.
- gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/A or 0.77 to 1.54 fl oz/A. PHI 7 days. Minimum interval between applications 5 days. Do not apply more than 0.045 lb ai per acre per season. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre.
- deltamethrin (Delta Gold) at 0.009 lb ai/A or 0.8 fl oz/A. Do not apply more than 1.5 fl oz of Delta Gold per acre on canola in one growing season. Allow 7 days between applications. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre and 5 gal of water by ground.
- lambda-cyhalothrin (LambdaStar Plus) at 0.015 to 0.03 lb ai/A or 0.96 to 1.92 fl oz/A. Do not apply within 7 days of harvest. Do not apply more than 0.09 lb ai (0.36 pint) per acre per year. Apply in a minimum of 10 gal per acre for ground applications or 2 gal per acre for air applications.
- pyrethrins, piperonyl butoxide (Pyronyl Crop Spray) at 0.004 to 0.050 lb ai/A or 1 to 12 fl oz./A. Designed as a pre-harvest spray when other materials cannot be used to PHI restrictions.
- zeta-cypermethrin (Mustang Maxx) at 4 fl oz/A or 0.025 lb ai/A. PHI 7 days. Do not apply more than 24 oz of product or 0.15 lb of active ingredient per acre per season. Do not make applications less than 7 days apart.

### Management—chemical control (Seed Treatment)

- clothianidin (Poncho 600, others). Seed treatment. Apply at 3.84 fl oz/100 lb seed for low-to-moderate insect pressure, 5.12 fl oz/100 lb seed for moderate pressure and 10.23 fl oz/100 lb seed under high-to-extreme insect pressure. Do not apply more than 0.2 lb of active ingredient clothianidin per acre per year.
- imidacloprid (Attendant 600) at 10.24 to 25.6 fl oz per hundredweight of seed. In areas where foliar insects are in high numbers, the higher application rate is recommended. Do not graze within 45 days of planting.
- thiamethoxam, difenoconazole, mefenoxam, fludioxonil and sedaxane (Helix Vibrance) Seed treatment. Apply at 23.0 fl oz per 100 lb of seed. Do not graze for feed on treated areas for 45 days after planting.

## Canola—Cabbage seedpod weevil

*Ceutorhynchus assimilis*

**Pest description and crop damage** The adult cabbage seedpod weevil (CSW) is ash-grey to black and approximately 4 mm (1/6 in) in length. Like all weevils, it has a snout that resembles an elephant's trunk. Larvae are white, C-shaped and legless and can be found only within the pod. Overwintering adults enter canola near flowering and may feed on the flower buds, resulting in blasting. Summer-emerging adults can also cause injury by feeding directly on the green pods of later-planted fields. Pod-feeding by the larvae can cause up to 35% yield loss. They also vector *Alternaria* leaf spot on the pods, which is common in Canada and moving into the Palouse region of the PNW. Control measures need to be taken if 20 or more adults are collected in ten 180-degree (side-to-side) sweeps.

### Management—chemical control (Foliar Treatment)

- azadirachtin (Azasol) spray at 6 oz in 50 gal water/A when pests first appear. Repeat application 5 to 7 days if required. Do not use with oil. OMRI-listed for organic use.
- *Beauveria bassiana* GHA (Mycotrol ESO) at 0.50 to 2 quarts/100 gal of spray volume. Apply at 5- to 10-day intervals. High insect populations may require 2- to 5-day intervals. This product may be applied up to the day of harvest. REI 4 hr. Mycotrol ESO contains live spores of the naturally occurring fungus *Beauveria bassiana* strain GHA. Spores are alive and may be harmed by storage at high temperatures or contact with water for more than 24 hr. OMRI-listed for organic use.
- bifenthrin (Tundra EC, others) at 0.033 to 0.04 lb ai/A or 2.1 to 2.6 fl oz/A. Do not exceed 0.08 lb ai/A or 5.12 oz formulated product per acre per season. Apply minimum 10 gal/A by ground or 2 gal minimum by air. Do not apply within 35 days of harvest. Do not apply less than 14 days apart.
- bifenthrin; zeta-cypermethrin (Hero Insecticide, others) at 4.0 to 5.5 oz per acre. Do not exceed 5.5 oz per application. Do not apply more than 11 oz of product per season. Do not apply within 35 days of harvest. Do not make applications less than 14 days apart. Apply at a minimum of 10 gal water by ground and 2 gal by air.
- chlorantraniliprole, lambda-cyhalothrin (Besiege) at 5.0 to 10.0 fl oz/A. PHI 21 days. Do not exceed a total of 28.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year. Make no more than 4 applications per acre per crop. Only use non-ionic surfactant (NIS).
- deltamethrin (Delta Gold) at 0.009 lb ai/A or 0.8 fl oz/A. Do not apply more than 1.5 fl oz of Delta Gold per acre on canola in one growing season. Allow 7 days between applications. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre and 5 gal water by ground.
- gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/A or 0.77 to 1.54 fl oz/A. PHI 7 days. Minimum interval between applications 5 days. Do not apply more than 0.045 lb ai per acre per season. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre.
- lambda-cyhalothrin (LambdaStar Plus) at 0.015 to 0.03 lb ai/A or 0.96 to 1.92 fl oz/A. Do not apply within 7 days of harvest. Do not apply more than 0.09 lb ai (0.36 pint) per acre per year. Apply in a minimum of 10 gal per acre for ground applications or 2 gal per acre for air applications.
- zeta-cypermethrin (Mustang Maxx) at 4 fl. oz/A or 0.025 lb ai/A. PHI 7 days. Do not apply more than 24 oz of product or 0.15 lb of active ingredient per acre per season. Do not make applications less than 7 days apart.

### Management—chemical control (Seed Treatment)

- imidacloprid (Attendant 600) at 10.24 to 25.6 fl oz per hundredweight of seed. In areas where foliar insects are in high numbers, the higher application rate is recommended. Do not graze within 45 days of planting.

## Canola—Diamondback moth

*Plutella xylostella*

**Pest description and crop damage** Adult diamondback moths are small gray or brown moths. Males have three diamond-shaped markings on the back of the forewing when the wings are folded together. Females lay eggs singly or in small clusters of two to eight. Newly hatched larvae are light green and turn darker green with maturation. Plant injury is caused entirely by larvae that show two distinct feeding patterns depending on their age. Young larvae are leaf miners, while older larvae feed externally and cause leaf defoliation, aborted flowers, and damaged seed pods and stems. The economic threshold at early flowering stage is 10 to 15 larvae per square foot (or one to two larvae per plant), and at pod stage increases to 20 to 30 larvae per square foot (or two to three larvae per plant). The best pest management practices to prevent losses from diamondback moth on canola include early monitoring of adults and larvae, and limiting use of insecticides to only those fields that reach economic thresholds.

### Management—Chemical control

- azadirachtin (Azasol, AzaGuard and others) spray at 0.018 to 0.035 lb if ai/A in 50 gal water/A when pests first appear. Repeat application 5 to 7 days if required. Do not use with oil. OMRI-listed for organic use.
- *Bacillus thuringiensis* ssp. *kurstaki* strain SA-11 (JavelinWG) at 0.12 to 1.5 lb ai/A. PHI 0 days. REI 4 hr. Acts slowly; may need multiple applications. Add an appropriate spreader-sticker to enhance control. Most effective on small larvae. Some formulations are OMRI-listed

for organic use.

- *Beauveria bassiana* GHA (Mycotrol ESO, Mycotrol ES, BotaniGard ES and BoteGHA ES) at 0.50 to 1 quart/100 gal of spray volume. Apply at 5- to 10-day intervals. High insect populations may require 2- to 5-day intervals. This product may be applied up to the day of harvest. REI 4 hr. Mycotrol ESO contains live spores of the naturally occurring fungus *Beauveria bassiana* strain GHA. Spores are alive and may be harmed by storage at high temperatures or contact with water for more than 24 hr. OMRI-listed for organic use.
- bifenthrin (Batallion 10 WSP, Bifenture 10DF, Bifender FC, Brigade WSB and others) at 0.033 to 0.04 lb ai/A. Apply in a minimum of 2 gal finished spray per acre by air or a minimum of 10 gal per acre with ground equipment. Do not apply more than 0.08 lb active ingredient (12.8 oz formulated) per acre per season. Do not make applications less than 14 days apart. Do not apply within 35 days of harvest.
- bifenthrin; zeta-cypermethrin (Hero EW) at 0.04 to 0.053 lb ai/A. Do not exceed 0.053 lb ai/A per application. Do not apply more than 0.265 lb ai/A of product per season. Do not apply within 35 days of harvest. Do not make applications less than 14 days apart. Apply at a minimum of 10 gal water by ground and 2 gal by air.
- *Burkholderia* spp. strain a396 (Venerate XC) at 1 to 4 quarts/A product. PHI 0 days. REI 4 hr. OMRI-listed for organic use.
- chlorantraniliprole [Coragen (FMC), Vantacore, Prevathon] at 0.045 to 0.098 lb ai/A. REI 4 hr. PHI 1 day. Do not exceed 0.2 lb ai of chlorantraniliprole-containing products per acre per year. Make no more than 4 applications per acre per year (Group 28). Performance is improved with the addition of a Methylated Seed Oil (MSO) adjuvant at 1 gal per 100 gal of spray volume (1% v/v). Do not make more than two sequential applications of Group 28 before rotating to another registered insecticide with different mode-of-action.
- chlorantraniliprole, lambda-cyhalothrin (Besiege) at 5.0 to 10.0 fl oz/A or 0.049 to 0.098 lb ai/A. PHI 21 days. Do not exceed a total of 28.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year. Make no more than 4 applications per acre per crop. Only use non-ionic surfactant (NIS) **Washington only**.
- *Chromobacterium subsugae* (Grandevo) at 1 to 3 lb/A. PHI 0 days. REI 4 hr. OMRI-listed for organic use.
- cyantraniliprole (Exirel) at 0.045 to 0.088 lb ai/A or 7 to 13.5 fluid oz/A. PHI 7 days. REI 12 hr. Minimum application interval between treatments is 7 days. Do not apply a total of more than 0.4 lb ai/A per calendar year.
- deltamethrin (Delta Gold) at 0.009 lb ai/A or 0.8 fl oz/A. Do not apply more than 1.5 fl oz of Delta Gold per acre on canola in one growing season. Allow 7 days between applications. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre and 5 gal water by ground.
- gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/A or 0.77 to 1.54 fl oz/A. PHI 7 days. Minimum interval between applications is 5 days. Do not apply more than 0.045 lb ai per acre per season. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre.
  - lambda-cyhalothrin (LambdaStar Plus) at 0.015 to 0.03 lb ai/A or 0.96 to 1.92 fl oz/A. Do not apply within 7 days of harvest. Do not apply more than 0.09 lb ai (0.36 pint) per acre per year. Apply in a minimum of 10 gal per acre for ground applications or 2 gal per acre for air applications.
  - zeta-cypermethrin (Mustang Maxx) at 4 fl. oz/A or 0.025 lb ai/A. PHI 7 days. Do not apply more than 24 oz of product or 0.15 lb of active ingredient per acre per season. Do not make applications less than 7 days apart.

## Canola—Grasshopper

*Amphitornus*, *Melanopus*, and *Xanthippus* spp.

**Pest description and crop damage** Nymph and adult grasshoppers can be a problem at seedling emergence. During years of high populations, grasshoppers migrate into emerging stands and devour the cotyledons. Damage is usually limited to the field margins, but total stand loss there can occur. An economic threshold of 7 to 12 grasshoppers per square meter is recommended.

### Management—Chemical control (Foliar Treatment)

- *Beauveria bassiana* GHA (Mycotrol ESO) at 0.50 to 2 quarts/100 gal of spray volume. Apply at 5- to 10-day intervals. High insect populations may require 2- to 5-day intervals. This product may be applied up to the day of harvest. REI 4 hr. Mycotrol ESO contains live spores of the naturally occurring fungus *Beauveria bassiana* strain GHA. Spores are alive and may be harmed by storage at high temperatures or contact with water for more than 24 hr. OMRI-listed for organic use.
- bifenthrin (Tundra EC, others) at 0.033 to 0.04 lb ai/A or 2.1 to 2.6 fl oz/A. Do not exceed 0.08 lb. ai/A or 5.12 ounces formulated product per acre per season. Apply minimum 10 gal/A by ground or 2 gal minimum by air. Do not apply within 35 days of harvest. Do not apply less than 14 days apart.
- bifenthrin; zeta-cypermethrin (Hero Insecticide, others) at 4.0 to 5.5 oz per acre. Do not exceed 5.5 oz per application. Do not apply more than 11 oz of product per season. Do not apply within 35 days of harvest. Do not make applications less than 14 days apart. Apply at a minimum of 10 gal water by ground and 2 gal by air.
- chlorantraniliprole (Coragen (FMC), Vantacore, Prevathon) at 0.026 to 0.065 lb ai/A. REI 4 hr. PHI 1 day. Do not exceed 0.2 lb ai of chlorantraniliprole-containing products per acre per year. Make no more than 4 applications per acre per year. (Group 28). Apply foliarly when grasshopper populations reach local established thresholds to prevent crop damage. Performance is improved with the addition of a Methylated Seed Oil (MSO) adjuvant at 1 gal per 100 gal of spray volume (1% v/v). Do not make more than two sequential applications of Group 28 before rotating to another registered insecticide with different mode-of-action.
- chlorantraniliprole, lambda-cyhalothrin (Besiege) at 5.0 to 10.0 fl oz/A or 0.049 to 0.098 lb ai/A. PHI 21 days. Do not exceed a total of 28.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year. Make no more than 4 applications per acre per crop. Only use non-ionic surfactant (NIS).
- deltamethrin (Delta Gold) at 0.009 lb ai/A or 0.8 fl oz/A. Do not apply more than 1.5 fl oz of Delta Gold per acre on canola in one

growing season. Allow 7 days between applications. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre and 5 gal water by ground.

- gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/A or 0.77 to 1.54 fl oz/A. PHI 7 days. Minimum interval between applications 5 days. Do not apply more than 0.045 lb ai per acre per season. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre.
- lambda-cyhalothrin (LambdaStar Plus) at 0.015 to 0.03 lb ai/A or 0.96 to 1.92 fl oz/A. Do not apply within 7 days of harvest. Do not apply more than 0.09 lb ai (0.36 pint) per acre per year. Apply in a minimum of 10 gal per acre for ground applications or 2 gal per acre for air applications.
- pyrethrins, piperonyl butoxide (Pyronyl Crop Spray) at 0.004 to 0.050 lb ai/A or 1 to 12 fl oz/A. Designed as a pre-harvest spray when other materials cannot be used to PHI restrictions.
- zeta-cypermethrin (Mustang Maxx) at 4 fl. oz/A or 0.025 lb ai/A. PHI 7 days. Do not apply more than 24 oz of product or 0.15 lb of active ingredient per acre per season. Do not make applications less than 7 days apart

#### Management—chemical control (Seed Treatment)

- clothianidin (Poncho 600, others). Seed treatment. Apply at 3.84 fl oz/100 lb seed for low-to-moderate insect pressure, 5.12 fl oz/100 lb seed for moderate pressure and 10.23 fl oz/100 lb seed under high-to-extreme insect pressure. Do not apply more than 0.2 lb of active ingredient clothianidin per acre per year.

## Canola—Tarnished Plant Bug

*Lygus lineolaris*

**Pest description and crop damage** Tarnished plant bug (TPB) adults are approximately 5 mm (1/5 inches) in length, mottled, yellowish-to-reddish-brown in color and have a small triangle shape on their back. Feeding on flowers can cause flower abortion. Feeding during pod stages results in scarring, malformation and dimpling or pitting of the pods. Sap may ooze from the feeding sites on the pods, which increases the risk of pod disease development. TPB can also drill directly into the seed, causing pick, reducing seed quality. Yield losses of up to 20% have been observed.

#### Management—chemical control (Foliar Treatment)

- azadirachtin (Azasol) at 6 oz in 50 gal water/A. Spray early when nymphs are young. OMRI-listed for organic use.
- *Beauveria bassiana* GHA (Mycotrol ESO) at 0.50 to 2 quarts/100 gal of spray volume. Apply at 5- to 10-day intervals. High insect populations may require 2- to 5-day intervals. This product may be applied up to the day of harvest. REI 4 hr. Mycotrol ESO contains live spores of the naturally occurring fungus *Beauveria bassiana* strain GHA. Spores are alive and may be harmed by storage at high temperatures or contact with water for more than 24 hr. OMRI-listed for organic use.
- bifenthrin (Tundra EC, others) at 0.033 to 0.04 lb ai/A or 2.1 to 2.6 fl oz/A. Do not exceed 0.08 lb ai/A or 5.12 oz formulated product per acre per season. Apply minimum 10 gal/A by ground or 2 gal minimum by air. Do not apply within 35 days of harvest. Do not apply less than 14 days apart.
- chlorantraniliprole, lambda-cyhalothrin (Besiege) at 5.0 to 10.0 fl oz/A. PHI 21 days. Do not exceed a total of 28.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year. Make no more than 4 applications per acre per crop. Only use non-ionic surfactant (NIS).
- deltamethrin (Delta Gold) at 0.009 lb ai/A or 0.8 fl oz/A. Do not apply more than 1.5 fl oz of Delta Gold per acre on canola in one growing season. Allow 7 days between applications. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre and 5 gal water by ground.
- flonicamid (Beleaf 50 SG) at 2.8 oz/A or 0.089 lb ai/A. Do not apply more than 2.8 oz per acre per application or 8.4 oz per acre per year. Do not apply more than 3 applications per year. Allow a minimum of 7 days between applications.
- gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/A or 0.77 to 1.54 fl oz/A. PHI 7 days. Minimum interval between applications 5 days. Do not apply more than 0.045 lb ai per acre per season. Do not apply within 7 days of harvest. When applying by air, apply a minimum of 2 gal water per acre.
- lambda-cyhalothrin (LambdaStar Plus) at 0.015 to 0.03 lb ai/A or 0.96 to 1.92 fl oz/A. Do not apply within 7 days of harvest. Do not apply more than 0.09 lb ai (0.36 pint) per acre per year. Apply in a minimum of 10 gal per acre for ground applications or 2 gal per acre for air applications.
- potassium salts of fatty acid (M-Pede) at 4 pints in 3 to 25 gal water per acre as a stand-alone rate. When applying with other insecticides, use 0.75 to 4 pints in 3 to 25 gal water per acre. OMRI-listed for organic use.
- pyrethrins, piperonyl butoxide (Pyronyl Crop Spray) at 0.004 to 0.050 lb ai/A or 1 to 12 fl oz/A. Designed as a pre-harvest spray when other materials cannot be used due to PHI restrictions.
- zeta-cypermethrin (Mustang Maxx) at 4 fl oz/A or 0.025 lb ai/A. PHI 7 days. Do not apply more than 24 oz of product or 0.15 lb of active ingredient per acre per season. Do not make applications less than 7 days apart

#### Management—chemical control (Seed Treatment)

- imidacloprid (Attendant 600) at 10.24 to 25.6 fl oz per hundredweight of seed. In areas where foliar insects are in high numbers, the higher application rate is recommended. Do not graze within 45 days of planting.

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# Pests of Clover Grown for Seed

Hana You, Alison Willette, and Nicole P. Anderson

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In all cases, **follow the instructions on the pesticide label**. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

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**Important notice** Several pesticides with 24c Special Local Need (SLN) registrations for use on seed crops lack legal tolerances established for pesticide residues that may be on the seed, screenings, or hay at harvest. Therefore, certain seed growers associations in Washington, Oregon, and Idaho have declared, through their respective state departments of agriculture, that the crop produced for seed in those states is a *nonfood crop*. This declaration means that none of the seed, screenings, hay, or sprouts produced from harvested seed will be available for human or animal consumption when these pesticides have been applied. The grower must notify the seed processing plant in writing of *any* seed treated with these pesticides. Processed seed must be labeled: “This seed was produced using one or more products for which the United States Environmental Protection Agency has not established pesticide residue tolerances. This seed, in whole, as sprouts, or in any form, may violate requirements of the Federal Food and Drug Administration, the Oregon Department of Agriculture and other regulatory agencies.”

**Protect pollinators:** See How to Reduce Bee Poisoning from Pesticides.

**Note:** Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

## Clover seed—Aphid

### Includes

Clover aphid (*Nearctaphis bakeri*)

Pea aphid (*Acyrtosiphon pisum*)

**Pest description and crop damage** Small aphids, light green or pinkish green, which secrete a sticky honeydew that cakes the seed head. They attack red clover, alsike clover, and white clover. The clover aphid, *N. bakeri*, significantly reduces red clover seed yields in western Oregon if not controlled early in the season. A hay or silage crop is usually taken in mid-May to early June; begin inspecting the regrowth about 2 to 3 weeks later. Look between the leaf stipules and the stem, which is where this aphid initially begins to accumulate. When at least half the stems show signs of aphids—this is usually well before bloom—apply insecticide. Bloom and postbloom treatments do little to prevent honeydew problems or increase seed yield.

### Management—chemical control

- bifenthrin (Batallion 2EC, Brigade 2EC, Discipline 2EC) at 0.06 to 0.1 lb ai/A. REI 12 hr. Do not apply to blooming crop or allow to drift while bees actively visit bloom. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. Do not graze clover after applying. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: Batallion 2EC, OR-200006 (expires 12/31/2025), Brigade 2EC, OR-070013 (expires 12/31/28), ID-070009 (expires 12/31/26); Discipline 2EC, OR-040039 (expires 12/31/2025) and ID-040009 (expires 12/31/24). Oregon and Idaho only. Group 3A
- flonicamid (Beleaf 50 SG) at 0.088 lb ai/A. REI 12 hr. PHI 60 days. Apply before aphid populations begin to build and before crop damage is evident. Do not apply more than two applications per year. Do not apply more than 0.18 lb ai/A per crop year. Do not allow foraging of fields or harvesting for hay within 60 days of the last application. Group 29.

## Clover seed—Clover leaf weevil

*Hypera punctata*

**Pest description and crop damage** This is the largest weevil found in legume fields. The full-grown larva is about 0.5 inch long and has a brown head. The body of the larva is green or yellowish-green shading to pink at the tip of the abdomen, with a white or pinkish line down the center of the back. Larvae feed on leaves.

### Management—chemical control

- bifenthrin (Batallion 2EC, Brigade 2EC, Discipline 2EC) at 0.06 to 0.1 lb ai/A. REI 12 hr. Do not apply to blooming crop or allow to drift while bees are actively visiting bloom. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. Do not graze clover after applying. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: Batallion 2EC, OR-200006 (expires 12/31/2025), Brigade 2EC, OR-070013 (expires 12/31/28), ID-070009 (expires 12/31/26); Discipline 2EC, OR-040039 (expires 12/31/2025) ID-040009 (12/31/25). Oregon and Idaho only.
- malathion (8 Aquamul, Gowan Malathion 8 Flowable, Fyfanon 57% EC) at 1 to 1.25 lb ai/A. REI 12 hr. Min. App. Interval 14 days. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area. Do not apply more than a total of 2.5 lbs of malathion per acre per calendar year (for Gowan Malathion 8 Flowable, the maximum application rate is 1.25 pints product per acre).

## Clover seed—Clover root borer

*Hylastinus obscurus*

**Pest description and crop damage** Adult beetles are about 0.1 inch long and dark brown. Larvae are creamy white and burrow within the roots of red clover. This insect is primarily a pest of red clover and is the major limiting factor in red clover production west of the Cascades. Because of reduced crop vigor, usually no more than two seed crops are economically feasible.

### Management—cultural control

Plowing out and rotation with a cereal crop destroys root borers in the field. However, reinvasion is rapid when red clover is replanted.

### Management—chemical control

No labeled insecticides are effective.

## Clover seed—Clover root curculio

*Sitona hispidula*

**Pest description and crop damage** Adults are small grayish weevils about 0.17 inch long. Larvae feed on fibrous roots and chew cavities in main roots.

### Management—cultural control

Plowing out and rotation with a cereal crop helps control this pest.

### Management—chemical control

No labeled insecticides are effective.

## Clover seed—Clover seed chalcid

*Bruchophagus platypterus*

**Pest description and crop damage** Adult is small, shiny black, and wasp-like. Larvae feed within the seed and destroy it.

### Management—cultural control

Remove chaff piles and screenings and destroy or bury before the first of April. Cutting and removing hay the first week in June greatly reduces seed chalcid populations. Remove volunteer and waste-area red clover plants, which act as a reservoir for the pest.

East of the Cascades post-harvest harrowing followed by irrigation has been used to control infested seeds left in field at harvest. Fall disking that buries seed at least 1 inch reduces adult emergence. Rotation with a non-host crop (anything that is not a legume seed crop) helps control this pest.

### Management—chemical control

No labeled insecticides are effective.



## Clover seed—Clover seed midge

*Dasineura leguminicola*

**Pest description and crop damage** This is a small, mosquito-like insect. Salmon-pink maggots prevent seed formation and make blossoms look lopsided. This insect is primarily a pest of red clover in western Oregon and Washington. It is not a problem in Idaho.

### Management—cultural control

Cut the hay crop the first week in June to destroy maggots in blossoms and prevent an infestation in the seed crop. It is important to remove hay from the field as soon as possible after cutting.

### Management—chemical control

No labeled insecticides are effective.

## Clover seed—Clover seed weevil

*Tychius picirostris*

**Pest description and crop damage** A small gray weevil about 0.1 inch long. Larvae damage two to four seeds in each pod. Adults feed during bloom, and larvae feed within and destroy seeds. This pest can seriously infest white clover and needs routine control in western Oregon. They attack alsike, white, arrowleaf, and ladino clover but not red clover. Second-generation weevils neither harm seeds nor lay eggs. Although they will be in fields near harvest, they do require control before harvest. Apply insecticide after pollination when first blooms turn brown. Ensure bees have moved from field or the beekeeper has been notified. Use a sweep net to sample the weevil adults. Treat when an average of two or more weevils are found per straight-line sweep (90°).

### Management—chemical control

Although bifenthrin (Battalion 2EC, Brigade 2EC, and Discipline) are labeled for treatment of clover seed weevil in clover grown for seed, this chemistry has been found no longer effective for control. Clover seed weevil is highly resistant to bifenthrin in the state for Oregon and continued use of this chemistry will likely increase clover seed weevil populations as predatory populations may be impacted.

- chlorantraniliprole (Vantacor) at 0.047 to 0.098 lb ai/A. Only use one application per cutting. maximum 4 applications per year. PHI 0 days. REI 4 hr.
- malathion (Malathion 5EC) at 0.93 lb ai/A. Minimum 14-day retreatment interval. Maximum 1.25 lb ai/A per cutting. PHI 0 days. Group 1B.

## Clover seed—Crane fly

### Includes

Common crane fly (*Tipula oleracea*)

European crane fly (*Tipula paludosa*)

**Pest description and crop damage** This has been a pest west of the Cascades. They have been problems in heavy, wet soils of OR/WA coastal pastures and in the Willamette Valley. New seedlings and weak stands are particularly at risk from large infestations of larvae. Heavy larval feeding has been associated with stand loss and poor crop vigor.

Adults are large, grayish brown, and resemble large mosquitoes. Adults do not feed other than possibly water and nectar. Eggs are black, narrow, rigid, and about 0.03 inch long and laid in the spring and fall where both tipula pests occur. The larvae, called leather-jackets, are large (1.5 inches at maturity) gray, cylindrical and without legs or very well-defined head. The larvae of these two pest species feed on many plant species, including grasses, clovers, mint crops, and root vegetables.

**Biology and life history** *T. paludosa* adults emerge in late August and September. *T. oleracea* may have two generations per year with flight activity in the spring and again in the fall, coincident with *T. paludosa*. Larvae damage crops from October through July.

### Management—chemical control

## Clover seed—Cutworm and armyworm

Several species

**Pest description and crop damage** True (common) armyworm (*Mythimna unipuncta*, formerly *Pseudoletia unipuncta*) and variegated cutworm (*Peridroma saucia*) are the most common species in western Oregon. They present from early bloom through seed set. Moths in the family Noctuidae

have gray or brown forewings with slate or buff-color markings. Hind wings are silvery-gray or beige. Average wingspan is 1.4 to 1.6 inches. Mature larvae are about 1.5 to 2 inches long, tan to brown, with a faint white or red midline stripe on the top of the body. These are bordered below by a white stripe on each side. A prominent black stripe is along each side bordered below by an orange-brown stripe. Larvae have an inverted white Y on the front of the head. Pupae are brownish-red and found in the top soil layer, commonly near the crowns of host plants. Winter cutworms (*Noctua pronuba*) have been recently detected in clover seed fields in western Oregon but significant damage has not been recorded.

**Scouting and thresholds** Look for armyworm and cutworm larvae in and around crowns, where birds (swallows, crows) are feeding. Dig around in crop residue and at the base of plants. Armyworms and cutworms typically feed at night. Also look for frass (excrement) that resembles tiny grass pellets. Treatment in established clover seed crops is suggested when 4 larvae per sq ft are observed. The threshold in seedling stands is 2 larvae per sq ft.

**Biology and life history** Armyworm and cutworm adults are believed to migrate into Oregon from California in summer. Eggs are laid in grasses and other spaces with strong plant density. They hatch in a week, and larvae feed through the fall. Larvae aggregate in small areas, where defoliation may be complete. Most armyworm damage is seen during late summer and fall in western Oregon. Outbreaks are infrequent and are associated with unusually high spring rainfall in California which favors survival of the first generation. Resultant moths migrate north following green plant

#### **Management- biological control**

Populations of noctuid moths are generally kept under control by a number of natural enemies that include parasitic wasps (*Trichogramma* species and braconid wasps), parasitic flies in the family Tachinidae, nematodes and several bacterial and viral pathogens. Natural predators will feed on cutworms readily, including predaceous ground beetles, birds and rodents. However, the impact of these natural predators on cutworm populations in Pacific Northwest production systems is unclear.

#### **Management—chemical control**

- *Bacillus thuringiensis* (*Bt*)—Use according to label directions. For armyworms, effective only on first and second instar larvae. Some formulations are OMRI-listed for organic use.
- chlorantraniliprole (Vantacor) at 0.047 to 0.098 lb ai/A. PHI 0 days. REI 4 hr. Do not make more than 4 applications per calendar year. Do not apply more than 0.2 lb ai/A per calendar year. Can be applied in-furrow at planting or as an overhead foliar spray. Is most effective through ingestion of treated plant material. Apply at egg lay, egg hatch or when larvae are newly hatched. Armyworms only.
- malathion (Malathion 5EC) at 1 to 1.25 lb ai/A. Minimum 14-day retreatment interval. Maximum 1.25 lb ai/A per cutting. PHI 0 days. Group 1B

**Note:** When bifenthrin is used to control other pests, armyworms and cutworms are effectively controlled as well.

## **Clover seed—Garden symphylan**

*Scutigera maculata*

**Pest description and crop damage** Small, white, centipede-like animals in soil. They prune rootlets and reduce stands and plant vigor.

#### **Management—chemical control**

- There are currently no insecticides registered for use on garden symphylans in clover seed crops.

## **Clover seed—Grasshopper**

#### **Includes**

*Melanoplus* spp. (dominant)

**Pest description and crop damage** Both young and adult grasshoppers do damage. In addition to foliage injury, feeding on blossoms prevents seed formation.

#### **Management—chemical control**

- chlorantraniliprole (Vantacor) at 0.098 to 0.47 lb ai/A. Apply to foliar when grasshopper populations reach local established thresholds to prevent crop damage. Correct timing of spray applications to nymphal stages and thorough coverage is critical to achieve control. Performance is improved with the addition of a methylated seed oil (MSO) adjuvant at 1 gal per 100 gal of spray volume (1% v/v) when eggs have hatched and the majority of the grasshopper population is 2nd - 3rd instar nymphs. Once grasshoppers contact and/or ingest VANTACOR® insect control there will be rapid feeding cessation; insect mortality may not occur until a week later or longer. Do not make more than two sequential applications of VANTACOR® insect control before rotating to another registered insecticide having a different mode-of-action. PHI 0 days, REI 4 hr. Group 28
- malathion at 1 to 1.25 lb ai/A. PHI 0 days. REI 12 hr. Apply to plants in bloom only in evening or early morning when bees are not working in the fields or are not hanging on the outside of the hives.

## Clover seed—Ladino clover seed midge

*Dasineura gentneri*

**Pest description and crop damage** Small, mosquito-like insects that attack white and alsike clovers. Salmon-pink maggots develop in the seed pod and prevent formation of alsike and ladino seed.

### Management—cultural control

Clipping blossoms when the first brood of midges emerges appears to help prevent damage to later blossoms.

### Management—chemical control

No labeled insecticides are effective.

## Clover seed—Lesser clover leaf weevil

*Hypera nigrirostris*

**Pest description and crop damage** Green or brown weevils about 1 inch long. Larvae feed under basal leaf sheath, tunnel in stem, and feed on florets in developing flowers. Mainly a pest of red and alsike clover.

### Management—chemical control

- bifenthrin (Batallion 2EC, Brigade 2EC, Discipline 2EC) at 0.06 to 0.1 lb ai/A. REI 12 hr. Do not apply to blooming crop or allow to drift while bees are actively visiting bloom. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. Do not graze clover after applying. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: Batallion 2EC, OR-200006 (expires 12/31/2025), Brigade 2EC, OR-070013 (expires 12/31/2028), ID-070009 (expires 12/31/26); Discipline 2EC, OR-040039 (expires 12/31/2025) ID-040009 (12/31/25). Oregon and Idaho only.

## Clover seed—Looper

**Includes** alfalfa looper (*Autographa californica*)

**Pest description and crop damage** Adult moth is grayish to light brown. Mature larvae are about 1 inch long, light green to olive-green, with a pale head. They move in a looping fashion.

### Management—chemical control

- Bacillus thuringiensis* (Bt)—Use as label directs. Some formulations are OMRI-listed for organic use.

**Note:** When bifenthrin is used to control other pests, armyworms and cutworms are effectively controlled as well.

## Clover seed—Lygus bug

*Lygus* spp.

**Pest description and crop damage** Adults are 0.2 inch long with a light yellow 'V' on the back. Lygus bugs pierce and damage meristematic tissue causing blasted buds, blossom drop, and shriveled seed. Lygus bugs reduce yields of alsike and ladino clover seed but are not considered a pest of red clover. Clover seed weevil treatments usually control lygus on white clover.

### Management—chemical control

- bifenthrin (Batallion 2EC, Brigade 2EC, Discipline 2EC) at 0.06 to 0.1 lb ai/A. REI 12 hr. Do not apply to blooming crop or allow to drift while bees are actively visiting bloom. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. Do not graze clover after applying. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: Batallion 2EC, OR-200006 (expires 12/31/2025), Brigade 2EC, OR-070013 (expires 12/31/2028), ID-070009 (expires 12/31/26); Discipline 2EC, OR-040039 (expires 12/31/2025), ID-040009 (12/31/25). Oregon and Idaho only.
- flonicamid (Beleaf 50 SG) at 0.088 lb ai/A. REI 12 hr. PHI 60 days. Apply before aphid populations begin to build and before crop damage is evident. Do not apply more than two applications per year. Do not apply more than 0.18 lb ai/A per crop year. Do not allow foraging of fields or harvesting for hay within 60 days of the last application. Group 29.

## Clover seed—Meadow spittlebug

*Philaenus spumarius*

**Pest description and crop damage** Nymphs stunt plant growth and are recognized easily by spittle mass. An average of one nymph or more per stem may damage alfalfa, clover, and many other crops.

### Management—chemical control

- malathion at 1 to 1.25 lb ai/A. Apply to plants in bloom only in evening or early morning, when bees are not working in the fields or hanging on the outside of the hives.
- zeta-cypermethrin (Mustang MAX, Mustang insecticide) at 0.014 to 0.05 lb ai/A. PHI 3 days for cutting or grazing. 7 days hay, seed. REI 12 hr. Retreatment interval 7 days. Do not exceed 0.025 lb ai/A per cutting nor 0.075 lb ai/A per season.

## Clover seed—Nitidulid beetle

*Meligethes nigrescens*

**Pest description and crop damage** Shiny black beetles about 0.09 inch long. Adults seeking pollen damage flowers and prevent seed set. Browned flowers are unattractive to pollinating insects. This insect is primarily a pest of red or white clovers blooming in July. Beetles usually are active in clover fields mid-July through August.

### Management—chemical control

Prebloom bifenthrin spray for clover aphid also helps suppress nitidulids.

## Clover seed—Omnivorous leaftier

*Cnephasia longana*

**Pest description and crop damage** Yellowish brown larvae with brown heads and light longitudinal stripes on each side of the back. They web terminal leaves and feed on new growth. Damage is in May and June. There is one generation per year. They seldom are a problem except in the Willamette Valley.

### Management—chemical control

- *Bacillus thuringiensis* (Bt)—Use as label directs. Some formulations are OMRI-listed for organic production.

## Clover seed—Pea leaf weevil

*Sitona lineata*

**Pest description and crop damage** Adults are small, grayish brown, faintly striped weevils about 0.17 inch long. They appear in large numbers in spring and sometimes late summer. Adult feeding may kill seedling plants and seriously defoliate older stands.

### Management—chemical control

- bifenthrin (Brigade 2EC, Discipline 2EC) at 0.06 to 0.1 lb ai/A. REI 12 hr. Do not apply to blooming crop or allow to drift while bees are actively visiting bloom. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. Do not graze clover after applying. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: Battalion 2EC, OR-200006 (expires 12/31/2025), Brigade 2EC, OR-070013 (expires 12/31/2028), WA-070015 (expires 12/31/2025); Discipline 2EC, OR-040039 (expires 12/31/2025) ID-040009 (12/31/25). Oregon and Idaho only.

## Clover seed—Red clover casebearer moth

*Coleophora deauratella*

**Pest description and crop damage** Shiny metallic adult moths are about 9 mm long. The larvae overwinter inside a cigar-like case within residue in a field and pupate inside of the case on the ground surface. Adults emerge in early summer to mate and white eggs are laid on the calyx of florets. Hatched larvae enter florets to feed, then move between florets by chewing holes through corolla, eventually causing feeding damage to pods and developing seeds. Moths usually are active in clover fields June through mid-August and can be found flying at dawn.

### Management—cultural control

Cutting/removing red clover silage in late May/early July appears to disrupt lifecycle and helps prevent damage to seeds during bloom and seed fill period.

### Management—chemical control

No labeled insecticides are known to be effective.

## Clover seed—Slug

Various species

**Pest description and crop damage** Mollusks that feed on various plants, damaging roots, crowns, leaves, and fruit. Snails and slugs are nocturnal and generally feed during the night damaging many varieties of plants and plant seedlings. They inhabit damp, moist areas around decaying refuse, organic matter, and hide at the base of growing plants. Their presence can be detected by the shiny trails left on the soil surface.

### Management—chemical control

- iron phosphate (Sluggo Maxx, Bug-N-Sluggo) granule bait at 1.0 to 1.5 lb ai/A. No PHI or REI. Control is usually optimized when warm, overcast conditions follow application.
- metaldehyde 4% (Deadline M-Ps, Metarex, Slugger 4.0, Slugger Ultra 4.0, Lock Out Trails End LG, TKO The Lockout, Slug Fest) granule bait at 0.4 to 1.2 lb ai/A. Control is usually optimized when warm, overcast conditions follow application. Maximum of 4 applications per year. 24c SLN: OR-140004A, OR-140004B, OR-140004C, OR-10004D, OR-140005, OR-140008.
- sodium ferric EDTA (Despot Slug and Snail, Ferroxx) granule bait at 0.25 to 1.0 lb ai/A. No PHI or REI. Control is usually optimized when warm, overcast conditions follow application.

See:

Slug Control

## Clover seed—Spider mite

### Includes

Strawberry spider mite (*Tetranychus turkestani*)

Twospotted spider mite (*T. urticae*)

**Pest description and crop damage** Pests are not insects but rather eight-legged arachnids less than 0.03 inch long. West of the Cascades, most mite problems in clover seed fields begin during postbloom or early seed set, when only heavy infestations justify control. East of the Cascades, overwintering mites that are colonizing a new crop sometimes are abundant. These may lay enough eggs to be a problem before bloom.

### Management—chemical control

- bifentazate (Acramite- 4SC) at 0.5 lb ai/A. PHI 7 days. Only 1 application is allowed per year. Rotate to a product with a different mode of action grouping if additional applications are needed. Do not graze clover after application. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: OR-1900015 (expires 12/31/2024). Oregon only.
- bifenthrin (Batallion 2EC, Brigade 2EC, Discipline 2EC) at 0.06 to 0.1 lb ai/A. REI 12 hr. Do not apply to blooming crop or allow to drift while bees are actively visiting bloom. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. Do not graze clover after applying. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: Batallion 2EC, OR-200006 (expires 12/31/2025), Brigade 2EC, OR-070013 (expires 12/31/2028), ID-070009 (expires 12/31/24); Discipline 2EC, OR-040039 (expires 12/31/2025), ID-040009 (expires 12/31/24). Oregon and Idaho only.
- hexythiazox (Onager Optek) at 0.0937 to 0.1875 lb ai/A. REI 12 hr. PHI 28 days. Apply at first sign of mites in upper half of the crop canopy before population build-up occurs. Controls all immature stages but does not control adult spider mites. Do not make more than one application per growing season. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: WA-190005 (expires 12/31/2028) malathion at 1 to 1.25 lb ai/A. Apply to plants in bloom only in evening or early morning, when bees are not working in the fields or hanging on the outside of the hives.
- propargite (Comite) at 1.64 to 2.46 lb ai/A. REI 9 days. Do not make more than two applications per year. Allow at least 14 days between applications. Do not graze clover after application. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: OR-240008 (expires 12/31/2029)

## Clover seed—Sweetclover weevil

*Sitona cylindricollis*

**Pest description and crop damage** Adults are gray or brownish gray and about 0.25 inch long. Weevils feed on and notch foliage. Most severe damage is to seedling plants. Sweet clover is the primary host, but weevils also attack alfalfa and have been found on ladino clover.

### Management—chemical control

- bifenthrin (Batallion 2EC, Brigade 2EC, Discipline 2EC) at 0.06 to 0.1 lb ai/A. REI 12 hr. Do not apply to blooming crop or allow to drift while bees are actively visiting bloom. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. Do not graze clover after applying. Do not cut treated clover for hay or forage. Do not use harvested seed for sprouting. No part of the treated field, including seed, seed screenings, hay, forage, or stubble, may be used for human or animal feed. Processed seed must be labeled. 24c SLN: Brigade 2EC, OR-070013 (expires 12/31/2028), ID-070009 (expires 12/31/24); Discipline 2EC, OR-040039 (expires 12/31/2025), ID-040009 (expires 12/31/24). Oregon and Idaho only.

## Clover seed—Western spotted cucumber beetle

*Diabrotica undecimpunctata*

**Pest description and crop damage** Yellowish green, black-spotted beetle, common only in western Oregon and Washington. Adults feed on tender seedlings and retard or destroy the stand. This insect also has been observed damaging red clover and trefoil blooms.

### **Management—chemical control**

No treatments currently listed.

# Dry Edible and Seed Pea Pests

Cody Copp

Latest revision—March 2025

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In all cases, **follow the instructions on the pesticide label**. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making *any* pesticide applications.

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**Protect pollinators:** See How to Reduce Bee Poisoning from Pesticides.

**Note:** Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

## Dry edible and seed pea—Cutworm, armyworm, and looper

### Includes

Alfalfa looper (*Autographa californica*)

Cabbage looper (*Trichoplusia ni*)

Variegated cutworm (*Peridroma saucia*)

Western yellowstriped armyworm (*Spodoptera praefica*)

**Pest description and crop damage** Cutworms are usually dull gray, brown, or black, and may be striped or spotted. They often curl up when disturbed. They usually feed at night, cutting off young plants or feeding on foliage of older plants. They are a pest primarily of alfalfa and clovers but attack other legumes also. Cutworms don't often seriously damage field peas.

### Management—chemical control

- alpha-cypermethrin (Fastac EC) at 0.008 to 0.025 lb ai/A. PHI 21 days. REI 12 hr. Usual retreatment interval 5 days.
- beta-cyfluthrin (Baythroid XL) at 0.019 to 0.025 lb ai/A. PHI 7 days. REI 12 hr. Retreatment interval 14 days. Do not exceed 0.05 lb ai/A per season.
- *Bacillus thuringiensis* (Summit or Thuricide) 0.5 to 1.0 lb/A. Retreatment interval 5 to 7 days. Some formulations are OMRI-listed for organic production.
- bifenthrin/imidacloprid (Brigadier, 11.3% ai by wt., each material) at 0.088 lb ai/A. PHI 14 days. REI 12 hr. Do not exceed 0.044 lb ai/A imidacloprid, 0.044 lb ai/A bifenthrin. Retreatment interval 7 days.
- chlorantraniliprole/lambda-cyhalothrin (4.63%/9.26%) (Besiege) at 0.060 to 0.1 lb ai/A. PHI 21 days. REI 24 hr. Do not exceed 0.12 lb ai/A lambda-cyhalothrin or 0.2 lb ai/A of clorantraniliprole per acre per year.
- cyfluthrin (Tombstone, Helios) at 0.013 to 0.05 lb ai/A. PHI 7 days. REI 12 hr. Do not exceed 0.05 lb ai/A per 14-day interval. Do not exceed 0.1 lb ai/A per year.
- esfenvalerate (Asana XL) at 0.03 to 0.05 lb ai/A. PHI 21 days. REI 12 hr. Do not exceed 0.2 lb ai/A per year.
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. PHI 21 days. REI 24 hr. Do not exceed 0.06 lb ai/A per season.
- methoxyfenozide (Intrepid 2F) at 0.06 to 0.12 lb ai/A early season, 0.12 to 0.25 lb ai/A mid to late season. PHI 7 days. REI 4 hr. Retreatment interval 7 days. Do not exceed 1 lb ai/A per season.
- spinetoram (Radiant SC) at 4.0 to 8.0 fl oz (0.031 to 0.063 lb ai/A. PHI 28 days. REI 4 hr. Retreatment interval 4 days. Do not exceed 0.094 lb ai/A per year. Limit 6 treatments.
- spinosad (Success, Entrust SC) at 0.062 to 0.094 lb ai/A. PHI 28 days. REI 4 hr. Do not exceed 0.188 lb ai/A per season. Do not feed forage or hay to meat or dairy animals. Limit 6 treatments. Entrust SC is OMRI-listed for organic production.
- zeta-cypermethrin (Mustang – 17.5% ai) at 0.05 lb ai/A soil at-plant and 0.016 to 0.05 lb ai/A post-plant. PHI 21 days. REI 12 hr. Minimum retreatment interval is 5 days. Do not exceed 0.3 lb ai/A per season.

These products contain commonly used active ingredients for control of caterpillars in dry edible and seed pea. There are other materials available. Please consult a licensed crop advisor for additional recommendations.

## Dry edible and seed pea—Pea aphid

*Acyrtosiphon pisum*

**Pest description and crop damage** The common light-green aphid found on legume plants. They feed by sucking plant juices. They can transmit virus diseases and can reduce yields when abundant.

### Management—chemical control

- alpha-cypermethrin (Fastac EC) at 0.02 to 0.025 lb ai/A. PHI 21 days. REI 4 hr. Retreatment interval 5 days. Do not exceed 0.075 lb ai/A per year.
- azadirachtin (Neemix 4.5) at 5 to 7 fl oz. (0.015 to 0.021 lb ai) /A. PHI 0 days. REI 4 hr. OMRI-listed for organic use.
- *Beauveria bassiana* (Mycotrol ESO) at 0.25 to 1 quart/A. PHI 0 days. REI 4 hr. OMRI-listed for organic use.
- cyfluthrin (Tombstone Helios) at 0.05 lb ai/A. PHI 7 days. REI 12 hr. Retreatment interval 14 days. Do not exceed 0.1 lb ai/A per year.
- dimethoate (Dimethoate LV4, Drexel) at 0.16 to 0.33 lb ai/A. PHI 14 days for harvest. Allow 7 days between applications. REI 48 hr. Do not exceed 0.5 lb ai/A per season (WA 4 x @ 0.125; OR and ID 3 x @ 0.166 ai/A). Do not graze livestock. Do not apply to blooming Austrian winter peas. SLN has been subsumed as part of Section 3 label EPA Reg. 19713-665.
- esfenvalerate (Asana XL) at 0.03 to 0.05 lb ai/A. PHI 21 days. REI 12 hr. Do not exceed 0.2 lb ai/A per year.
- malathion (Fyfanon) at 1 lb ai/A. PHI 3 days. Do not graze or feed forage to livestock. REI 12 hr. Limit 2 treatments.
- zeta-cypermethrin (Mustang Maxx). at 0.020 to 0.025 lb ai/A. PHI 21 days. REI 12 hr. Do not exceed 0.15 lb ai/A per season.

These products contain commonly used active ingredients for control of pea aphids in dry edible and seed pea. There are other materials available. Please consult a licensed crop advisor for additional recommendations.

## Dry edible and seed pea—Pea leaf weevil

*Sitona lineata*

**Pest description and crop damage** Adults are small, grayish brown, faintly striped weevils about 0.17 inch long. They appear in large numbers in spring and sometimes late summer. Adult feeding on young plants in spring may considerably notch and rag leaves, but this damage has not been found to reduce stand or yield appreciably.

### Management—chemical control

- alpha-cypermethrin (Fastac EC) at 0.017 to 0.025 lb ai/A. PHI 21 days. REI 4 hr. Retreatment interval 5 days. Do not exceed 0.075 lb ai/A per year.
- carbaryl (Carbaryl 4L) at 1.5 lb ai/A. PHI 14 days for grazing or harvest for forage, 21 days for harvest. Do not exceed 6 lb ai/A per season. Retreatment interval 7 days. REI 12 hr.
- cyfluthrin (Tombstone Helios) at 0.038 to 0.050 lb ai/A. PHI 7 days. REI 12 hr. Retreatment interval 14 days. Do not exceed 0.1 lb ai/A per year.
- phosmet (Imidan 70W) at 0.7 to 1 lb ai/A. PHI 7 to 10 days. REI 5 days. Do not exceed 2.8 lb ai/A per season. Do not feed forage to livestock within 7 days. Do not cut treated fresh pea forage for hay within 10 days.
- thiamethoxam (Cruiser Maxx) at 1.5 fl oz /100 lb seed (about 25g ai/100 g seed)

These products contain commonly used active ingredients for control of pea leaf weevil in dry edible and seed pea. There are other materials available. Please consult a licensed crop advisor for additional recommendations.

## Dry edible and seed pea—Pea weevil

*Bruchus pisorum*

**Pest description and crop damage** A small, grayish-brown weevil 0.2 inch long, marked with dark and light spots. Larvae feed within the seed and destroy its viability.

**Sampling and thresholds** Usually, one weevil per 25 sweeps of an insect net will result in weevil infested peas at harvest.



### Management—chemical control

Apply insecticides to kill adults before they lay eggs. Once eggs are on pods, it is too late to prevent infested seeds. Therefore, apply insecticide when first pods appear and before eggs are laid.

- alpha-cypermethrin (Fastac EC) at 0.017 to 0.025 lb ai/A. PHI 21 days. REI 4 hr. Retreatment interval 5 days. Do not exceed 0.075 lb ai/A per year.
- carbaryl (Carbaryl 4L) at 1.5 lb ai/A. PHI 14 days for grazing or harvest for forage, 21 days for harvest. Do not exceed 6 lb ai/A per season. Retreatment interval 7 days. REI 12 hr.
- cyfluthrin (Tombstone Helios) at 0.038 to 0.050 lb ai/A. PHI 7 days. REI 12 hr. Retreatment interval 14 days. Do not exceed 0.1 lb ai/A per year.
- phosmet (Imidan 70W) at 0.7 to 1 lb ai/A. PHI 7 to 10 days. REI 5 days. Do not exceed 2.8 lb ai/A per season. Do not feed forage to livestock within 7 days. Do not cut treated fresh pea forage for hay within 10 days.

These products contain commonly used active ingredients for control of pea weevil in dry edible and seed pea. There are other materials available. Please consult a licensed crop advisor for additional recommendations.

### Dry edible and seed pea—Wireworm and seedcorn maggot

Seed corn maggot (*Delia platura*) and several species of wireworm

#### Management—chemical control

- bifenthrin (Capture LFR) at 0.04 to 0.08 lb ai/A soil at-plant. Do not exceed 0.1 lb ai/A per season at-plant. Apply at 0.08 to 0.1 lb ai/A for pre-emergent or pre-plant incorporated. PHI 14 days. REI 12 hr. Retreatment interval 7 days.
- imidacloprid (Gaucho 600) at 1.6 to 3.2 fl oz/100 lb seed.
- thiamethoxam (Cruiser Maxx) at 1.5 fl oz/100 lb seed (about 25g ai/100 g seed).
- zeta-cypermethrin (Mustang Maxx) at 0.025 lb ai/A soil at-plant. PHI 21 days. REI 4 hr. Do not exceed 0.15 lb ai/A per season.

These products contain commonly used active ingredients for control of wireworms and seed corn maggot in dry edible and seed pea. There are other materials available. Please consult a licensed crop advisor for additional recommendations.

# Grass Seed Pests

Alison Willette, Navneet Kaur, and Nicole P. Anderson

Latest revision—March 2025

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In all cases, **follow the instructions on the pesticide label**. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

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**Protect pollinators:** See How to Reduce Bee Poisoning from Pesticides.

**Note:** Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

## Grass seed—Aphid

Bird cherry-oat aphid (*Rhopalosiphum padi*)

Corn leaf aphid (*Rhopalosiphum maidis*)

English grain aphid (*Macrosiphum avenae*)

Rose grass aphid (*Metopolophium dirhodum*)

**Pest description and crop damage** Aphids are smaller than 0.04 inch (1 mm), winged or wingless, and feed in colonies on leaves and stems of grasses. They vary in color from yellow to dark green and have two distinctive cornicles, which look like “tailpipes” on the top-side end of the abdomen.

Perennial ryegrass, fescue, orchardgrass and Kentucky bluegrass are susceptible to damage from large populations of bird-cherry oat aphid. Damage is most significant to seedling plants, particularly in direct seed or no-till fields and when aphids on the previous crop may colonize emerging seedlings as the old crop dies down. Aphids remove plant sap, secrete honeydew, and mechanically damage leaf tissue and developing seed heads. Light seed and reduced yields can occur, although not very often.

All aphid species colonizing grass (except possibly root aphid species not mentioned in this section) can vector barley yellow dwarf virus (BYDV) among susceptible grass and cereal crops. Symptoms of BYDV have been pronounced in Willamette Valley grasses in recent years. Refer to the PNW Plant Disease Control Handbook for information on the virus.

**Scouting and thresholds** Inspect seedling grasses for aphid colonies. Winged forms colonize fields in irregular patterns, often according to prevailing-wind direction and wind-blocking features along field margins. Aphid flights from region to region and locally from field to field occur late spring through fall. When bird-cherry oat aphids exceed an average of 10 aphids per two- to six-leaf seedling, and the population appears to be increasing in the absence of natural predators or parasites, crop may be injured even in the absence of virus.

When heads begin to form during boot stage, aphid populations averaging 10 to 20 per stem or head (and increasing) may cause damage if not checked biologically or with insecticide. Drought-like conditions, weak stands, and fields under other stresses magnify aphid damage.

### Management—biological and physical controls

Aphid populations are susceptible to rainy, windy weather and sudden cold. Unseasonably high temperatures from April through June can reduce aphid populations quite effectively.

Ladybird beetles, big-eyed bugs, damsel bugs, syrphid fly larvae, and parasitic wasps may regulate aphid populations below damaging levels in grasses. Consider these beneficial when deciding whether or not to apply an insecticide. Individual aphids that are parasitized appear brown to gold. If predator insects and parasitized aphids increase from one week to the next, and there is a corresponding drop in aphids as the weather dries and warms, sprays often are unnecessary from late April through June.

### Management—chemical control

- bifenthrin (Brigade<sup>®</sup> 2EC and WSB and others) at 0.1 lb ai/A. Apply in spring and fall when aphids are seen. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed. IRAC group 3A.
- dimethoate (Dimethoate 400 and 400EC) at 0.25 to 0.33 lb ai/A. PHI 10 days. REI 48 hr. Do not graze or feed hay, forage, seed, or use screenings from treated fields. Seed conditioners must be informed if seed is from a treated field. Control is best when grass is succulent and not drought stressed. IRAC group 1B (organophosphate)
- flupyradifurone (Sivanto Prime) at 0.09 to 0.22 lb ai/A. PHI 7 days, REI 4 hours. IRAC group 4D. EPA SLN # OR-240009 (Exp. 12/31/2029)
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. Best control is prior to aphids rolling leaves. Labeled for use on bird cherry-oat aphid and English grain aphid. PHI 7 days. REI 24 hr. IRAC group 3A.
- lambda-cyhalothrin (Warrior and several others) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days straw and seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- malathion at 0.9375 to 1.25 lb ai/A. PHI 0 days. REI 12 hr. Maximum single application rate is 1.25 lb ai/A. Maximum one application of malathion allowed per year.
- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw and seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days.

## Grass seed—Armyworm

Army cutworm (*Euxoa auxiliaris*)

True (common) armyworm (*Mythimna unipuncta* formerly *Pseudoletia unipuncta*)

**Pest description and crop damage** Moths in the family Noctuidae have gray or brown forewings with slate or buff-color markings. Hind wings are silvery-gray or beige. Average wingspan is 1.4 to 1.6 inches.

Mature larvae are about 1.5 to 2 inches in length, tan to brown, with a faint white or red midline stripe on the top of the body. These are bordered below by a white stripe on each side. A prominent black stripe is along each side bordered below by an orange-brown stripe. Larvae have an inverted white Y on the front of the head.

Pupae are brownish-red and found in the top soil layer, commonly near the crowns of host plants.

In eastern Oregon, army cutworm occasionally damages grasses grown for seed, pastures and cereals; look for larvae in fall or late winter if damage is seen. In western Oregon, the true armyworm infrequently infests grasses in the fall, usually tall fescue and orchardgrass. Late-summer flights of moths lay eggs in established grass seed fields after harvest. Larvae feed on fall regrowth.

Extensive but localized damage may result if the population is not treated. Large numbers of larvae feed so voraciously that mass migrations of larvae within and away from fields occur as regrowth fails.

**Scouting and thresholds** Look for armyworm larvae in and around crowns, where birds (swallows, crows) are feeding. Dig around in the thatch, grass residue, and at the base of plants. Armyworms typically feed at night. Also look for frass (excrement) that resembles tiny grass pellets. Treatment in

established grass crops is suggested when 4 larvae per sq ft are observed. The threshold in seedling stands is 2 larvae per sq ft.

**Biology and life history** Armyworm adults migrate into Oregon from California in summer. Eggs are laid in grasses. They hatch in a week, and larvae feed through the fall. Larvae aggregate in small areas, where defoliation may be complete. Most armyworm damage is seen during late summer and fall in western Oregon. Outbreaks are infrequent and are associated with unusually high spring rainfall in California which favors survival of the first generation. Resultant moths migrate north following green plant material.

#### **Management—biological control**

Tachinid flies heavily parasitize armyworm larvae and often cause armyworm populations to collapse over large areas after a season or two.

#### **Management—chemical control**

Insecticides are most effective when larvae are young and small. It is advised to apply insecticides at night when armyworms are above ground and active.

- bifenthrin (Brigade/E 2EC and WSB) at 0.1 lb ai/A. Apply in spring and fall when insects are present at their economic threshold level. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed.
- carbaryl (e.g., Sevin XLR Plus, 4F) at 1.0 to 1.5 lb ai/A product. PHI 14 days. REI 12 hr. Up to two applications per year, but not more than once every 14 days. Do not exceed 3 lb ai/A per season.
- cyfluthrin (Baythroid XL) 0.013 to 0.015 lb ai/A. recommended on 1st and 2nd instar larvae only. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.
- lambda-cyhalothrin (Warrior and others) at 0.015 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- malathion at 1.25 lb ai/A. PHI 0 days. REI 12 hr. Maximum single application rate is 1.25 lb ai/A. Maximum one application of malathion allowed per year.
- spinosad (Blackhawk) at 0.025 to 0.050 lb ai/A per season. PHI 0 days forage, 3 days hay or fodder. REI 4 hr. For resistance management, do not apply Success more than three times in any 21-day period. Do not exceed 0.186 lb ai/A per season. Do not make more than six applications per season.
- spinosad (Success) at 0.031 to 0.062 lb ai/A. PHI 0 days forage, 3 days hay or fodder. REI 4 hr. For resistance management, do not apply Success more than three times in any 21-day period. Do not exceed 0.186 lb ai/A per season. Do not make more than six applications per season.
- zeta-cypermethrin (Deadlock G) at 10 lb/A. Distribute granules evenly in the furrow at planting. Only one application is allowed per season. Maximum amount that can be applied is 10 lb/A per season. No rotation crops can be planted within 30 days of the last application. REI 12 hr.
- zeta-cypermethrin (Mustang MAX) at 0.0175 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw and seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season, make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days.

## **Grass seed—Billbug**

### **East of the Cascades, in bluegrass:**

Bluegrass billbug (*Sphenophorus parvulus*)

Denver billbug (*Sphenophorus cicatristriatus*)

### **West of the Cascades, in orchardgrass:**

Western orchardgrass billbug (*Sphenophorus venatus confluens*)

**Pest description and crop damage** The following description is of the western orchardgrass billbug, a common billbug in grasses, for which we have the most biological knowledge: Adults are beetles about 0.5 inch in length, black to dark brown, with mandibles extended into a fairly long "snout." Elbowed antennae insert near the end of the snout. The body is covered with small punctations and irregular-size pits, as if poked with needles. Adults feed on developing leaves while the leaves are still folded longitudinally and close to the crown. As the leaves grow and elongate in the spring (March and April) and

in the fall (October), distinctive, paired feeding holes about 0.25 to 0.33 inch in diameter become apparent. Larvae are legless, very plump, dirty white with chestnut brown heads, and mature usually in August. The small, white, oval eggs are about 0.03 inch in length and are inserted individually into stem or crown tissue in the spring. The pupae progress from white to tan to brown, are shaped much like the adults, and are found in the soil with plant crowns in July and August. Larvae severely damage orchardgrass; tunneling up stems and into crowns. Heavy infestations may destroy entire plants, or fields, in one season. Yields are affected drastically, and stands decline and become unproductive if billbugs are not controlled.

**Biology and life history** Eggs are deposited in crown and stem tissue from late April or early May through June. They hatch in 2 to 3 weeks. Larvae feed in plant stems until they outgrow them: then they feed and develop in crown and root tissue. Mature larvae are found in crowns and roots as well as in adjacent soil.

Western orchardgrass billbug begins pupation in late July or early August. About 90% of pupae transform to new adults by mid-October. These adults feed for a week or two on fall regrowth at the crown and are tightly wedged among the shoots of the plant crown. Adults may wander through the field for a week or two before becoming inactive and hibernating in crowns.

There is one generation per year. Bluegrass billbug also has one generation per year, but the development stages are slightly faster than those of the orchardgrass billbug.

**Scouting and thresholds** Orchardgrass billbug—Walk orchardgrass fields from late March through early April (spring control of adults) and again from mid-October through early November. Carefully inspect at least 200 randomly selected crowns as you walk. If you see any adult feeding holes on even a single leaf of a crown, mark the crown “infested.” The treatment threshold is adult feeding damage in 6 to 10% of crowns. Initial infestations may begin at field margins, but within a year may spread throughout the field. If you notice a small amount of feeding damage on field edges, spray the infested border areas.

#### **Management—cultural control**

*Orchardgrass billbug*—Postharvest open-field burns kill less than 35% of the adults present at the time. Further, the burning orchardgrass fields that have been moderately to severely injured can result in stand loss, because the greatly weakened plants often die as a result of the fire.

*Crop rotation*—This billbug does not injure other grass species, even though small numbers often are found in bentgrass and bluegrass fields. Adult billbugs will also feed on a wheat crop that follows orchardgrass; however, injury is minimal and generally insufficient to justify control.

#### **Management—chemical control**

- bifenthrin (Brigade/E 2EC and WSB) at 0.1 lb ai/A. Apply in early fall and/or spring when larvae are active. Best results are achieved with 25 to 40 gallons of spray solution per acre followed by irrigation or rainfall. Maximum amount allowed is 0.2 lb ai/A per season but no more than once every 14 days. PHI 30 days prior to harvest for forage, hay and seed.
- chlorantraniliprole (Vantacor) at 0.066 to 0.098 lb ai/A (1.7 to 2.5 fl oz/A). PHI is 0 days. REI 4 hr.
- lambda-cyhalothrin (Warrior and others) at 0.02 to 0.03 lb ai/A. Suppression only. PHI 0 days for grazing and forage, 7 days for straw and seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Suppression only. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
  - Unirrigated crops—Apply in early April during rain. Spring rain is absolutely necessary to move product to plant crowns where adult billbugs are active. Fall application—Apply after Oct. 15 and before Nov. 7, when adults are active and moving among plant crowns prior to hibernation. Treating at this time may provide better control than applications made in spring because re-growth is slight and rain is not as critical to move chlorpyrifos to the crowns of plants.
  - Drop or flood nozzles that direct streams of insecticide to crowns tend to provide better control than nozzles that broadcast spray. Charcoal on the soil surface (from previous field burns) and/or a heavy postharvest straw load in the field and on plant crowns will tie up chlorpyrifos or any other insecticide—resulting in virtually no pest control. **RESTRICTED USE IN OREGON.**

## Grass seed—Black cutworm

*Agrotis ipsilon*

See also

Grass seed—Winter cutworm

**Pest description and crop damage** Black cutworm larvae are 1.2 to 1.6 inches in length when mature. They can be gray, brown, or black and have lighter brown stripes running the length of the body. The head capsule is dark brown or black. By day, they hide in the soil or under plant debris on the soil surface. The adults of this moth are brownish gray with a spot and a light silvery band on the front wings. The wingspan is about 1.4 inches.

This cutworm, one of the most common species in western Oregon, is a pest of new seedlings. Larval populations are often in soil when grass is seeded in summer or early fall and follows fallow ground with weeds, legumes, crucifers, sugar beets for seed, pasture, or other grass seed crops. Generally, one can expect black cutworm larvae in fields where no-till and conservation tillage follow these cropping regimes.

Larvae feed at night, hiding in soil or resting under clods or plant residue by day. Even a few larvae in an area can cause substantial clipping and defoliation. Stand loss can occur if seedlings are clipped off repeatedly or if the growing points are destroyed.

**Biology and life history** Apparently, either moth or pupa may overwinter in the Pacific Northwest or moths migrate into the region during late spring; females deposit eggs during this time. Eggs hatch soon after deposition.

Young larvae feed and survive on many grasses and broadleaf plants. In the first week or two, the small larvae tend to stay above ground on a host plant. Later, they move to the soil and feed at night above ground at the soil surface. They also feed by day on some crops like table beet seedlings. They clip roots underground and pull foliage into the soil.

Larvae feed for 1 to 3 months, depending on soil and ambient temperature. When mature, they pupate in the soil. Adults emerge 2 to 3 weeks later. There appears to be a second generation of larvae occurring in late summer and fall that are present in soil and cause stand reduction when fall grasses are sown.

**Scouting and thresholds** Seedling grasses emerge well but later begin disappearing overnight. Suspect black cutworm when you notice that many of the injured grasses are clipped at ground level (as a rodent might do). Often, individual blades are left wilting by the seed furrow. Occasionally, seedlings will be severed underground.

Sift through soil in the seed furrow, dig and screen soil from cracks in the soil near the seed line, and inspect under clods, organic matter, and hollow stems of the previous crop's residue to find black cutworm larvae. Damage usually is in irregular patches of less than an acre to many contiguous acres.

There are no established thresholds. Treat when the potential for stand reduction is great.

### Management—cultural control

Plowing and disking prior to seeding may not always reduce larval populations below damaging levels.

### Management—chemical control

- bifenthrin (Brigade 2EC and WSB) at 0.1 lb ai/A. Apply in spring and fall when insects are present at their economic threshold level. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed.
- carbaryl (e.g., Sevin XLR Plus, 4F) at 1.0 to 1.5 lb ai/A product. PHI 14 days. REI 12 hr. Up to two applications per year, but not more than once every 14 days. Do not exceed 3 lb ai/A per season.
- cyfluthrin (Baythroid XL) 0.013 to 0.015 lb ai/A. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.

- lambda-cyhalothrin (Warrior and others) at 0.015 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 5.0 to 8.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- spinosad (Blackhawk) at 0.025 to 0.050 lb ai/A per season. PHI 0 days graze, 3 days hay. REI 4 hr. No more than 6 applications per season or a total of 0.186 lb ai/A.
- zeta-cypermethrin (Deadlock G) 10 lb/A Distribute granules evenly in the furrow at planting. Only one application is allowed per season. Maximum amount that can be applied is 10 lb/A per season. No rotation crops can be planted within 30 days of the last application. REI 12 hr.
- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw and seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days.

## Grass seed—Cereal leaf beetle

*Oulema melanopus*

**Pest description and crop damage** Adults are slender, about 0.33 inch in length, and have metallic, bluish-black elytra. They have a black head, orange thorax, and orange legs. They are known to fall to the ground when disturbed. A single, yellow, cylindrical egg usually is laid parallel to the mid-vein. Sometimes eggs may be in groups of two or three. Eggs are about 0.04 inch in length and darken before they are about to hatch.

Larvae are small and rounded with a black head and yellow-orange body. They resemble a small Colorado potato beetle with a “slimy backpack.” They have three pairs of black legs near the head of the larvae.

Both larvae and adults feed on and damage tall fescue in Oregon. On other grasses, adult beetles enter fields in late summer and fall and feed before going into hibernation. In cereal crops, both larvae and adults prefer seedlings or new growth on old plants. Feeding is between the leaf veins, but adults eat completely through the leaf. Larvae eat long strips of surface tissue, leaving behind the translucent cuticle of the lower leaf—the characteristic “window-pane” look of CLB damage. Tips of damaged leaves often turn white, giving a heavily infested field a frosted look. This has been primarily a pest of wheat, oats, and barley.

**Biology and life history** In spring, adults emerge and mate. Each female can lay several hundred eggs. Larvae feed for up to 3 weeks and then pupate in soil. New adults emerge in June but do not mate; they feed as summer progresses, then seek out sheltered margins of fields in the fall. It is these adults that overwinter, allowing for one generation per year.

### Management—chemical control

- bifenthrin (Brigade 2EC and WSB) at 0.1 lb ai/A. Apply in spring if one or more eggs or larvae are detected or in late summer if beetles are defoliating seedling stands. Maximum amount allowed is 0.2 lb ai/A per season but no more than once every 14 days. PHI 30 days prior to harvest for forage, hay and seed.
- cyfluthrin (Baythroid XL) at 0.013 to 0.015 lb ai/A. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.
- lambda-cyhalothrin (Warrior) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and forage, 7 days for straw and seed crop. REI 24 hr.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- zeta-cypermethrin (Mustang MAX) at 0.0175 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw and seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days.

## Grass seed—Crane fly

European crane fly (*Tipula paludosa*)

Common or marsh crane fly (*Tipula oleracea*)

**Pest description and crop damage** Adults are large (wing span of 1 to 1.5 inches), grayish brown, and resemble large, long-legged mosquitoes. They do not bite! The wings of these pest species are long, slightly milky-brown along the fore-edges, and folded in roof-like when the adults are at rest.

Commonly referred to as “mosquito hawks” or “mosquito eaters” they do not eat mosquitoes; in fact, they probably feed only on a little free moisture during their short existence (3 to 7 days).

Mature larvae are 1 to 1.5 inches in length, legless, and earthy gray. The body is cylindrical, squishy, but very tough and resilient (the larvae are called “leatherjackets”). The body extends and retracts considerably, and the primitive head can retract, giving the larva a tightly packed and pudgy appearance. Eggs are black, narrow, rigid, and about 0.03 inch in length.

The larvae of these two pest species feed on many plant species, including grasses, clovers, mint crops, root vegetables, and probably even decaying matter. As larvae mature, they come to the soil surface at night and feed above ground on crowns of grasses. They have been seen to clip stems of peppermint.

Most larval infestations in grasses have been in irrigated turf—golf courses, lawns, parkways. However, large numbers of larvae occasionally are in perennial ryegrass and other grass seed crops when there is heavy rainfall and excessive soil moisture. In grass seed crops, larval heavy feeding has been associated with stand loss. However, usually other stresses are present as well. Full effects of larval feeding on grass seed crops have yet to be described.

Be aware that adults of many crane fly species often are in grass seed fields, particularly in winter and spring. Most are not harmful and have emerged from larvae that lived in waterways in and around the fields. With the exception of these two new pests, Oregon crane flies are aquatic or semiaquatic, do not feed on living plants, and are not pests of plants.

**Biology and life history** The European crane fly, *T. paludosa*, deposits eggs randomly on moist soil, grasses, clovers, and cover crops by dropping them in flight or when walking over these areas. An adult female produces 300 to 400 eggs, which hatch in 11 to 15 days. Larvae enter the soil and feed on humus, vegetable waste that is decomposing, and crowns or roots of plants through late April and early May. Young larvae tend to remain in the soil day and night and are highly resistant to cold. In spring, the larger larvae come to the soil surface at night and feed on aerial parts of plants. Larvae pupate in the soil (late June, July, early August). Adults emerge in late August and September. *Tipula paludosa* has one generation per year. *Tipula oleracea* may have two generations per year with flight activity in the spring and again in the fall, coincident with *T. paludosa*.

**Scouting and thresholds** The extent to which these crane fly larvae damage grass seed crops has not been researched adequately. In turf grasses that are of normal vigor, well fertilized and watered, and without other stresses, more than 20 crane fly larvae per sq ft have not produced aesthetic damage or stand loss. However, larval populations approaching 5-10 per sq ft in some grass seed crops are thought to damage grasses that are weakened or subject to other stresses.

Crane fly larvae can at times be flushed from moist soils by pouring a caustic solution over the soil surface and allowing it to penetrate to where larvae are. Soap solutions, chlorpyrifos (Lorsban) insecticide, and weak concentrations of pyrethroid insecticides cause the larvae to wiggle to the surface soon after application.

Soil cores 3 inches deep are usually sufficient to detect larvae in root material. Pick apart roots and soil over a series of screens and observe larvae that collect on the screens. Berlese funnels also are used to process soil cores, but this can take a substantial amount of time (days) to process.



### Management—chemical control

- azadirachtin/pyrethrins (Azera, Azera Pro) at 1 to 3.5 pints/A. REI 12 hr. PHI 0 days. OMRI listed for organic production.
- carbaryl (e.g., Sevin XLR Plus, 4F) at 1.0 to 1.5 lb ai/A product. PHI 14 days. REI 12 hr. Up to two applications per year, but not more than once every 14 days. Do not exceed 3 lb ai/A per season. IRAC group 1.
- chlorantraniliprole (Vantacor) at 0.066 to 0.098 lb ai/A (1.7 to 2.5 fl oz/A). PHI 0 days. REI 4 hr.
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. REI 24 hr. PHI 7 days. Do not exceed 0.045 lb ai/A per season. IRAC group 3.  
**Restricted use pesticide.**
- lambda-cyhalothrin (Warrior and others) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and forage, 7 days for straw and seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.

## Grass seed—Garden symphylan

*Scutigerella immaculata*

**Pest description and crop damage** Adult symphylans are about 0.12 to 0.33 inch in length, white, with prominent antennae 12 pairs of legs. Juveniles look similar to adults only with less legs and smaller body. Their bodies are creamy white. They resemble centipedes, but centipedes usually are larger, yellowish to brown, and when mature have more than 12 pair of legs.

Symphylans are general feeders that eat the fine root hairs and germinating seeds of many types of grasses and crop plants.

### Scouting for pest pressure

**Two primary** sampling methods are used: baiting methods, **and** soil sampling methods. Each method has benefits and drawbacks, and the selection of a sampling method will vary depending on the objectives of the sampling (e.g., detection vs. precise population density estimation), time of year, and site conditions. **Visit garden symphylan details to view how and when to employ each method.**

### Management—cultural control

Tillage reduces populations but usually not enough to achieve control where they are a problem. Crop rotation can be effective at suppressing symphylans. Crops grown in sandy soil have lower crop loss due to symphylan damage. Planting in higher densities can help reduce garden symphylan pressure per plant.

### Management—chemical control

- azadirachtin/pyrethrins (Azera Pro, Azera and others) – Biological. See label rates as they vary for each product. REI 12 hr. PHI 0 days. Azadirachtin products have been evaluated in field trials in both preplant incorporation and carbon banding systems and shown efficacy for symphylan suppression at 15 days after treatment. Some products are OMRI listed for organic use.

*See:*

Biology and control of the garden symphylan

## Grass seed—Glassy cutworm

*Crymodes devastator* and an identical species east of the Cascades

*Protagrotis obscura* (no common name)

**Pest description and crop damage** The adults of glassy cutworm are heavy grayish moths with a wingspan of about 1.25 inches.

Larvae of both species look identical, have the same life histories, and cause similar damage. Their bodies are a translucent (glassy) dirty gray. Heads are red-brown. They can be 1.5 inches in length when mature (late spring). They are true subterranean cutworms, spending nearly their entire larval life in the crown or in and among the roots.

West of the Cascades, glassy cutworm is one of the most common species infesting grasses. East of the Cascades, *Protagrotis obscura* is the primary pest.

Larvae bore into the crown and through roots, seldom feeding above ground or on leaves. They are pests primarily of established grasses, reflecting the egg-laying preferences of the moths. Damage is from fall through spring. In western Oregon, larvae feed through the winter. In eastern Oregon,

Washington, and Idaho, larvae usually diapause (an inactive state, like hibernation). Heavy infestations seriously weaken and even kill mature plants. Extremely cold winters worsen injury; in fact, larval populations usually are detected in spring after damage erroneously labeled “winterkill.”

**Biology and life history** Adults emerge in late June, July, and August, mate, and lay eggs on the soil surface near the crowns of grass host plants. Eggs hatch in about 10 days. Larvae begin to bore into and feed in grass crowns. Spring-seeded tall fescue in western Oregon should be scouted carefully, beginning in early October, for larvae that will feed just below and within crowns. Larvae feed through the winter west of the Cascades and diapause (hibernate) during the coldest winter months east of the Cascades. Larvae pupate in soil during spring.

**Scouting and thresholds** Scout for larvae in October. Dig plant crowns and roots to at least 3 inches and carefully inspect them for larvae.

No thresholds are established for this pest.

**Note:** Don’t mistake sod webworm for glassy cutworm. Cutworm damage is from September through April. Sod webworm (cranberry girdler) larvae (western Oregon) complete feeding and prepare to overwinter by late October, they do not resume feeding in the spring, but pupate and emerge as moths in June.

*See:*

Grass seed—Sod webworm (cranberry girdler)

#### **Management—chemical control**

Chemical control of this pest is seldom successful because most of the larvae occur too far below the soil surface to be reached by insecticides, even when irrigated.

- bifenthrin (Brigade 2EC and WSB) at 0.1 lb ai/A. Apply in spring and fall when insects are present at their economic threshold level. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed.
- cyfluthrin (Baythroid XL, Sultrus) at 0.013 to 0.015 lb ai/A. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A. IRAC group 3A.
- lambda-cyhalothrin (Warrior and others) at 0.015 to 0.025 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 5.0 to 8.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw and seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days.

#### **Grass seed—Grass gelechiid**

*Chionodes psiloptera*

**Pest description and crop damage** Adults (moth) have two sets of thin wings that are dark and shiny. The underwing has a feathered edge, with upturned labial palps protruding from the mouth area, characteristic of the family Gelechiidae. Adults range in size to about 0.5 inch in length. When disturbed, they make short, darting flights and suddenly hide at the base of vegetation or under clumps of soil. The larvae are about 0.5 inch in length and have rusty, red-brown, or slightly pinkish body segments, with a deep tan head capsule.

These insects feed on grass crowns, killing the plant outright or severely stunting growth. They feed on the root system and often burrow into the base of the stem. Damage first appears as individual dead tillers, progressing to destruction of the plant during August to November. This pest is found in eastern Oregon, Washington, and Idaho.

**Biology and life history** Larvae feed in spring and pupate on the soil surface in late April or early May. Adults emerge 2 weeks later, in mid-May through June and sometimes into July. Eggs are laid on the host plant in clumps of 5 to 25 in early June through July. Eggs hatch in about 5 to 10 days. Larvae feed into the

fall, diapause until the next spring, and then resume feeding again for a month or so until they mature and pupate. There is one generation per year.

#### Management—chemical control

No products are labeled for this use.

### Grass seed—Grass mealybug

*Phenacoccus graminum* (western OR) and other species east of the Cascade Range

**Pest description and damage** Mealybugs are scale insects about the size of aphids, covered with waxy whitish, yellowish secretions. They feed with piercing, sucking mouthparts. Heavy populations stunt and yellow grasses. In the Palouse, nymphs of the mealybug species on Kentucky bluegrass transmit *Fusarium poae* at the time of head emergence. The adults feed at the node below the head. Damage in the 30 to 50% range is common in susceptible varieties. The heads become silver before the field ripens. Plants may be stunted and leaf sheaths may yellow or turn brown. In western Oregon, *Phenacoccus graminum* occasionally infests perennial ryegrass. Symptoms and overall damage have not been determined for this species on grass seed crops at this time.

**Biology and life history** Life histories of these two species have not been completely studied on their grass hosts. Adult females are present in late May through June on the Palouse.

#### Management—chemical control

- bifenthrin (Brigade 2EC, Brigade WSB and others) – several products with varied rates, see label. Apply in spring and fall when insects are present at their economic threshold level. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed. IRAC group 3.
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. REI 24 hr. PHI 7 days. Do not exceed 0.045 lb ai/A per season. IRAC group 3.  
**Restricted use pesticide.**
- lambda-cyhalothrin (Warrior II and others) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- zeta-cypermethrin (Mustang MAX) at 0.0175 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw and seed screenings. REI 24 hr. For forage and hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days. In the Palouse, time applications to head emergence and anthesis.

### Grass seed—Grasshopper

#### Includes

Clear-winged grasshopper (*Camnula pellucida*)

Migratory grasshopper (*Melanoplus sanguinipes*)

Red-legged grasshopper (*Melanoplus femurrubrum*)

**Pest description and crop damage** These species are known to infest and cause economic damage to grass seed crops. These species have overlapping generations. Eggs are laid in fall, overwinter in protective tubular pods under the soil, and hatch in spring. These grasshoppers can fly, which allows them to quickly disperse and find new habitats. Both young (nymphs) and adult grasshoppers feed on leaves, stems, and seed heads and destroy the developing seeds. Bentgrass is particularly susceptible to damage. Crop damage looks like notching, stripping, chewing holes on any and all plants; damage similar to armyworms and cutworm chewing.

**Scouting** When scouting, first check for numbers of grasshoppers per square yard (7-12) and the number of young grasshoppers. Scout field borders and walk through a field to estimate the number of grasshoppers per square yard as they jump in front of you. A yard measuring stick can help visualize a square yard, just above the crop.

### Management—chemical control

Many insecticides have activity on grasshoppers. However, they are most effective against young grasshoppers. Nymphs are wingless and are found hopping on the ground instead of flying. Grasshoppers are active during the day and rest on the tops or within grasses and weedy areas.

- bifenthrin (Brigade 2EC and WSB) at 0.1 lb ai/A. Apply in spring and fall when insects are present at their economic threshold level. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed.
- cyfluthrin (Baythroid XL) at 0.02 to 0.022 lb ai/A. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. REI 24 hr. PHI 7 days. Do not exceed 0.045 lb ai/A per season. IRAC group 3.  
**Restricted use pesticide.**
- lambda-cyhalothrin (Warrior II and others) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- malathion at 0.9375 to 1.25 lb ai/A. PHI 0 days. REI 12 hr. Maximum single application rate is 1.25 lb ai/A. Maximum one application of malathion allowed per year.
- zeta-cypermethrin (Mustang MAX) at 0.0175 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw & seed screenings. REI 12 hr. For forage & hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days.

### Management—cultural control

Tillage in late fall can destroy grasshopper egg pods, but is not a means to control feeding grasshoppers. Strips of green foliage (Trap Strips) have been used to attract grasshoppers to a small area where they can be more easily treated. Also, spraying only fence lines where grasses are taller has been found to be effective at controlling grasshoppers. Tracking degree-days as a way of informing growth and development of adults as well as timing sprays with neighboring farms is more effective than sprays alone.

### Management - biological control

Birds will eat grasshoppers. There are diseases (e.g., Nosema, fungi, bacteria) that can keep populations down. Eggs can die from mites, parasitic wasps and flies.

## Grass seed—Leafhopper

Many species

**Pest description and crop damage** Small, 0.25 inch in length, pale to bright green, wedge or torpedo-shaped insects whose wings fold roof-like when resting. Similar in appearance to sharpshooters, though half the size. Large numbers cause stippling and a bleached look on leaf blades and chlorosis. They also excrete honeydew indicated by a black sooty mold on the leaf. The damage often looks like that of mites or aphids.

They develop through three distinct life stages; eggs, nymphs and adults. Adult females insert eggs into leaf tissues where eggs hatch and nymphs develop through 5 increasingly larger instars until developing into adults.

Yield loss has not been documented.

### Management—chemical control

- bifenthrin (Brigade 2EC and WSB) at 0.1 lb ai/A. Apply in spring and fall when aphids are seen. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed.
- cyfluthrin (Baythroid XL) at 0.013 to 0.015 lb ai/A. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. REI 24 hr. PHI 7 days. Do not exceed 0.045 lb ai/A per season. IRAC group 3.  
**Restricted use pesticide.**
- lambda-cyhalothrin (Warrior II and others) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. IRAC group 3.

- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- malathion at 0.9375 to 1.25 lb ai/A. PHI 0 days. REI 12 hr. Maximum single application rate is 1.25 lb ai/A. Maximum one application of malathion allowed per year.
- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw and seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days.

## Grass seed—Leafminer

*Phytomyza nigra*

**Pest description and crop damage** This pest is most commonly in young stands. Visually, damage looks like pale-yellow lines moving vertically up the leaf. Very localized damage within a field may result in some seedling die-out. Larvae (small, white maggots) mine between the epidermal layers of grass blades. Moisture stress coupled with the chlorotic symptoms produced by the miner can kill seedling grasses.

### Management—biological control

Parasitic wasps often prey heavily on leafminer larvae. As a result, leafminer populations crash—a good biological control that suppresses quite a few future generations of the fly.

### Management—chemical control

Chemical control usually is not recommended. Dimethoate applied to control other pests on the grass seed label has been observed to give good control.

## Grass seed—March fly

*Bibio xanthopus*

**Pest description and crop damage** Adults are dark brown to black flies around 0.45 inch in length with reddish legs; smallish, dirty-looking, light brown to gray larvae (0.5 inch in length when mature in February or March) are quite common in western Oregon fields high in organic matter. They feed primarily on decaying organic matter and only incidentally on grass seedlings.

Heavy fall and winter rains that cause water to puddle force the larvae to the soil surface. Large numbers of these wiggling, squirming larvae roll into seed furrows, “heaving” the seedling plants. If a freeze follows soon afterward, seedling mortality can be high.

**Biology and life history** In late March and April of some years, flies, bright blue with orange legs, inundate western Oregon. Females scatter eggs randomly over soil surfaces, crop and non-crop alike. The eggs lie dormant through summer and early fall, hatching in unirrigated soils with the onset of fall rains. Larvae develop through February and March of the next year and then pupate. There is one generation per year.

### Management—cultural control

The following cultural practices may help in reducing damage.

- Prepare a fine seedbed and pack well.
- Close seed row at planting.
- Plant early. Well established seedlings tolerate more injury than smaller ones.

### Management—chemical control

None are registered for this site and use.

## Grass seed—Meadow plant bug

*Leptoterna dolabrata*

**Pest description and crop damage** Meadow plant bug adults are dirty yellow and dark brown, narrow, about 0.375 inch in length, with either short or long wings. They have an unpleasant odor. They suck plant

juices and reduce seed yields if abundant. They produce “silver top” by feeding on the stem just above the uppermost node.

#### **Management—cultural control**

Open field burns control this pest by killing any adults and nymphs present during burn. Most important, fire destroys the straw in which the eggs overwinter.

#### **Management—chemical control**

- bifenthrin (Brigade2EC and WSB) at 0.1 lb ai/A. Apply in spring and fall when insects are present at their economic threshold level. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed.
- cyfluthrin (Baythroid XL) at 0.02 to 0.022 lb ai/A. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.
- dimethoate (Dimethoate, Dimate) at 0.25 to 0.33 lb ai/A. REI 48 hr. Apply during boot stage. Do not graze or feed hay, forage, seed, or use screenings from treated fields. Seed conditioners must be informed if seed is from a treated field.
- zeta-cypermethrin (Mustang MAX) at 0.0175 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw & seed screenings. REI 12 hr. For forage & hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days.

## **Grass seed—Mite**

#### **Includes**

Banks grass mite (*Oligonychus pratensis*)

Brown wheat mite (*Petrobia lateans*)

Winter grain mite (*Penthaleus major*)

**Pest description and crop damage** These three mites are pests of many grasses and cereals east of the Cascades. Adults are tiny, brown to green, and have eight legs. Eggs are small, round or oval, white, and laid on leaves. Mites feed by puncturing and removing contents of epidermal cells of leaves. This results in a grayish cast to the field. Individual leaves are “stippled.” Large populations of Banks grass mite build through the summer, having four or five generations before harvest. Timothy and bluegrass can be injured. Seed yield losses up to 50% have been reported under heavy infestations. Adult winter grain mites are dark blue to black with orange-red legs. Infested fields look grayish or silvery due to the destruction of epidermal cells and removal of plant sap and chlorophyll. Large populations of mites may begin to build in late September and continue through the winter. Another generation is in the spring and may injure grasses through May before over-summering mite forms are produced and the population crashes. Seedling grasses can be stunted or die if large populations infest seedling stands in the fall and if the winter is exceptionally cold. In western Oregon, the incidence of this mite has increased greatly in grasses grown for seed, particularly in direct seed and no-till seedling fields. In the fall, direct seeding of grass into a previous grass crop provides seedling grasses for the mites to crawl on as the previous crop dies down. Seedling stands can be lost if the mites are not controlled at this stage.

**Biology and life history** Winter grain mite survives hot, dry summers in the egg stage. In early fall, the over-summering eggs hatch (late September to early October). Mites mature in about 2 weeks. Two or three generations occur in the fall and early winter when temperatures are above 40°F. In eastern Oregon, Washington, and Idaho, populations may continue to develop slowly through the winter, under insulating snow cover. Damaging populations usually peak in late November. A second and third population peak can be from late winter through early spring.

**Scouting and thresholds** Inspect fields in October and November for presence of mites. On bright and/or windy days, mites usually are not on grasses; instead, they are in or on the soil, in soil cracks and crevices and along roots. From dusk until dawn on still evenings and on cloudy, overcast days, they feed on the leaves’ epidermal cells.

No thresholds are established in grasses grown for seed. If the field generally looks off-color, grayish, or chlorotic, determine whether mites are the cause and treat accordingly.

#### **Management—chemical control**

- bifenthrin (Brigade 2EC and WSB) at 0.1 lb ai/A. Apply when mites appear, generally late-winter and early spring. Maximum amount allowed is 0.2 lb ai/A per season but no more than once every 14 days. PHI 30 days prior to harvest for forage, hay and seed.

- lambda-cyhalothrin (Warrior II and others) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Suppression only. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Suppression only. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.
- **Note:** dimethoate and chlorpyrifos (Lorsban Advanced), although effective for control of winter grain mite, do not satisfactorily control these two species.

## Grass seed—Sawfly

*Dolerus nitens*

*Pachynematus setator*

**Pest description and crop damage** Adults are predominantly black with brownish legs and markings on the body. They are not “true” flies, but are related to wasps. The female’s abdomen is distended greatly at emergence, and the intersegmental membrane is translucent greenish blue. Eggs are small and green at first, but after about a week they turn yellow, and the plant tissue around them turns dark reddish brown.

Larvae look like “many-legged” armyworms, except that the sawflies have three sets of larger true legs on the first three segments and eight sets of smaller prolegs on most proceeding segments of the abdomen. Armyworms, cutworms, and most caterpillars have prolegs only on abdominal segments 3, 4, 5, and 6. Early instars are pale yellowish green but turn gradually to a vivid green (around 0.75 inch in length at final instar). The pupae are green, gradually darkening with age. They are found at the soil surface around the periphery of plant crowns.

The larval stage is most damaging when feeding on leaves and chewing through stems, resulting in the loss of the entire seed head; or, if the stem is not entirely severed, harvested seeds are usually sterile.

**Biology and life history** Adults emerge in April. Mating is within 1 or 2 days, and the females begin laying eggs on leaves. The eggs hatch in 7 to 10 days, and the larvae feed for 3 to 4 weeks while going through several instars. The larvae drop to the ground and spin cocoons on the soil in the duff. They remain in and on the soil until spring. There is one generation per year.

### Biological and cultural control

Parasitic wasps are key in preventing sawflies from reaching economically damaging levels. Scouting in early May can determine if larvae will be economically damaging. Also, spring tillage prior to planting can reduce populations of larvae in soil and reduce pest pressure.

### Management—chemical control

- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. REI 24 hr. PHI 7 days. Do not exceed 0.045 lb ai/A per season. IRAC group 3.  
**Restricted use pesticide.**
- lambda-cyhalothrin (Warrior) at 0.02 to 0.03 lb ai/A. PHI 7 days for seed crop. REI 24 hr. IRAC group 3.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole per acre per year.

Field experience has shown that carbaryl or any of the pyrethroids as applied to control armyworm give good control.

## Grass seed—Silvertop

**Pest description and crop damage** “Silvertop” is a condition in grasses in which the seed head turns white and dries off before some or all seeds develop. Silvertop is most noticeable in fine-leaf grasses (bluegrasses, bents, and fine fescues). It can be the result of weather, poor pollination, insect damage, and/or disease.

In western Oregon, meadow plant bug and thrips can produce silvertop symptoms in fine-leaf grasses when feeding activity injures plant tissue essential to normal seed development and maturity. Silvertop

produced by meadow plant bug can be distinguished by injury to the stem below the seed head. The stem kinks and withers where the insect's mouth parts were inserted.

In annual ryegrass, silvertop is caused by larva of the cereal stem moth, which bores into and damages the conductive tissues transporting nutrients to the seed head.

#### **Management—chemical control**

See meadow plant bug, grass mealybug and thrips for managing these pests when they are the causal agents of silvertop in grass seed fields.

### **Grass seed—Slug**

Brown-banded Arion slug (*Arion circumscriptus*)

Marsh slug (*Deroceras laeve*)

Gray garden slug (*Deroceras reticulatum*)

**Pest description and crop damage** Land mollusks that feed on various plants, damaging roots, crowns, leaves, and fruit.

#### **Management—chemical control**

- iron phosphate (Sluggo) granule bait at 1.0 to 1.5 lb ai/A. No PHI or REI. Control is usually optimized when warm, overcast conditions follow application.
- metaldehyde 3%, 3.5%, 4%, and 7.5% granule bait. Application rates vary by product labels. Consult the product label for appropriate application rate. Control is usually optimized when warm, overcast conditions follow application.
- metaldehyde (Slug-Fest) Apply 0.771 lb ai/A (47 fl oz/A) in sufficient water for thorough coverage or ten gallons of water per treated 1,000 sq ft. Apply a maximum of 4 applications per season with at least 21 days between applications. Withhold heavy watering for at least 2 days after treatment.
- sodium ferric EDTA (Ironfist, Ferrox) granule bait at 0.25 to 1.0 lb ai/A. No PHI or REI. Control is usually optimized when warm, overcast conditions follow application.

See:

Slug Control

### **Grass seed—Sod webworm (cranberry girdler)**

*Chrysoteuchia topiaria*

**Pest description and crop damage** Moths have protruded snouts projecting from the head. Moths are about 0.33 inch in length with colorful iridescent scales on the wings and body. Eggs are scattered on plant crowns and the soil surface.

Larvae are creamy white or pinkish with a light brown head. Small hooks on the abdominal prolegs are in circles or ovals, distinguishing them from armyworms or cutworms whose hooks are in a line. Larvae feed on and in crowns and roots of most grasses and can seriously injure established stands wherever grass is grown for seed.

**Biology and life history** Moths fly from June through July. A smaller flight is noted in the fall in some years. Larvae feed on crowns from late June through late October to early November. Most larvae have finished feeding and are in cocoons by late October. Pupae form the next spring, and moths emerge shortly thereafter. This species has one generation a year. Other species of sod webworm whose larvae feed in the fall and may continue feeding in the spring prior to pupating may also infest grasses.

**Sampling and thresholds** Pheromone traps baited with cranberry girdler pheromone can be used to monitor populations of moths. Place two to four traps at canopy height in fields beginning in mid-June. Larval injury has been noted when captures exceed 50 to 75 moths per trap in any 5-day period (usually June 20 to July 15 in western Oregon). Sample for larvae in early September to determine the need for control. From two to six per crown can result in damage.

#### **Management—biological and cultural control**

- Diseases and bird predation significantly reduce larval populations from October through March. Unfortunately, these natural controls usually occur after most damage has been done.



- Endophyte-containing turf varieties of grasses may help reduce populations.

#### Management—chemical control

Larval control—Apply insecticides in September with irrigation (western Oregon) when larvae are small and easier to control. Applications in late October and later are not effective, as most of the population has ceased feeding and begun dormancy in cocoons. Dryland grass production: rainfall at application is absolutely necessary for these products to be effective on this pest. Otherwise product does not reach larvae to control them.

- bifenthrin (Brigade 2EC and WSB) at 0.1 lb ai/A. Apply in early fall and/or spring when larvae are active. Best results are achieved with 25 to 40 gal spray solution per acre followed by irrigation or rainfall. Maximum amount allowed is 0.2 lb ai/A per season but no more than once every 14 days. PHI 30 days prior to harvest for forage, hay and seed.
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. REI 24 hr. PHI 7 days. Do not exceed 0.045 lb ai/A per season. IRAC group 3.  
**Restricted use pesticide.**
- cyfluthrin (Baythroid XL) at 0.0125 to 0.022 lb ai/A. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.
- lambda-cyhalothrin (Warrior) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year.
- zeta-cypermethrin (Mustang Maxx, and Mustang) at 0.028 to 0.05 lb ai/A Mustang and at 0.014 to 0.025 lb ai/A for Mustang MAXX. PHI 7 days for seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season; make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season; make subsequent applications no closer than 17 days. IRAC group 3A.

### Grass seed—Thrips

*Anaphothrips obscurus* and others

**Pest description and crop damage** Small, winged or wingless, narrow insects about 0.06 inch in length. If winged, the insect has four wings with a characteristic “hair” fringe margin. Thrips feed by rasping the surface of the leaves with their mouthparts and sucking up the exuding plant juices. This whitens, yellows, or stipples leaves. Eggs are inserted into stems. Thrips cause “silvertop” in certain fine-leaf grasses when large numbers lay eggs in stem tissue of seed heads during and shortly after boot stage.

**Biology and life history** Adults overwinter in and around grass seed fields. They become active in the spring and lay eggs in host plant tissues. There are many generations per year.

**Scouting and thresholds** Inspect susceptible varieties as heads approach boot stage. Large numbers of thrips (25 per head) probably result in silvertop symptoms in fine-leaf grasses.

#### Management—chemical control

- bifenthrin (Brigade 2EC and WSB) at 0.1 lb ai/A. Apply in spring and fall when insects are present at their economic threshold level. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed.
- carbaryl (Carbaryl, Sevin) at 1 to 1.5 lb ai/A. PHI 14 days. REI 12 hr. Up to two applications per year but not less than 14 days apart. Do not exceed 3 lb ai/A per season. Use high pressure to improve spray penetration into boot.
- cyfluthrin (Baythroid XL) at 0.02 to 0.022 lb ai/A. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.
- gamma-cyhalothrin (Declare) at 0.01 to 0.015 lb ai/A. REI 24 hr. PHI 7 days. Do not exceed 0.045 lb ai/A per season. IRAC group 3.  
**Restricted use pesticide.**
- dimethoate at 0.25 to 0.33 lb ai/A. PHI 14 days. Do not graze or feed hay, forage, seed, or use screenings from treated fields. Seed conditioners must be informed if seed is from a treated field.
- lambda-cyhalothrin (Warrior) at 0.02 to 0.03 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year.

## Grass seed—Winter cutworm

*Noctua pronuba*

**Pest description and crop damage** Adults, commonly called large yellow underwing moths, are large (2-inch wingspan) and polymorphic, though consistently dull gray to dark reddish-brown with black markings on the upper surface of the forewing. When at rest, the hindwing (or underwing) is most distinguishable by its bright yellow to orange color with a dark band along the outer margin.

Eggs are ribbed and reticulate, and are laid in flat clusters that may be difficult to find on weed or crop foliage. They are cream in color initially, but darken to yellow as they develop. Eggs require 2 to 4 weeks to hatch, depending on conditions.

Winter cutworms are 0.125 to 2 inches in length depending on developmental stage. Coloration of larvae progresses with development, changing from greenish-gray to dark brown larvae. All larvae are characterized by dark brown/black hash marks along the sides and back, becoming more prominent toward the posterior end of the abdomen. White or cream lateral stripes run the length of the body. The light brown head capsule has a black upside-down “Y” with two black, angled lines.

The pupae are reddish-brown, about 1 inch in length, and found hidden in cavities under the soil and debris about 2-3 inches. They are difficult to identify because of the close similarities to other Noctuid species in this pupal stage, especially armyworm and other cutworm species.

Above-ground crop damage occurs when larvae chew/notch leaves, or chew through stems completely at ground level (mowing). Root feeding has also been observed.

**Biology and life history** Winter cutworm was first detected in Oregon in 2001, and was recently reported in high numbers in 2015, feeding on many crops including grass seed fields, cover crops, grass pastures, lawns, meadows, sod, golf course collars, the approach to putting greens, foliage of vegetables, and weeds. Periodic outbreaks have occurred, though the environmental conditions leading up to outbreaks are not well understood.

The adults are strong fliers, can migrate, and are able to disperse over long distances. Females will lay as many as 2,000 eggs over the reproductive lifespan, on both plant and non-plant surfaces, making detection difficult.

Larvae have a wide plant host range and cause a considerable amount of feeding damage to crops in a short amount of time. The caterpillars are gregarious, similar to armyworms, feeding and moving across the landscape in large groups. They are primarily night feeding, which makes detection difficult during the day. Winter cutworm is tolerant to cold temperatures, actively feeding September through March when temperatures are above freezing. Mature larvae will pupate in the early spring, while less mature larvae will continue feeding into the spring before pupating.

**Sampling and thresholds** Field borders should be checked regularly for the presence of larvae – search vegetation for notching, crown damage, or plants cut through the stem at the soil level. Within fields, look for low-lying irregular patches of plant damage. If damage is found, search the soil around the damaged plants to a depth of about 2 to 3 inches for resting larvae. Cutworms are often visible at the soil surface when present, but may burrow under leaf litter or under soil clods to rest during the day. Larvae will often curl into a characteristic C-shape when disturbed.

There are no established thresholds for winter cutworm in grass seed crops, but recommendations for armyworm management suggest thresholds of 1-2 larvae per sq ft in newly planted fields and 3 to 4 larvae per sq ft in mature stands. Hay and grass pastures can tolerate as many as 4-6 larvae per sq ft.

Moths are active at night and can be monitored with basic light traps.

### Management - Cultural control

- Removing border vegetation and plant residues can limit the availability of egg deposition sites and alternate food sources for larvae
- Tilling exposes and kills overwintering and early spring pupae before planting

### Management - Biological control

Populations of noctuid moths are generally kept under control by a number of natural enemies that include parasitic wasps (*Trichogramma* species and braconid wasps), parasitic flies in the family Tachinidae, nematodes and several bacterial and viral pathogens. Natural predators will feed on cutworms readily, including predaceous ground beetles, birds and rodents. However, the impact of these natural predators on cutworm populations in Pacific Northwest production systems is unclear.

### Management - Chemical control

In general, the smallest, least mature larval stages are most susceptible to control using an insecticide. When applying, rain may help move insecticides into the soil where larvae may be resting, but too much rain will move it too deep to target cutworms. When possible, apply pesticides late in the day to increase exposure to night-feeding larvae.

- bifenthrin (Brigade 2EC and WSB and others) at 0.1 lb ai/A. Apply in spring and fall when insects are present at their economic threshold level. Maximum amount allowed is 0.2 lb ai/A per season. Applications made no less than 14 days apart. PHI 30 days prior to harvest for forage, hay and seed.
- cyfluthrin (Baythroid XL) at 0.013 to 0.015 lb ai/A. Recommended on 1st and 2nd instar larvae only. PHI 0 days. REI 12 hr. Maximum amount allowed per 5-day interval is 0.022 lb ai/A. Maximum amount allowed per crop season is 0.089 lb ai/A.
- lambda-cyhalothrin (Warrior) at 0.015 to 0.025 lb ai/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr.
- lambda-cyhalothrin/chlorantraniliprole (Besiege) at 5.0 to 8.0 fl oz/A. PHI 0 days for grazing and cut for forage, 7 days for straw and seed crop. REI 24 hr. Do not exceed a total of 27.0 fl oz of Besiege or 0.09 lb ai of lambda-cyhalothrin-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year.
- spinosad (Blackhawk) at 0.025 to 0.050 lb ai/A per season. PHI 0 days graze, 3 days hay. REI 4 hr.
- spinosad (Success or Entrust) at 0.031 to 0.062 lb ai/A. PHI 0 days forage, 3 days hay or fodder. REI 4 hr. For resistance management, do not apply Success more than three times in any 21-day period. Do not exceed 0.186 lb ai/A per season. Do not make more than six applications per season. Entrust is the formulation that appears on the OMRI list for organic production. (Supplemental label).
- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 0 days forage, hay; 7 days straw and seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season, make subsequent applications no closer than 7 days. For straw and seed screenings. IRAC group 3A.

## Grass seed—Wireworm (click beetle)

Dryland wireworm (*Ctenicera pruinina*)

Pacific coast wireworm (*Limonius canus*)

Sugarbeet wireworm (*Limonius californicus*)

**Pest description and crop damage** Adults are hard-shelled, slender beetles called click beetles. They range in color from tan to very dark brown and are 0.3 to 0.5 inch in length. They appear in the spring and summer months. Larvae are the damaging stage. They are yellow-brown and up to 0.5 inch in length. Larvae have three pairs of legs. The last segment of the body is usually pronged or forked at the end. Larvae feed on the roots and into the crowns of plants, killing them or severely stunting growth.

Wireworm-damaged seedling stands often appear yellow, and plants eventually brown and die. Symptoms are apparent in the fall. Occasionally, summer-seeded grass seed is damaged before emergence, and there will be long lines of empty seed furrows.

**Biology and life history** Adult beetles appear in late spring through summer. Females lay many hundreds of eggs in both fallow and crop land. Eggs hatch in 3 to 4 weeks. Larvae usually infest non-irrigated grass seed land and can live in soil up to 3 years.

**Sampling and thresholds** Dig deeply to find wireworm larvae. They migrate readily up and down the soil profile. After 2 or 3 inches of rain have fallen in September and early October, wireworm larvae often can be found feeding within the root systems and lower crowns of grasses.

### Management—chemical control

Effective soil-applied insecticides are not labeled for use on grasses grown. Preplant soil fumigation is used in high-value crops and suitable soils.

- azadirachtin/pyrethrin (Azera, Azera Pro) – Biological. See label rates as they vary for each product. REI 12 hr. PHI 0 days. Some products are OMRI listed for organic use.

- zeta-cypermethrin (Deadlock G) at 10 lb/A. Distribute granules evenly in the furrow at planting. Only one application is allowed per season. Maximum amount that can be applied is 10 lb/A per season. No rotation crops can be planted within 30 days of the last application. REI 12 hr.

**For more information:**

Pocket Guide to Grass Seed Pests and Beneficials: Identification, Monitoring, Management  
<https://extension.oregonstate.edu/catalog/pub/em9318>

# Meadowfoam Seed Crop Pests

Christy Tanner

*Latest revision—March 2025*

In all cases, **follow the instructions on the pesticide label**. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

**Protect pollinators:** See How to Reduce Bee Poisoning from Pesticides.

**Note:** Products are listed in alphabetical order and not in order of preference or superiority of pest control.

## Meadowfoam Grown for Seed—Meadowfoam fly

*Scaptomyza apicalis*

**Pest description and crop damage** A small fly in the fruit fly family occurs throughout the Willamette Valley in most commercial plantings. Larval infestations cause extensive damage to plant crowns and flower buds. Stand losses and reduced seed yields have been observed in heavily infested fields. Adults are about 3 mm (1/8 inch) long. Body color ranges from drab brown to gray. Eyes are red. Eggs are very small, white, and somewhat elliptical. When flower buds are present, flies insert eggs almost exclusively into these buds. During the vegetative growth stage, however, they will lay eggs in plant leaves, stems, and crowns. Eggs hatch in 7 to 10 days. The larvae are light-colored and about 3 mm long at maturity.

**Pest biology** A few flies can be found in meadowfoam fields when seedlings emerge in the fall. Beginning in late January, populations increase rapidly. Three or four generations peak from late January through mid-June. Water availability seems to govern adult MFF activity and population size. Few adults are seen from late June through August as fields mature and dry out. Eggs are laid singly anytime adults are active; the peak egg-laying period usually occurs from mid-January through April. The first larvae are usually detected in January in small, yellowish, distorted plants. The number of larvae increases sharply after mid-February and peaks in April. Few larvae are found in plants after bloom.

**Scouting and thresholds** MFF adults are monitored with unbaited yellow sticky cards. In mid-January, place traps within fields and near field borders. The bottom of the sticky card should be just above canopy height, but high enough to avoid mud splashes in seedling stands. Use approximately one trap for every 3 acres. Inspect traps weekly from mid-January to April. Meadowfoam plants infested with MFF larvae are weak, stunted, and yellowish. A hand lens or microscope often is necessary to see the smaller larvae. Berlese funnels are used to quantify larval infestations. Apply insecticide when average daily fly counts on sticky traps increase from less than one per trap per day to four or more per trap per day. Cold, rainy, and windy weather reduces trap catches even when MFF is abundant: do not underestimate fly counts.

### Management—chemical control

Control of larval infestations in individual fields and test plots does not always increase seed yield. Replicated trials indicate a benefit from a midwinter (late February) broadcast insecticide application on fields at risk of heavy infestations. This application reduces significant fly infestations and increases the potential for a boost in seed yield.

The following insecticide labels are for Oregon only.

- bifenthrin (Brigade 2EC) at 0.1 lb ai/A or 6.4 oz. Apply as a broadcast spray at 20 gal minimum by ground, or 10 gal minimum by air. REI

12 hr. Do not apply more than 0.2 lb. ai/A or make more than two applications per year. Do not make an application after the bloom begins. Do not graze livestock in treated areas or cut treated crops for feed. Do not apply through chemigation. SLN No. OR-070012. Oregon only.

- dimethoate (Dimethoate 400) at 0.5 lb ai/A (1 pint) as a broadcast spray. For ground applications, apply in a minimum of 20 gallons. Aerial application is permitted. Do not apply after crop begins to bloom. REI 48 hr. SLN OR-050020. Oregon only.

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# Pests of Sugar Beet Grown for Seed

Erik J. Wenninger and Anastasia Stanzak

*Latest revision—March 2025*

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In all cases, **follow the instructions on the pesticide label**. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

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Pesticides registered for pest control on a given vegetable crop can also be used for that vegetable's seed crop, unless prohibited. For pesticide recommendations in addition to those listed below, see the appropriate vegetable section in this handbook.

**Important notice** Several pesticides with 24c SLN (Special Local Need) registrations for use on seed crops lack legal tolerances established for pesticide residues that may be on the seed, screenings, or hay at harvest. Therefore, certain seed grower associations in Washington, Oregon, and Idaho have declared, through their respective state departments of agriculture, that the crop produced for seed in those states is a *nonfood crop*. This declaration means that none of the seed, screenings, hay, or sprouts produced from harvested seed will be available for human or animal consumption when these pesticides have been applied. The grower must notify the seed processing plant in writing of *any* seed treated with these pesticides. Processed seed must be labeled: "This seed was produced using one or more products for which the United States Environmental Protection Agency has not established pesticide residue tolerances. This seed, in whole, as sprouts, or in any form, may violate requirements of the Federal Food and Drug Administration, the Oregon Department of Agriculture and other regulatory agencies."

**Protect pollinators:** See How to Reduce Bee Poisoning from Pesticides.

**Note:** Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

## Sugar beet seed—Aphid

Green peach aphid (*Myzus persicae*)

**Pest description and crop damage** The green peach aphid is yellowish green and teardrop-shaped. Most damaging as a vector of virus diseases rather than by feeding injury through sucking sap.

### Management—chemical control

See Table 1.

## Sugar beet seed—Garden symphylan

*Scutigerella immaculata*

**Pest description and crop damage** Active, white, fragile, centipede-like arthropod soilborne relatives of insects, 0.25 inch long, with 12 or more pairs of legs. This pest moves vertically in the soil and will cause root damage to new steckling and seedlings once temperatures reach 45 degrees Fahrenheit. They damage sugar beet primarily early in the season by feeding on germinating seed or on small root hairs of steckling beets. Symphylans are in unpredictably spotty infestations and can be scouted for by placing potato baits throughout field to identify hot spots. Treatment may be necessary as in-furrow incorporation in fields with a history of symphylan issues prior to planting seed or steckling transplant.

### Management—chemical control

No formal economic thresholds exist for insecticide treatment decisions. No effective "rescue" treatments for symphylans can be applied postemergence in sugar beet seed fields. Only ethoprop, labelled for at-plant application, is registered.

## Sugar beet seed—Slug

Various species

### Management—chemical control

See Table 1.

See also:  
Slug Control

Sugar beet seed—Two-spotted spider mite

*Tetranychus urticae*

Management—chemical control

See Table 1.

Table 1. Pesticides registered for arthropods and slugs in sugar beet grown for seed.

Active Ingredient	Trade Name	Aphids	Garden symphylan	Slugs	Two-spotted spider mite	Insecticide Group	Signal Word	REI	PHI (days)	24c SLN	SLN Expiration
ethoprop	Mocap EC		X			1B	D	48-72 h		OR-120006	12/31/2028
metaldehyde	Slugger 4.0, Metarex 4%, Deadline M-Ps			X			C	12 h		OR-140005; OR-140008	OR-140005: 12/31/28; OR-140008: 12/31/27
propargite	Comite				X	12C	D	9 days		OR-240008	12/31/2029
pymetrozine	Fulfill	X				9B	C	12 h		OR-180013	12/31/2028
thiamethoxam	Actara	X				4A	C	12 h	-	OR-070020, WA-130009	OR-070020: 12/31/2025; WA-130009: 12/31/27

All trade names may not be listed. The products that are listed are not in order of efficacy or preference. Always refer to the specific product label before making recommendations and/or applications.

X = labelled for control

Abbreviations: C = Caution; W = Warning; D = Danger. PHI = Pre-harvest interval. REI = Restricted entry interval.

Table 1. Table beet grown for seed.

Active ingredient	Trade Name	Aphids	Slug	Spider mite	Insecticide Group	Signal Word	REI	PHI (days)	24cSLN	SLN Expiration
bifenazate	Vigilant 4SC			X	20D	C	12 hr	14	WA=230009	12/31/2027
metaldehyde	Slugger 4.0		X			C	12 hr	30	OR-140004	12/31/2028
Propargite	Comite			X	12C	D	9 days		WA-040019	12/31/2025
pymetrozine	Fulfill	X			9B	C	12 hr		WA-190003	12/31/2024

All trade names may not be listed. The products that are listed are not in order of efficacy or preference. Always refer to the specific product label before making recommendations and/or applications.

X=labelled for control

Abbreviations: C=Caution, W=Warning, D=Danger. PHI = Pre-harvest interval. REI=Restricted entry interval.



# Pests of Vetch Grown for Seed

Nicole P. Anderson and Alison Willette

*Latest revision—March 2024*

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In all cases, follow the instructions on the pesticide label. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

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## Protect pollinators: See How to Reduce Bee Poisoning from Pesticide

**Note:** Products are listed in alphabetical order and not in order of preference or superiority of pest control.

## Vetch seed—Aphid

### Includes

Cowpea aphid (*Aphis craccivora*)

Pea aphid (*Acyrtosiphon pisum*)

**Pest description and crop damage** Pea aphid is the most common aphid on vetch. It is large, light green, and found on almost all legumes. Cowpea aphid is small and dark, almost black. Both pests feed by sucking plant juice. They build up quickly and stunt and yellow plants. Large populations of either aphid affect yield.

### Management—chemical control

- afidopyropen (Sefina) at 0.009 to 0.018 lb ai/A. PHI 0 days. REI 12 hr. Apply at first sign of aphid presences, and before population increases to damaging levels. Minimum retreatment interval 7 days. Do not exceed more than 0.05 lb ai/A per season. (supplemental label expires October 31, 2023)
- azadirachtin (Aza Direct, Debug, Azera Pro)—Several brands. See label for concentrations. REI 4 hr. Some formulation OMRI listed for organic production.
- malathion (Malathion 57 EC, Fyfanon 8 LB, and others) at 1 to 1.25 lb ai/A. PHI 7 days. REI 12 hr. Avoid applying spray on bloom. **Malathion is toxic to all bees.** To control pests when bloom is present, apply only in evening or early morning, when bees are not actively foraging in vetch. Always contact beekeeper before applying.
- zeta-cypermethrin (Mustang MAX, Mustang insecticide) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing. 7 days hay, seed. REI 12 hr. Retreatment interval 7 days. Do not exceed 0.025 lb ai/A per cutting nor 0.75 lb ai/A per season.

## Vetch seed—Armyworm and cutworm

Several species

**Pest description and crop damage** True (common) armyworm (*Mythimna unipuncta*, formerly *Pseudoletia unipuncta*) and variegated cutworm (*Peridroma saucia*) are the most common species in western Oregon. They are present from early bloom through seed set. Moths in the family Noctuidae have gray or brown forewings with slate or buff-color markings. Hind wings are silvery-gray or beige. Average wingspan is 1.4 to 1.6 inches. Mature larvae are about 1.5 to 2 inches long, tan to brown, with a faint white or red midline stripe on the top of the body. These are bordered below by a white stripe on each side. A prominent black stripe is along each side bordered below by an orange-brown stripe. Larvae have an inverted white Y on the front of the head. Pupae are brownish-red and found in the top soil layer, commonly near the crowns of host plants. Winter cutworms (*Noctua pronuba*) have been recently detected in vetch seed fields in western Oregon but significant damage has not been recorded.

**Sampling and thresholds** Look for armyworm and cutworm larvae around the base of vetch plants, where birds (swallows, crows) are feeding. Dig around in crop residue and at the base of plants. Armyworms and cutworms typically feed at night. Also look for frass (excrement) that resembles tiny grass pellets. Treat when larvae are less than 0.5 inch long and there are >1 per sq ft on seedling stands.

### Management—chemical control

- *Bacillus thuringiensis* (Bt)—Use according to label directions. For armyworms, effective only on first and second instar larvae. Some formulations are OMRI-listed for organic use.
- chlorantraniliprole (Vantacor) at 0.047 to 0.098 lb ai/A. PHI 0 days. REI 4 hr. Do not make more than 4 applications per calendar year. Do not apply more than 0.2 lb ai/A per calendar year. Can be applied in-furrow at planting or as an overhead foliar spray. Is most effective through ingestion of treated plant material. Apply at egg lay, egg hatch or when larvae are newly hatched. Armyworms only.
- malathion at 1 to 1.25 lb ai/A. PHI 7 days. REI 12 hr. Avoid applying spray on bloom. **Malathion is toxic to all bees.** To control pests when bloom is present, apply only in evening or early morning, when bees are not actively foraging in vetch. Always contact beekeeper before applying. Armyworms only.
- methoxyfenozide (Intrepid 2F, Withstand insecticide, etc.) at 0.06 to 0.16 ai lb/A. Do not exceed 0.5 lb ai per year. PHI 7 days for hay. No PHI for forage.
- spinosad (Entrust SC, Entrust Naturalite) at 0.31 to 0.62 lb ai/A. Not to exceed 0.186 lb ai/A. REI 4 hr. PHI 3 days for cutting. No PHI for grazing.
- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing; 7 days hay, seed. REI 12 hr. Retreatment interval 7 days. Do not exceed 0.025 lb ai/A per cutting nor 0.75 lb ai/A per season.

## Vetch seed—Omnivorous leaftier

*Cnephasia longana*

**Pest description and crop damage** Yellowish brown larvae with a brown head and light stripes on each side of the back. They web terminal leaves and feed on terminal growth.

### Management—chemical control

- *Bacillus thuringiensis* (Bt)—PHI 0 days. REI 12 hr. Use as label directs. Some formulations are OMRI-listed for organic use.
- malathion at 1 to 1.25 lb ai/A. PHI 7 days. REI 12 hr. Avoid applying spray on bloom. **Malathion is toxic to all bees.** To control pests when bloom is present, apply only in evening or early morning, when bees are not actively foraging in vetch. Always contact beekeeper before applying.
- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing, 7 days for hay and seed. REI 12 hr. Retreatment interval 7 days. Do not exceed 0.025 lb ai/A per cutting nor 0.75 lb ai/A per season.

## Vetch seed—Pea leaf weevil

*Sitona lineata*

**Pest description and crop damage** Adults are small, grayish brown, faintly striped, and about 0.17 inch long. They appear in large numbers in spring, and sometimes again in late summer. If adult feeding on seedling plants in spring causes considerable leaf notching, chemical control may be necessary.

### Management—chemical control

No products are labeled for this specific use. However, when Mustang MAX is applied to control other pests, pea leaf weevil is controlled if present.

- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 0 days forage and hay, 7 days straw and seed screenings. REI 12 hr. For forage and hay use no more than 0.10 lb ai/A per season and make subsequent applications no closer than 7 days. For straw and seed screenings use no more than 0.125 lb ai/A per season and make subsequent applications no closer than 7 days.

## Vetch seed—Slug

Gray garden slug (*Deroceras reticulatum*) and others

**Pest description and crop damage** Land mollusks that feed on various plants, damaging roots, crowns, leaves, and fruit. Snails and slugs are nocturnal and generally feed during the night damaging many varieties of plants and plant seedlings. They inhabit damp, moist areas around decaying refuse, organic matter, and hide at the base of growing plants. Their presence can be detected by the shiny trails left on the soil surface.

### Management—chemical control

- iron phosphate (Bug-N-Sluggo) granule bait at 1.0 to 1.5 lb ai/A. No PHI or REI. Control is usually optimized when warm, overcast conditions follow application.
- metaldehyde 4% (Deadline M-Ps, Metarex, Slugger 4.0, Slugger Ultra 4.0, Lock Out TKO the Knockout) granule bait at 0.4 to 1.2 lb ai/A. Control is usually optimized when warm, overcast conditions follow application. 24c SLN: OR-140008, OR-140005, OR-140004A, OR-140004C, OR-140004D, OR-140004E. Oregon only.
- sodium ferric EDTA (Despot Snail and Slug, FerroxAQ) granule bait at 0.25 to 1.0 lb ai/A. No PHI or REI. Control is usually optimized when warm, overcast conditions follow application.

## Vetch seed—Vetch bruchid

*Bruchus brachialis*

**Pest description and crop damage** A small, dark weevil, 0.12 inch long, that resembles the pea weevil but is only half as large. These weevils are almost always in western Oregon vetch seed crops and require control. They move into hairy vetch varieties at first bloom and lay eggs on new pods. Larvae hatch in 7 to 10 days, burrow through the seed pod, and destroy developing seeds. All hairy vetch varieties are susceptible to damage. Note: This weevil does not infest the seeds of plain or smooth vetch varieties.

### Management—chemical control

Apply insecticides shortly after the first pods appear and when eggs are seen on them in order to kill adults before they begin to lay eggs in large numbers. Once eggs are on pods, it is too late to prevent weevil infestation of seeds.

- malathion at 1 to 1.25 lb ai/A. PHI 0 days. REI 12 hr. Malathion does not kill eggs and lacks sufficient residual activity to kill larvae hatching from these eggs and entering pods. Avoid applying spray on bloom. **Malathion is toxic to all bees.** To control pests in blooming crop, apply only in evening or early morning, when bees are not actively foraging in the vetch. Always contact beekeeper before applying.
- zeta-cypermethrin (Mustang MAX) at 0.014 to 0.025 lb ai/A. PHI 3 days for cutting or grazing; 7 days hay, seed. REI 12 hr. Retreatment interval 7 days. Do not exceed 0.025 lb ai/A per cutting nor 0.75 lb ai/A per season.