

Legume, Grass, and Field Seed Crops

Pests of Alfalfa Grown for Seed

Doug Walsh

Latest revision—March 2018

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.

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 growers associations in Washington, Oregon, Idaho, Wyoming and Nevada have declared, through their respective state departments of agriculture, that alfalfa produced for seed in those states is a nonfood crop. This declaration means that none of the seed, screenings, or hay will be available for human or animal consumption when special nonfood pesticides 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.

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.

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.

Management—chemical control

- ◆ bifenthrin (Brigade 2E/Cor Discipline 2EC) at 0.06 to 0.1 lb ai/a. REI 12 hr. Do not apply more than three times per season or at intervals less than 21 days. May not be used for hay, forage, or human consumption. Do not apply at ground level within 25 ft of aquatic habitat, 150 ft if applied by air. 24c SLN ID-070009 and 040009; OR-070011 and 040039; WA-070015 and 040027.

- ◆ dimethoate 4EC 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.
- ◆ 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.
- ◆ indoxacarb (Steward EC) at 0.065 to 0.11 lb ai/a. PHI 7 days. REI 12 hr. 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 (Warrior) at 0.02 to 0.03 lb ai/a. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.03 lb ai/a per cutting or 0.12 lb ai/a per season. Do not apply on ground within 25 ft of aquatic habitat, 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.
- ◆ 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, 14 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.
- ◆ zeta-cypermethrin (Mustang Max) at 0.014 to 0.025 lb ai/acre. 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 season. 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

- ◆ bifenthrin (Brigade 2EC or Discipline 2EC) at 0.06 to 0.1 lb ai/a. REI 12 hr. Do not apply more than three times per season or at intervals less than 21 days. May not be used for hay, forage, or human consumption. Do not apply at ground level within 25 ft of aquatic habitat, 150 ft if applied by air. 24c SLN ID-070009 and 040009; OR-070011 and 040039; WA-070015 and 040027.
- ◆ dimethoate 4EC at 0.25 to 0.5 lb ai/a. PHI 10 days. REI 48 hr. For suppression of alfalfa weevil only. Do not apply if crop or weeds are in bloom. Do not feed or graze livestock.
- ◆ endosulfan (Thionex 3EC) at 1 lb ai/a. (spotted alfalfa aphid) PHI 21 days. REI 24 hr. Do not apply more than twice per season. Do not graze treated fields or feed treated forage, crop residue, or seed millings. SLN ID-030004; OR-030016; WA-030024; NV-030001; UT-030003.
- ◆ flonicamid (Beleaf) 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 (Warrior) at 0.02 to 0.03 lb ai/a. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not apply on ground within 25 ft of aquatic habitat, 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.
- ◆ malathion 8EC at 0.75 to 1 lb ai/a. PHI 0 days. REI 12 hr. Not effective below 65°F.
- ◆ methidathion (Supracide 2E) at 0.5 to 1 lb ai/a. PHI 28 days. REI 3 days. No portion of the field may be used for feed. Idaho and Oregon only. SLN ID-000005; OR-000010.
- ◆ 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, 14 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.
- ◆ 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.
- ◆ zeta-cypermethrin (Mustang) at 0.014 to 0.25 lb ai/a. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Do not reapply at less than 7-day intervals or exceed 0.05 lb ai/a per cutting or 0.15 lb ai/a per season. 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 considerably 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 at 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 0.065 lb ai/acre. 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.
- ◆ chlorantraniliprole/lambda-cyhalothrin (Voliam Xpress) at 5 to 8 fl. oz/a. PHI 1 day for forage and 7 days for hay. REI 24 hr. Minimum of 5 days between applications. Do not exceed a total of 31.0 fl oz of Voliam Xpress or 0.12 lb ai of products containing lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole-containing foliar products per acre per growing season.
- ◆ 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 (Warrior) at 0.02 to 0.03 lb ai/a. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.03 lb ai/a per cutting or 0.12 lb ai/a per season. Do not apply on ground within 25 ft of aquatic habitat, 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.
- ◆ 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.
- ◆ 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, 14 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.
- ◆ zeta-cypermethrin (Mustang) at 0.035 to 0.05 lb ai/a. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Do not reapply at less than 7-day intervals or exceed 0.05 lb ai/a per cutting or 0.15 lb ai/a per season. 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 (Warrior) at 0.02 to 0.03 lb ai/a. PHI 1 day for forage, 7 days for hay. For adult control only. Do not exceed 0.12 lb ai/a per season. 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—Cutworm

Most common species:

Army cutworm (*Euxoa auxiliaries*)
 Clover cutworm (*Scotogramma 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.
- ◆ chlorantraniliprole (Coragen) at 0.045 to 0.065 lb ai/acre. 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.
- ◆ chlorantraniliprole/lambda-cyhalothrin (Voliam Xpress) at 5 to 8 fl. oz/a. PHI 1 day for forage and 7 days for hay. REI 24 hr. Minimum of 5 days between applications. Do not exceed a total of 31.0 fl oz of Voliam Xpress or 0.12 lb ai of products containing lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole-containing foliar products per acre per growing season.
- ◆ 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 (Warrior) at 0.015 to 0.025 lb ai/a. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.03 lb ai/a per cutting or 0.12 lb ai/a per season. Do not apply on ground within 25 ft of aquatic habitat, 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.
- ◆ 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, 14 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.
- ◆ zeta-cypermethrin (Mustang) at 0.028 to 0.05 lb ai/a. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between treatments. Do not exceed 0.05 lb ai/a per cutting or 0.15 lb ai/a per season. 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

- ◆ 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 4EC at 0.25 to 0.5 lb ai/a. PHI 10 days. REI 48 hr. Do not feed any crop portion within 10 days of treatment. Do not apply during bloom.
- ◆ 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 (Warrior) at 0.02 to 0.03 lb ai/a. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.03 lb ai/a per cutting or 0.12 lb ai/a per season. Do not apply on ground within 25 ft of aquatic habitat, 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.
- ◆ 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.
- ◆ *Nosema locustae* (Nolo Bait)—PHI 0 days. Use as directed.
- ◆ zeta-cypermethrin (Mustang) at 0.035 to 0.05 lb ai/a. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between treatments. Do not exceed 0.05 lb ai/a per cutting or 0.15 lb ai/a per season. 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.
- ◆ chlorantraniliprole (Coragen) at 0.045 to 0.065 lb ai/acre. 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.
- ◆ chlorantraniliprole/lambda-cyhalothrin (Voliam Xpress) at 5 to 8 fl. oz/a. PHI 1 day for forage and 7 days for hay. REI 24 hr. Minimum of 5 days between applications. Do not exceed a total of 31.0 fl oz of Voliam Xpress or 0.12 lb ai of products containing lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole-containing foliar products per acre per growing season.

- ◆ 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 (Warrior) at 0.015 to 0.025 lb ai/a. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.03 lb ai/a per cutting or 0.12 lb ai/a per season. Do not apply on ground within 25 ft of aquatic habitat, 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.
- ◆ 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, 14 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.
- ◆ zeta-cypermethrin (Mustang) at 0.028 to 0.05 lb ai/a. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between treatments. Do not exceed 0.05 lb ai/a per cutting or 0.15 lb ai/a per season. 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 (Warrior) at 0.02 to 0.03 lb ai/a. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.03 lb ai/a per cutting or 0.12 lb ai/a per season. Do not apply on ground within 25 ft of aquatic habitat, 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.
- ◆ malathion 8EC at 0.75 to 1.25 lb ai/a. PHI 0 days. REI 12 hr. Not effective below 65°F.
- ◆ methidathion (Supracide 2E) at 0.5 to 1 lb ai/a. PHI 28 days. REI 3 days. No part of treated field may be used as feed. Lower rates are recommended in new seed-growing areas to help prevent developing insecticide resistance. Idaho and Oregon only. SLN ID-000005; OR-000010.
- ◆ 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, 14 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.
- ◆ zeta-cypermethrin (Mustang) at 0.035 to 0.05 lb ai/a. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between treatments. Do not exceed 0.05 lb ai/a per cutting or 0.15 lb ai/a per season. 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. Use bifenthrin (Capture 2EC). Naled (Dibrom) is not recommended during early season if leafcutting or alkalai bees are active. Capture 2EC (bifenthrin) at the lower label rate tends to be least destructive to beneficials.

- ◆ bifenthrin (Brigade 2EC or Discipline 2EC) at 0.06 to 0.1 lb ai/a. REI 12 hr. Do not apply more than three times per season or at intervals less than 21 days. May not be used for hay, forage, or human consumption. Do not apply at ground level within 25 ft of aquatic habitat, 150 ft if applied by air. 24c SLN ID-070009 and 040009; OR-070011 and 040039; WA-070015 and 040027.
- ◆ dimethoate 4EC at 0.25 to 0.5 lb ai/a. PHI 10 days. REI 48 hr. 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.
- ◆ 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.

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 0.15EC) 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 hours. 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. SLN ID-98007; OR-040013; WA-980019.
- ◆ bifentazate (Acramite 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.
- ◆ etoxazole (Zeal) at 0.035 to 0.525 lb ai/acre. Do not apply more than 3 oz Zeal per acre per season or make more than one application per season. Apply by ground in a minimum of 20 gal per acre or by air at 10 gal per acre. Coverage is essential for good control. Use of higher water volume will assure better coverage. Best results are achieved when mite populations are low. Zeal is predominately an ovicide/larvicide and should be used early in the life cycle of mites.
- ◆ 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. SLN ID-070001; OR-070008; WA-060021.
- ◆ propargite (Comite) at 1.23 to 2.05 lb ai/a. REI 7 days. Do not feed. Do not exceed 1.6 lb ai/a in ground application. Ground application with 25 to 40 gal/a water gives best results. Use at least 10 gal/a water if applying by air. Do not apply in mixtures with insecticides; this increases hazard to pollinating bees. After the first 48 hours of the REI, workers may enter the treated area to perform hand labor if they wear the early-entry personal protective equipment. SLN ID-960016; OR-030020; WA-040019.
- ◆ Sulfur DF at 2.4 to 4 lb ai/a. PHI 0 days. REI 24 hr. Repeat every 14 days as necessary.
- ◆ 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 (Warrior) at 0.015 to 0.025 lb ai/a. PHI 1 day for forage, 7 days for hay. REI 24 hr. Do not exceed 0.03 lb ai/a per cutting or 0.12 lb ai/a per season. Do not apply on ground within 25 ft of aquatic habitat, 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.
- ◆ 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, 14 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.
- ◆ zeta-cypermethrin (Mustang) at 0.028 to 0.05 lb ai/a. PHI 3 days for cutting or grazing, 7 days for harvest. REI 12 hr. Allow at least 7 days between treatments. Do not exceed 0.05 lb ai/a per cutting or 0.15 lb ai/a per season. 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—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.

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/acre. 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.

Canola Pests

Dale Whaley

Latest revision—March 2018

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.

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 (AzaGuard) at 0.28 lb ai/gal. Spray 10 to 16 oz when pests first appear. Repeat application every 7 to 10 days. Use in combination with 0.25 to 1.0% non-phytotoxic crop oil in sufficient water to cover undersides of leaves.
- ◆ *Beauveria bassiana* GHA (Mycotrol O) at 0.5 to 1 qt/100 gal when pests first appear. REI 4 hr. Mycotrol O is most effective when used early, before high insect populations develop. Reapply as necessary under a pest management program that includes close scouting.
- ◆ bifenthrin (Bifen 2 AG Gold, 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 fl oz per season. Do not apply less than 14 days apart.
- ◆ chlorantraniliprole (Besiege, others) at 5.0 to 10.0 fl oz/a. 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 season. PHI 21 days. Minimum interval between applications is 5 days. If adjuvants are used, use only a non-ionic surfactant (NIS).
- ◆ chlorpyrifos (Whirlwind, others) at 1 to 2 pts/a. PHI 21. Do not make more than three applications of any product containing chlorpyrifos per crop. Do not make a 2nd application of Whirlwind or other products containing chlorpyrifos within 10 days of the first application.
- ◆ flonicamid (Beleaf 50 SG) at 0.089 lb ai/a. Do not apply more than 2.8 oz per acre or 8.4 oz/a per season. Do not apply more than 3 applications per season. Allow a minimum of 7 days between applications.
- ◆ gamma-cyhalothrin (Declare) at 0.015 lb ai/a. PHI 7 days. Do not apply more than 0.045 lb ai per acre per season.
- ◆ lambda-cyhalothrin (Warrior II with Zeon Technology) at 0.03 lb ai/a. Do not apply more than 0.09 lb ai/a per season. Do not apply within 7 days of harvest.

- ◆ sulfoxaflor (Transform WG) at 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 this product until after petal fall.
- ◆ zeta-cypermethrin (Mustang Maxx) at 4.0 fl oz/a (0.025 lb ai/a). PHI 7 days. Do not apply more than 24 fl oz of product (0.15 lb of ai) per acre per season. Do not make applications less than seven days apart.

Management—chemical control (Seed Treatment)

- ◆ thiamethoxam, difenoconazole, mefenoxam, fludioxonil and sedaxane (Helix Vibrance)—Apply at 23.0 fl oz per 100 lb of seed.

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 (AzaGuard) at 0.28 lb ai/gal. Spray 8 to 16 oz when pests first appear. Repeat application every 7 to 10 days. Use in combination with 0.25-1.0% non-phytotoxic crop oil in sufficient water to cover undersides of leaves.
- ◆ *Beauveria bassiana* GHA (Mycotrol O) at 0.25 to 1 qt/a. Apply in sufficient water to thoroughly cover foliage infested with insects, typically 5 to 100 gallons of water per acre. 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 hours.
- ◆ bifenthrin (Bifen 2 AG Gold, 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 fl oz per season. Do not apply less than 14 days apart.
- ◆ chlorantraniliprole (Besiege, others) at 5.0 to 10.0 fl oz/a. 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 season. PHI 21 days. Minimum interval between applications is 5 days. If adjuvants are used, use only a non-ionic surfactant (NIS).
- ◆ chlorpyrifos (Whirlwind, others) at 1 to 2 pts/a. PHI 21 days. Do not make more than three applications of any product containing chlorpyrifos per crop. Do not make a second application of Whirlwind or other products containing chlorpyrifos within 10 days of the first application.
- ◆ deltamethrin (Delta Gold) at 0.009 lb ai/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 and do not apply within 7 days of harvest.
- ◆ gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/a. PHI 7 days. Do not apply more than 0.045 lb ai per acre per season.
- ◆ lambda-cyhalothrin (Warrior II with Zeon Technology) at 0.015 to 0.03 lb ai/a. PHI 7 days. Do not apply more than 0.09 lb ai/a per season. Do not apply within 7 days of harvest.
- ◆ zeta-cypermethrin (Mustang Maxx) at 4.0 fl oz/a (0.025 lb ai/a). PHI 7 days. Do not apply more than 24 fl oz of product (0.15 lb ai) per acre per season. Do not make applications less than 7 days apart.

Management—chemical control (Seed Treatment)

- ◆ chlorothianidin (NipsIt Inside) seed treatment at 10.23 fl oz per 100 lb seed depending on flea beetle pressure. Do not apply more than 0.2 lb ai/a per year.
- ◆ thiamethoxam, difenoconazole, mefenoxam, fludioxonil and sedaxane (Helix Vibrance)—Apply at 23.0 fl oz per 100 lb of seed.

Canola—Cabbage seedpod weevil

Ceutorhynchus asimilis

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. Over-wintering 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° (side-to-side) sweeps.

Management—chemical control (Foliar Treatment)

- ◆ bifenthrin (Bifen 2 AG Gold, 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 fl oz per season. Do not apply less than 14 days apart.
- ◆ chlorantraniliprole (Besiege, others) at 5.0 to 10.0 fl oz/a. 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 season. PHI 21 days. Minimum interval between applications is 5 days. If adjuvants are used, use only a non-ionic surfactant (NIS).
- ◆ deltamethrin (Delta Gold) at 0.009 lb ai/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 and do not apply within 7 days of harvest.
- ◆ gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/a. PHI 7 days. Do not apply more than 0.045 lb ai per acre per season.
- ◆ lambda-cyhalothrin (Warrior II with Zeon Technology) at 0.015 to 0.03 lb ai/a. PHI 7 days. Do not apply more than 0.09 lb ai/a per season. Do not apply within 7 days of harvest.
- ◆ zeta-cypermethrin (Mustang Maxx) at 4.0 fl oz/a (0.025 lb ai/a). PHI 7 days. Do not apply more than 24 fl oz of product (0.15 lb ai) per acre per season. Do not make applications less than 7 days apart.

Management—chemical control (Seed Treatment)

- ◆ imidacloprid (Gaucho 600) at 15.36 to 25.6 fl oz per 100 lb of seed. Suppression only. Do not graze for feed.

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)

- ◆ azadirachtin (AzaGuard) at 0.28 lb ai/gal. Spray 10 to 16 oz when pests first appear. Repeat application every 7 to 10 days. Use in combination with 0.25 to 1.0% non-phytotoxic crop oil in sufficient water to cover undersides of leaves.

- ◆ *Beauveria bassiana* GHA (Mycotrol O) at 0.25 to 1 qt/a. Apply in sufficient water to thoroughly cover foliage infested with insects, typically 5 to 100 gallons of water per acre. 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 hours.
- ◆ bifenthrin (Bifen 2 AG Gold, 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 fl oz per season. Do not apply less than 14 days apart.
- ◆ chlorantraniliprole (Besiege, others) at 5.0 to 10.0 fl oz/a. 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 season. PHI 21 days. Minimum interval between applications is 5 days. If adjuvants are used, use only a non-ionic surfactant (NIS).
- ◆ deltamethrin (Delta Gold) at 0.009 lb ai/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 and do not apply within 7 days of harvest.
- ◆ gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/a. PHI 7 days. Do not apply more than 0.045 lb ai per acre per season.
- ◆ lambda-cyhalothrin (Warrior II with Zeon Technology) at 0.015 to 0.03 lb ai/a. PHI 7 days. Do not apply more than 0.09 lb ai/a per season. Do not apply within 7 days of harvest.
- ◆ zeta-cypermethrin (Mustang Maxx) at 4.0 fl oz/a (0.025 lb ai/a). PHI 7 days. Do not apply more than 24 fl oz of product (0.15 lb ai) per acre per season. Do not make applications less than 7 days apart

Canola—Tarnished Plant Bug

Lygus lineolaris

Pest description and crop damage Tarnished plant bug (TPB) adults are approximately 5 mm (1/5 in.) 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)

- ◆ *Beauveria bassiana* GHA (Mycotrol O) at 0.25 to 1 qt/a. Apply in sufficient water to thoroughly cover foliage infested with insects, typically 5 to 100 gallons of water per acre. 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 hours.
- ◆ bifenthrin (Bifen 2 AG Gold, others) at 0.033 to 0.04 lb ai/a or 2.1 to 2.6 fl oz/a. PHI 35 days. Do not exceed 0.08 lb ai/a or 5.12 fl oz per acre per season. Repeat applications if needed to maintain control, but do not make applications less than 14 days apart.
- ◆ chlorantraniliprole (Besiege, others) at 5.0 to 10.0 fl oz/a. 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 season. PHI 21 days. If adjuvants are used, use only a non-ionic surfactant (NIS).
- ◆ deltamethrin (Delta Gold) at 0.009 lb ai/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 and do not apply within 7 days of harvest.

- ◆ flonicamid (Beleaf 50 SG) at 0.089 lb ai/a. Do not apply more than 2.8 oz per acre or 8.4 oz/a per season. Do not apply more than 3 applications per season. Allow a minimum of 7 days between applications.
- ◆ gamma-cyhalothrin (Declare) at 0.0075 to 0.015 lb ai/a. PHI 7 days. Do not apply more than 0.045 lb ai/a per season.
- ◆ lambda-cyhalothrin (Warrior II with Zeon Technology) at 0.015 to 0.03 lb ai/a. PHI 7 days. Do not apply more than 0.09 lb ai/a per season. Do not apply within 7 days of harvest.
- ◆ pyrethrins (Pyronyl Crop Spray) apply up to 0.05 lb/a and repeat as required to maintain effective control. Do not reapply within 3 days except under extreme pest pressure. In case of extreme pest pressure, do not reapply within 24 hours. Do not apply more than 10 applications per season. Do not harvest until spray has dried.
- ◆ zeta-cypermethrin (Mustang Maxx) at 4.0 fl oz/a (0.025 lb ai/a). PHI 7 days. Do not apply more than 24 fl oz of product (0.15 lb ai) per acre per season. Do not make applications less than 7 days apart.

Management—chemical control (Seed Treatment)

- ◆ imidacloprid (Gaucho 600) at 15.36 to 25.6 fl oz per 100 lb of seed. Suppression only. Do not graze for feed.

Pests of Clover Grown for Seed

Nicole P. Anderson

Latest revision—March 2018

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.

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. Seed yield losses of over 200 lb/a have been documented in Washington County, OR. 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

- ◆ acetamiprid (Assail 30SG) at 0.047 to 0.075 lb ai/a. PHI 56 days. This product is toxic to bees. Do not apply while bees are actively visiting the treated area. Do not apply more than one time per crop cycle. Begin applications when thresholds have been reached. Thorough coverage is important to obtain optimum control. Label is for OR, ID, and WA only.

- ◆ bifenthrin (Bifenture EC, Brigade 2EC, Discipline 2EC, Fanfare 2EC, Fanfare ES, Tundra EC) 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: OR-040039, OR-070013, OR-170012, ID-080011, ID-040009, ID-070009, ID-060023, ID-130004, WA-040027, WA-070015.
- ◆ chlorpyrifos (Lorsban Advanced) at 0.5 to 1.0 lb ai/a. REI 24 hr. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. 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-090010. Oregon only.
- ◆ lupyradifuron (Sivanto 200 SL) at 0.09 to 0.14 lb ai/a. PHI 14 days. Apply in late afternoon, evening, night, or outside of daily peak foraging periods to minimize exposure to pollinators. Do not apply more than 0.365 lb ai/a per year. Retreatment interval 10 days. 24c SLN: OR-160008, ID-150002.
- ◆ malathion at 1 to 1.25 lb ai/a. REI 12 hr. Apply to clover in bloom only in evening or early morning, when bees are not working in the field or hanging on the outside of the hives. Apply when aphid population is low. Check field for aphids before heads form by looking under basal leaf sheaths, and treat before aphids migrate from the sheaths to the seed heads.
- ◆ oxydemeton-methyl (MSR Spray Concentrate) at 0.375 to 0.5 lb ai/a. PHI 21 days. REI 15 days. Chaff from seed crop may be used for feed or forage, but do not cut green crop for these purposes. Do not apply more than two times per crop cycle. Retreatment interval 14 days. Apply by air, chemigation or groundboom.

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 (Bifenture EC, Brigade 2EC, Capture 2EC, Discipline 2EC, Fanfare 2EC, Fanfare ES, Tundra EC) at 0.06 to 0.1 lb ai/a. REI 12 hr. Do not apply while bees are present. 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: OR-040039, OR-070013, OR-170012, ID-080011, ID-040009, ID-070009, ID-060023, ID-130004, WA-040027, WA-070015.
- ◆ chlorpyrifos (Lorsban Advanced) at 1.0 lb ai/a. REI 24 hr. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. 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: OR-090010. Oregon only.

- ◆ 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 hanging on the outside of the hives.

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. It is known to attack peas and vetch but has not been a serious pest on them.

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 The 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

- ◆ bifenthrin (Bifenture EC, Brigade 2EC, Discipline 2EC, Fanfare 2EC, Fanfare ES, Tundra EC) 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 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-040039, OR-070013, OR-170012, ID-080011, ID-040009, ID-070009, ID-060023, ID-130004, WA-040027, WA-070015.
- ◆ chlorpyrifos (Lorsban Advanced) at 1.0 lb ai/a. REI 24 hr. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. 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-090010. Oregon only.

Clover seed—Cranefly

Includes

Common cranefly (*Tipula oleracea*)
European cranefly (*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

- ◆ carbaryl (Sevin 4F) at 1 to 1.5 lb ai/a. PHI 14 days. REI 12 hr. Up to two applications per year with at least 14 days between applications. Do not exceed 3 lb ai/a per season.

Note: Chlorpyrifos (Lorsban Advanced) at 0.5 lb ai/a, applied to control other pests on the label, results in cranefly control.

Clover seed—Cutworm and armyworm

Several species

Pest description and crop damage True (common) armyworm (*Mythimna unipuncta*, formerly *Pseudaletia 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 Tachinidae family, 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.
- ◆ chlorpyrifos (Lorsban Advanced) at 1.0 lb ai/a. REI 24 hr. For best control, soil should be moist and cutworms active on or near the soil surface at treatment. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. 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-090010. Oregon only.
- ◆ malathion at 1 to 1.25 lb ai/a. PHI 0 days. REI 12 hr. Use higher rate for armyworm control. 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.

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

- ◆ chlorpyrifos (Lorsban Advanced) at 2.0 lb ai/a. REI 24 hr. Broadcast preplant and incorporate the same day into the top 2 to 4 inches of soil. On established plantings, before spring growth apply as a broadcast foliar spray in at least 40 gal/a water and incorporate 2 to 4 inches deep. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per year. 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-090010. Oregon only.

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

- ◆ diflubenzuron (Dimilin 2L) insect growth regulator at 0.03 lb ai/a. Include 1 pint to 2 quarts/a of emulsified vegetable oil or paraffinic crop oil. For best results, apply when most nymphs have reached the second and third instar. Not effective once grasshoppers reach the adult stage. Repeat applications every 10 to 14 days for more complete coverage of new foliage during rapid growth. Dimilin 2L is NOT hazardous to bees when used alone. 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: ID-000013. Idaho only.
- ◆ 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 (Bifenture EC, Brigade 2EC, Capture 2EC, Discipline 2EC, Fanfare 2EC, Fanfare ES, Tundra EC) at 0.06 to 0.1 lb ai/a. REI 12 hr. Do not apply while bees are present. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. 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-040039, OR-070013, OR-170012, ID-080011, ID-040009, ID-070009, ID-060023, ID-130004, WA-040027, WA-070015.
- ◆ chlorpyrifos (Lorsban Advanced) at 1.0 lb ai/a. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. REI 24 hr. 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-090010. Oregon only.
- ◆ phosmet (Imidan 70-W) at 0.93 lb ai/a. This product is toxic to bees. Do not apply when bees are present. Spray weevil larvae during active feeding. Do not apply more than once per season. Do not graze clover after application. Do not cut treated clover for hay or forage. Processed seed must be labeled. 24c SLN: ID-990024. 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 (Bifenture EC, Brigade 2EC, Discipline 2EC, Fanfare 2EC, Fanfare ES, Tundra EC) 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 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-960021, OR-040039, OR-070013, OR-170012, ID-080011, ID-900006, ID-040009, ID-070009, ID-060023, ID-130004, WA-040027, WA-070015.
- ◆ chlorpyrifos (Lorsban Advanced) at 1.0 lb ai/a. REI 24 hr. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. 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-940031. Oregon only.
- ◆ 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 field or hanging on the outside of the hives.
- ◆ oxydemeton-methyl (MSR Spray Concentrate) at 0.375 to 0.5 lb ai/a. PHI 21 days. REI 15 days. Chaff from seed crop may be used for feed or forage, but do not cut green crop for these purposes. Do not apply more than two times per crop cycle. Wait a minimum of 14 days between applications. Apply by air, chemigation or groundboom.

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

- ◆ chlorpyrifos (Lorsban Advanced) at 1.0 lb ai/a. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. REI 24 hr. 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-090010. Oregon only.
- ◆ 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.

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 chlorpyrifos or 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 of Oregon.

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 (Bifenture EC, Brigade 2EC, Capture 2EC, Discipline 2EC, Fanfare 2EC, Fanfare ES, Tundra EC) at 0.06 to 0.1 lb ai/a. Do not apply while bees are present. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. REI 12 hr. 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-960021, OR-040039, OR-070013, OR-170012 ID-080011, ID-900006, ID-040009, ID-070009, ID-060023, ID-130004, WA-040027, WA-070015.
- ◆ chlorpyrifos (Lorsban Advanced) at 1.0 lb ai/a. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. REI 24 hr. 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-090010. Oregon 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

- ◆ metaldehyde 4% (Deadline M-Ps, Metarex, Slugger 4.0, Wilco Blue 4.0) granule bait at 0.4 to 1.2 lb ai/a. Control is usually optimized when warm, overcast conditions follow application. 24c SLN: OR-140004A, OR-140004B, OR-140005, OR-140008.
- ◆ 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.
- ◆ 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

Clover seed—Spider mite

Includes

Strawberry spider mite (*Tetranychus turkestanii*)

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

- ◆ bifenthrin (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-120007. Oregon only.
- ◆ bifenthrin (Bifenture EC, Brigade 2EC, Discipline 2EC, Fanfare 2EC, Fanfare ES, Tundra EC) at 0.06 to 0.1 lb ai/a. 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. REI 12 hr. 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-960021, OR-040039, OR-070013,

OR-170012, ID-080011, ID-900006, ID-040009, ID-070009, ID-060023, ID-130004, WA-040027, WA-070015.

- ◆ 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.
- ◆ oxydemeton-methyl (MSR Spray Concentrate) at 0.375 to 0.5 lb ai/a. PHI 21 days. REI 15 days. Chaff from seed crop may be used for feed or forage, but do not cut green crop for these purposes. Do not apply more than two times per crop cycle. Wait a minimum of 14 days between applications. Apply by air, chemigation or groundboom.
- ◆ propargite (Comite) at 1.64 to 2.46 lb ai/a. REI 2 to 7 days. 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-080017, ID-770005, WA-040019.

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 (Bifenture EC, Brigade 2EC, Capture 2EC, Discipline 2EC, Fanfare 2EC, Fanfare ES, Tundra EC) at 0.06 to 0.1 lb ai/a. Do not apply while bees are present. Do not make more than 3 applications per crop year. Allow at least 21 days between treatments. REI 12 hr. 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-960021, OR-040039, OR-070013, OR-170012, ID-900006, ID-080011, ID-040009, ID-070009, ID-060023, ID-130004, WA-040027, WA-070015.
- ◆ chlorpyrifos (Lorsban Advanced) at 1.0 lb ai/a. This product is highly toxic to bees. Do not apply when any clover bloom is present. Do not make more than one application per crop year. REI 24 hr. 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-090010. Oregon 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

- ◆ carbaryl (Carbaryl, Sevin) at 1 lb ai/a. One application per cutting. PHI 7 days of harvest. REI 12 hr. This product is highly toxic to bees exposed to direct treatment or residues on blooming crops. Do not apply this product or allow it to drift to blooming clover crops.

Dry Edible and Seed Pea Pests

John Rinehold

Latest revision—March 2018

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.

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 4 hr. Retreatment interval 5 days.
- ◆ beta-cyfluthrin (Baythroid XL) at 0.007 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* (Javelin) 0.12 to 1.5 lb/a. Some formulations are OMRI-listed for organic production.
- ◆ bifenthrin/imidacloprid (Brigadier) at 0.086 lb ai/a. PHI 14 days. REI 12 hr. Do not exceed 0.13 lb ai/a imidacloprid, 0.13 lb ai/a bifenthrin. Retreatment interval 7 days.
- ◆ carbaryl at 1 to 1.5 lb ai/a. PHI 14 days for grazing or harvest for forage, 21 days before harvest. REI 12 hr. Do not exceed 6 lb ai/a per season. Retreatment interval 7 days.
- ◆ chlorantraniliprole + lambda-cyhalothrin (Besiege) at 0.049 to 0.098 lb ai/a. PHI 21 days. REI 24 hr.
- ◆ cyfluthrin (Tombstone) at 0.13 to 0.5 lb ai/a. PHI 7 days. REI 12 hr. Retreatment interval 14 days. Do not exceed 0.1 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 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 0.0625 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) at 0.05 lb ai/a soil at-plant. PHI 21 days. REI 4 hr. Do not exceed 0.3 lb ai/a per season.

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.
- ◆ *Beauveria bassiana* (Mycotrol O) at 0.25 to 1 qt/a. PHI 0 days. REI 4 hr. OMRI-listed for organic use.
- ◆ cyfluthrin (Tombstone) at 0.5 lb ai/a. PHI 7 days. REI 12 hr. Retreatment interval 14 days. Do not exceed 0.1 lb ai/a per year.
- ◆ dimethoate at 0.165 to 0.33 lb ai/a. PHI 14 days for harvest. Allow 7 days between applications. Do not exceed 0.5 lb ai/a per season. Do not graze livestock. Do not apply to blooming Austrian winter peas. SLNs: WA-970029, OR-050019, ID-980006, ID-970008 and ID-110008.
- ◆ imidacloprid (Admire Pro) at 0.25 to 0.38 lb ai/a soil, 0.43 lb ai/a foliar. PHI 21 days soil, 7 days foliar. REI 12 hr. Do not exceed 0.38 lb ai/a per season.
- ◆ imidacloprid (Provado) at 0.044 lb ai/a foliar applied. PHI 7 days. REI 12 hr. Retreatment interval 7 days. Do not exceed 0.13 lb ai/a per season.
- ◆ malathion (Gowan Malathion 8) at 1 to 2.5 lb ai/a. PHI 3 days. Do not graze or feed forage to livestock. REI 12 hr. Limit 2 treatments.

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 0.02 to 0.025 lb ai/a. PHI 21 days. REI 4 hr. Retreatment interval 5 days.
- ◆ carbaryl 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) at 0.13 to 0.5 lb ai/a. PHI 7 days. REI 12 hr. Retreatment interval 14 days. Do not exceed 0.1 lb ai/a per year.
- ◆ malathion at 1 to 1.25 lb ai/a. PHI 3 days. REI 12 hr. Do not graze or feed forage to livestock. Limit 2 treatments.
- ◆ phosmet (Imidan) at 0.7 to 1 lb ai/a. PHI 7 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.

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 0.02 to 0.025 lb ai/a. PHI 21 days. REI 4 hr. Retreatment interval 5 days.
- ◆ carbaryl 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) at 0.13 to 0.5 lb ai/a. PHI 7 days. REI 12 hr. Retreatment interval 14 days. Do not exceed 0.1 lb ai/a per year.
- ◆ malathion (Fyfanon 8) at 1 lb ai/a. PHI 3 days. Do not graze or feed forage to livestock. REI 12 hr. Limit 2 treatments.
- ◆ phosmet (Imidan) at 0.7 to 1.0 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 or cut pea forage for hay within 10 days.

Dry edible and seed pea—Wireworm and seedcorn maggot

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

Management—chemical control

- ◆ 1,3-dichloropropene (Telone II, C-17, or C-35)—Fumigate pre-plant.
- ◆ bifenthrin (Capture LFR) at 0.04 to 0.08 lb ai/a soil at-plant. REI 12 hr.
- ◆ zeta-cypermethrin (Mustang) at 0.05 lb ai/a soil at-plant. PHI 21 days. REI 4 hr. Do not exceed 0.3 lb ai/a per season.

Grass Seed Pests

Steven E. Salisbury and Nicole P. Anderson

Latest revision—March 2018

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.

Note: Chlorpyrifos (Lorsban) is labeled ONLY for perennial grasses grown for seed. It is NOT labeled for annual grasses.

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 beneficials 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[®] 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.
- ◆ chlorpyrifos (Lorsban Advanced) at 0.47 to 0.94 lb ai/a. For use on perennial grass seed crops only. PHI not given. REI 24 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. OR and ID SLN's allows up to 3 applications per year at the max rate of 0.94 lb ai/a per application. WA SLN allows 2 applications per year at the 0.94 lb ai/a rate. Washington and Idaho labels allow applications only during the year of establishment. 24c SLN WA-090010, OR-090009, ID-090003.
- ◆ dimethoate at 0.25 to 0.33 lb ai/a. PHI 14 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.
- ◆ 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/acre. 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.
- ◆ 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 *Pseudaletia 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 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.

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[®] 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.
- ◆ carbaryl (eg. 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.
- ◆ chlorpyrifos (Lorsban Advanced) at 0.94 lb ai/a. For use on perennial grass seed crops only. PHI not given. REI 24 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. OR and ID SLNs allows up to 3 applications per year at the max rate of 0.94 lb ai/a per application. WA SLN allows 2 applications per year at the 0.94 lb ai/a rate. Washington and Idaho labels allow applications only during the year of establishment. 24c SLN WA-090010, OR-090009, ID-090003.
- ◆ 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) 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.

- ◆ lambda-cyhalothrin + chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/acre. 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.
- ◆ 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 long, 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 punctuations 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 long 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 (BrigadeÆ 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.
- ◆ lambda-cyhalothrin (Warrior) 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.
- ◆ lambda-cyhalothrin + chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/acre. 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-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per year.
- ◆ chlorpyrifos (Lorsban Advanced) at 0.94 lb ai/a. For use on perennial grass seed crops only. PHI not given. REI 24 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. OR and ID SLNs allows up to 3 applications per year at the max rate of 0.94 lb ai/a per application. WA SLN allows 2 applications per year at the 0.94 lb ai/a rate. Washington and Idaho labels allow applications only during the year of establishment. 24c SLN WA-090010, OR-090009, ID-090003.
 - 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.

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 long 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 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.
- ♦ carbaryl (eg. 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.
- ♦ chlorpyrifos (Lorsban Advanced) at 0.94 lb ai/a. For use on perennial grass seed crops only. PHI not given. REI 24 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. OR and ID SLNs allows up to 3 applications per year at the max rate of 0.94 lb ai/a per application. WA SLN allows 2 applications per year at the 0.94 lb ai/a rate. Washington and Idaho labels allow applications only during the year of establishment. 24c SLN WA-090010, OR-090009, ID-090003.
- ♦ 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) 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.
- ♦ lambda-cyhalothrin + chlorantraniliprole (Besiege) at 5.0 to 8.0 fl oz/acre. 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. 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 long, 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 long 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/E 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/acre. 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 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,” 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 long, 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 long.

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, 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) at 1 to 3.5 pints/a. OMRI listed for organic production.
- ◆ 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.
- ◆ carbaryl (eg. 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.
- ◆ chlorpyrifos (Lorsban Advanced) at 0.5 lb ai/a, or cyfluthrin (Baythroid XL) at 0.022 lb ai/a applied to control other pests on their labels, have given good control of crane fly larvae infesting grasses grown for seed.
- ◆ chlorpyrifos (Lorsban) labeled ONLY for perennial grasses grown for seed. It is NOT labeled for annual grasses. Best fall application timing is from late October through mid-November. Best results have been when product is applied in the rain and to fields with minimal straw load or charcoal residue.
- ◆ 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/acre. 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 (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.

Grass seed—Garden symphylan

Scutigereella immaculata

Pest description and crop damage Adult symphylans are about 0.12 to 0.33 inch long, white, with prominent antennae and 6 to 12 pairs of legs. 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.

Management—cultural control

Tillage reduces populations but usually not enough to achieve control where they are a problem.

Management—chemical control

There are no chemical control options labeled for grasses grown for seed to control garden symphylan.

When rotating out of grass seed, use an effective soil-incorporated insecticide, such as Lorsban or MoCap, on the rotation crop for which the insecticide is labeled.

See:

Biology and Control of the Garden Symphylan

Grass seed—Glassy cutworm

Crymodes devastator and an identical species east of the Cascades
Protogrotis 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 long 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, *Protogrotis 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 (BrigadeÆ 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.
- ◆ chlorpyrifos (Lorsban Advanced) at 0.94 lb ai/a. For use on perennial grass seed crops only. In unirrigated grasses, apply as a foliar spray when it is raining. If irrigation is available apply through an appropriate sprinkler irrigation system. For satisfactory results, grass and soil should be moist at time of treatment. Post-harvest residues, and carbon residues from field burning catch and hold this insecticide, often resulting in control failures—even when the product is applied in rain or with chemigation. **Note:** Best chance for control is in September when larvae are small. Do not graze or feed hay, forage, seed, or screening from treated fields. Seed conditioners must be informed if seed is from a treated field. 24c SLN WA-090010, OR-090009, ID-090003. The Washington and Idaho labels allow for applications only during the year of establishment.
- ◆ 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) 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/acre. 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 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 are dark and shiny with upturned labial palps characteristic of the family Gelechiidae. Adults range in size to about 0.5 inch long. 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 long 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 Mountains

Pest description and damage Mealybugs are 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. Head loss can reach 65% near Worley ID. 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 history 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 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.
- ◆ 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/acre. 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 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 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 0.02 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.
- ◆ 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/acre. 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.
- ◆ 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

Management - biological control

Birds will eat grasshoppers. There are diseases (e.g., nosema, fungus, 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, pale, torpedo-shaped insects, whose wings fold rooflike when resting. Large numbers cause stippling of leaf blades and chlorosis. 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.
- ◆ 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/acre. 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.
- ◆ 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. 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 inches with reddish legs; smallish, dirty-looking, light brown to gray larvae (0.5 inch long 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 long, 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 (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 0.02 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/E 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) 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.
- ◆ lambda-cyhalothrin + chlorantraniliprole (Besiege) at 6.0 to 10.0 fl oz/acre. 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-containing products or 0.2 lb ai of chlorantraniliprole-containing products 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 abdominal prolegs on almost every segment 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 long 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 feeds on leaves and chews 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.

Management—chemical control

- ◆ 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/acre. 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.

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.

Ongoing research at WSU indicates that silvertop disease in fescues and bluegrasses is caused in part by the fungus *Fusarium* sp. The disease may be vectored by the grass mealybug.

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—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 long 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 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.
- ◆ chlorpyrifos (Lorsban Advanced) at 0.94 lb ai/a. For use on perennial grass seed crops only. PHI not given. REI 24 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. OR and ID SLNs allows up to 3 applications per year at the max rate of 0.94 lb ai/a per application. WA SLN allows 2 applications per year at the 0.94 lb ai/a rate. Washington and Idaho labels allow applications only during the year of establishment. 24c SLN WA-090010, OR-090009, ID-090003.

- ◆ 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/acre. 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 (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 0.014 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—Slug

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—Thrips

Anaphothrips obscurus and others

Pest description and crop damage Small, winged or wingless, narrow insects about 0.06 inch long. 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/Æ 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.
- ◆ 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.
- ◆ 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/acre. 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 an inch long, 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 2-3 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 3-4 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 Tachinidae family, 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/Æ 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.
- ◆ chlorpyrifos (Lorsban Advanced) at 0.94 lb ai/a. For use on perennial grass seed crops only. PHI not given. REI 24 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. OR and ID SLNs allows up to 3 applications per year at the max rate of 0.94 lb ai/a per application. WA SLN allows 2 applications per year at the 0.94 lb ai/a rate. Washington and Idaho labels allow applications only during the year of establishment.

24c SLN WA-090010, OR-090009, ID-090003.

- ◆ 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/acre. 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 (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 0.014 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.

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 long. They appear in the spring and summer months. Larvae are the damaging stage. They are yellow-brown and up to 0.5 inch long. 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.

- ◆ 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.

Meadowfoam Pests

Dale Whaley

Latest revision—March 2018

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—Meadowfoam fly

Scaptomyza apicalis

Pest description and crop damage A small fly in the fruit fly family, occurring 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. 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 usually are 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. 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 seem to indicate 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.

- ◆ dimethoate (Dimethoate 400) at 1 pint (0.5 lb ai/a) in a minimum of 20 gal of water for ground applications. Make application based on detection as determined by adult trapping or field inspection for larval damage (peak adult emergence is usually in mid-February in Western Oregon). Do not apply after crop begins to bloom. Aerial application is permitted and must be completed before blooming period. REI 48 hr. SLN 24c OR-050020. Expires 12/31/2018. Oregon only.

The following insecticide labels list meadowfoam along with other oilseed crops but does not specifically list meadowfoam fly as a pest.

- ◆ chlorantraniliprole (Coragen) at 0.045 to 0.065 lb ai/a. Make no more than 4 applications per acre per crop. Minimum interval between treatments is 5 days. Do not apply more than 15.4 fl oz Coragen or 0.2 lb ai of chlorantraniliprole-containing products per acre per year. If adjuvants are used, use only a non-ionic surfactant (NIS). PHI 21 days. REI 4 days.
- ◆ flonicamid (Beleaf 50 SG) at 0.089 lb ai/a. Apply in sufficient water to ensure good coverage; use a minimum of 10 gal per acre when applied by ground; use a minimum of 3 gal per acre by air. Do not apply more than 8.4 oz/a per season. Do not apply more than 3 applications per season. Retreatment interval 7 days.
- ◆ zeta-cypermethrin (Mustang Max) at 4.0 ounces (0.025 lb/ai/a). Do not apply more than 24 oz of product or 0.15 lb ai/a per acre per season. Retreatment interval 7 days. PHI 7 days.

Pests of Sugar Beet Grown for Seed

Edward John Bechinski

Latest revision—March 2018

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.

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

- ◆ thiamethoxam (Actara) at 0.04687 lb ai/a to 0.0625 lb ai/a (3-4 oz product/a) for control of green peach aphid. Do not exceed 0.125 lb ai/a (8 oz product/a) per growing season. Use sufficient water volume to ensure thorough coverage of foliage. Allow at least 7 days between applications. 24c SLN OR-070020 (expires 31/12/2020) Oregon only; application restrictions exist for this product because of risk to bees and other pollinators.

Sugar beet seed—Garden symphylan

Scutigera immaculata

Pest description and crop damage Active, white, fragile, centipede-like soilborne relatives of insects, 0.25 inch long, with 12 or more pairs of legs. They damage sugar beets primarily early in the season by feeding on germinating seed or on small roots of

seedling plants. Symphylans are in unpredictably spotty infestations and generally are considered minor pests.

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.

- ◆ chlorpyrifos—(Lorsban Advanced)
 - Idaho only. Restricted to one application at 1.88 lb ai/a in the fall, prior to planting, to protect sugar beets grown the next year. 24c SLN ID-090002 (expires 12/31/2019).
 - Oregon only. Restricted to one of the following two types of uses: either one pre-plant broadcast application at 1.88 lb ai/a and incorporated into the top 4 inches of soil –or– one at-planting/transplanting application at 0.94 lb ai/a as 5-to-7 inch band over row and incorporated into the top 2 to 4 inches of soil. 24c SLN OR-090007 (expires 12/31/2018).

Sugar beet seed—Slug

Various species

Management—chemical control

- ◆ iron phosphate (Leaf Life Sluggo Snail and Slug Bait) at 0.20 to 0.44 lb ai/a (20 to 44 lb product/a).
- ◆ metaldehyde
 - Slugger 4.0 Slug & Snail Bait or Wilco Blue 4.0 Slug & Snail Bait broadcast at 0.2 to 0.8 lb ai/a (5 to 20 lb product/a); 24c SLN OR-140004 (expires 31 Dec 2019). Oregon only.
 - Metarex Snail and Slug Bait broadcast at 0.2 to 0.8 lb ai/a (5 to 20 lb product/a); 24c SLN OR-140005 (expires 31 Dec 2019). Oregon only.
 - Deadline M-Ps Mini Pellets broadcast at 0.2 to 0.8 lb ai/a (5 to 20 lb product/a); 24c SLN OR-140008 (expires 31 Dec 2019). Oregon only.

See also:

Slug Control

Sugar beet seed—Twospotted spider mite

Tetranychus urticae

Management—chemical control

- ◆ propargite (Comite) at 1.6375 to 2.45625 lb ai/a in at least 10 gal/a (aerial). REI 9 days. Do not exceed two sprays per year; 14-day minimum spray interval. 24c SLN OR-080014 (expires 12/31/2018). Oregon only.

Pests of Vetch Grown for Seed

Nicole P. Anderson

Latest revision—March 2018

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.

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

- ◆ 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.** If necessary 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 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.
- ◆ 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.** If necessary 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.
- ◆ 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 leaf-tier

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.** If necessary 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 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—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, 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 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 (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, Wilco Blue 4.0) granule bait at 0.4 to 1.2 lb ai/a. Control is usually optimized when warm, overcast conditions follow application. 24c SLN OR-140004A, OR-140004B, OR-140005, OR-140008.
- ◆ sodium ferric EDTA (Ironfist, 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.

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.** If necessary 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.