

Alfalfa INSECT MANAGEMENT 2019



How to Use This Guide

This publication was prepared to help producers manage insect populations with the best available methods proven practical under Kansas conditions. It is revised annually and intended for use this calendar year. Pesticide label directions and restrictions are subject to change, and may have changed since the date of publication.

The economics of control should be considered in any pest management decision. Because costs vary greatly over time and are influenced by factors beyond the scope of this publication, product cost was not a consideration for including or omitting specific insecticide products in these recommendations.

Growers should compare product price, safety, and availability when making treatment decisions. The user bears ultimate responsibility for correct pesticide use. For proper use, always read label directions carefully before applying pesticides. Remember, it is illegal to use a pesticide in a manner inconsistent with the label. More information on pests covered in this publication as well as other potential pests in alfalfa are available at: www.entomology.k-state.edu/extension/insect-information/crop-pests/alfalfa/. Entries include details on identification, life history and behavior of each pest, specific to the crop. K-State assumes no responsibility for product performance, personal injury, property damage, or other types of loss resulting from the handling or use of the pesticides listed.

Using Insecticides Safely

Read the label carefully. It is a legal document. It tells what, where, how, and when the product can be used. For poison control information contact the Mid-America Poison Control Center. Emergency phone number: 800-222-1222.

Beneficials in Alfalfa

Alfalfa is an important early season habitat for many beneficial species. Many generalist predators complete their first generation of the year in this crop, multiply their numbers, and then emigrate to other summer crops where they contribute to biological control of

| Perennial | Winter/Spring | Summer | Fall/Winter | | | | | | | | | |
|-----------------------|---------------|--------|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Alfalfa Weevil | Pg.1 | | | | | | | | | | | |
| Potato Leafhopper | | Pg.5 | | | | | | | | | | |
| Occasional | Winter/Spring | Summer | Fall/Winter | | | | | | | | | |
| Blue Alfalfa Aphid | Pg.1 | | | | | | | | | | | |
| Cowpea Aphid | | Pg.1 | | | | | | | | | | |
| Pea Aphid | Pg.1 | | | | | | | | | | | |
| Clover Leaf Weevil | Pg.3 | | | | | | | | | | | |
| Army Cutworm | Pg.4 | | | | | | | | | | | |
| Spotted Alfalfa Aphid | | Pg.4 | | | | | | | | | | |
| Blister Beetle | | Pg.4 | | | | | | | | | | |
| Grasshoppers | | Pg.5 | | | | | | | | | | |
| Seed Chalcid | | Pg.6 | | | | | | | | | | |
| Alfalfa Caterpillar | | Pg.6 | | | | | | | | | | |
| Beet Armyworm | | Pg.6 | | | | | | | | | | |
| Fall Armyworm | | Pg.8 | | | | | | | | | | |
| Variagated Cutworm | Pg.8 | | | | | | | | | | | |
| Garden Webworm | | Pg.8 | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |

many pests. Many pest species such as aphids are a perennial presence in alfalfa, but rarely require treatment. There are also selective insecticides now available that have minimal impact on beneficial species. These include chlorantraniliprole, flupyradifurone and indoxacarb.

Neonicotinoid Seed Treatments

The seed of many crops is quickly becoming impossible to obtain without some kind of insecticidal seed treatment, and it is alarming that farmers may no longer have access to untreated seed. In Kansas, seed treatments employing thiamethoxam, clothianidin or imidacloprid as active ingredients can only be recommended when planting into fields containing known populations of seed-destroying insects such as wireworms. Otherwise, there are no consistent yield benefits that justify their prophylactic use at this latitude, and such use is incompatible with the principles of integrated pest management. Even neighboring plants can take up these materials, which can then contaminate sources of pollen and nectar that are critical resources for many beneficial species.

Seed treatment adds about \$5 per acre to planting costs and there is mounting evidence of neonicotinoid accumulation in soils, movement in ground water, and wide-ranging negative environmental impacts on both terrestrial and aquatic invertebrates that are key food sources for fish, birds and other vertebrates.

Early Spring Pests, Aphids

Blue Alfalfa Aphid

Blue alfalfa aphids resemble pea aphids, but do not have dark bands encircling the base of each antennal segment. Light infestations have been recorded in most Kansas counties, but serious damage has not been observed so far. Heavy infestations that seem to be pea aphids, particularly on pea aphid-resistant varieties, should be identified by an entomologist.

Stunting of plant growth is evident at lower infestation densities than with pea aphid feeding. For instance, 20 blue alfalfa aphids per stem on 10-inch tall alfalfa, or 50 blue alfalfa aphids on 20-inch tall alfalfa, may justify insecticide treatment.

Blue Alfalfa Aphid Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.022 lb. a.i./acre (2.8 fl. oz./acre) |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 13 to 26 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 9.25 to 11.75 fl. oz./acre |
| Dimethoate (Dimethoate or Dimate) | 0.25 to 0.5 lb. a.i./acre |
| Flupyradifurone (Sivanto Prime) | 7.0 to 14.0 fl. oz./acre |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Lambda-cyhalothrin (numerous products) | 0.02 to 0.03 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 6.0 to 10.0 fl. oz./acre |
| Methomyl (Lannate) | LV 1.5 to 3 pints/acre, SP 0.5 to 1 lb/acre |
| Permethrin (multiple products) | 0.05 to 0.2 lb. a.i./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |

Cowpea Aphid Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.022 lb. a.i./acre (2.8 fl. oz./acre) |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 19 to 38 fl. oz./acre |
| Cyfluthrin (Tombstone) | 0.025 to 0.044 lb. a.i./a (1.6 to 2.8 fl. oz.) (suppression) |
| Dimethoate (Dimethoate or Dimate) | 0.25 to 0.5 lb. a.i./acre |
| Flupyradifurone (Sivanto Prime) | 7.0 to 14.0 fl. oz./acre |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Lambda-cyhalothrin (numerous products) | 0.02 to 0.03 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 6.0 to 10.0 fl. oz./acre |
| Methomyl (Lannate) | LV 1.5 to 3 pints/acre, SP 0.5 to 1 lb./acre |

Pea Aphid Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.022 lb. a.i./acre (2.8 fl. oz./acre) |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 13 to 26 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 9.25 to 11.75 fl. oz./acre |
| Cyfluthrin (Tombstone) | 2.8 fl. oz./a.i./acre (0.044) (suppression) |
| Dimethoate (Dimethoate or Dimate) | 0.25 to 0.5 lb. a.i./acre |
| Flupyradifurone (Sivanto Prime) | 7.0 to 14.0 fl. oz./acre |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Lambda-cyhalothrin (numerous products) | 0.02 to 0.03 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 6.0 to 10.0 fl. oz./acre |
| Methomyl (Lannate) | LV 1.5 to 3 pints/acre, SP 0.5 to 1 lb./acre |
| Permethrin (multiple products) | 0.05 to 0.2 lb. a.i./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |

Cowpea Aphid

These large, dark aphids generally feed near the tips of infested stems and have been sporadically reported from alfalfa fields since 1999. Damage is similar to that caused by the pea aphid, and thresholds are likely to be comparable. Significant populations developed in 2009 and 2012. For more information see MF2865, *Cowpea Aphid*.

Pea Aphid

These large green aphids are about 3/16-inch long and 1/16-inch wide at maturity. Pea aphids have a dark band encircling the base of each antennal segment.

Evaluating plant vigor is often the key to determining the need to treat for this insect. Heavily infested plants may turn yellow and wilt, usually in March, April, and May. Monitor fields closely early in the season during periods of slow growth. Untreated aphid populations may support early season beneficial populations.

Host-plant resistance can reduce aphid damage. Early cutting may solve the problem when significant infestations develop

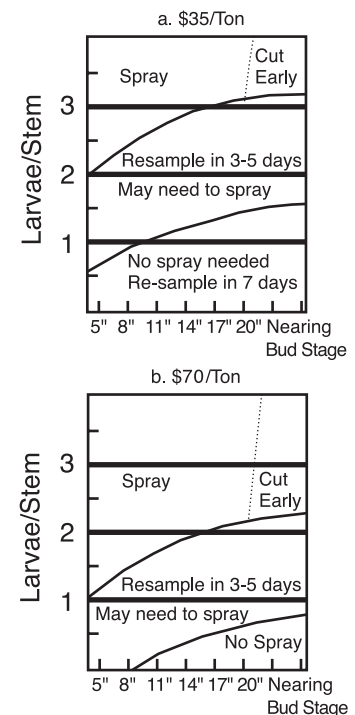
close to cutting time. Small populations may be beneficial by providing food for beneficial insects. On 10-inch tall alfalfa, no treatment is needed until nearly 50 aphids per stem are present. On alfalfa 20-inches tall, twice as many aphids per stem are required to justify treatment. The registration of Sivanto for aphids in alfalfa provides growers with alternative control that will be more selective for beneficial insects compared to organophosphate or pyrethroid materials.

Weevils

Alfalfa Weevil

The 3/16-inch long adult weevil is light brown with a dark line extending down the middle of the back. Adults possess a distinctive snout and readily fall to the ground when disturbed. Eggs are laid inside alfalfa stems in the fall and spring. Small, light green, black-headed, legless larvae have a distinct white stripe down the center of the body. Larvae feed on terminal and upper plant leaves early in

Alfalfa Weevil Stem Count Decision Guide



Alfalfa Weevil Management Options

| Insecticide | Rate |
|---|--|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.0125 to 0.022 lb. a.i./acre (1.6 to 2.8 fl. oz.) Data indicates that rates of 0.015 to 0.02 should provide the longest protection against larval damage. |
| Chlorpyrifos* (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin* (Cobalt Advanced) | 19 to 38 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 9.25 to 11.75 fl. oz./acre |
| Cyfluthrin (Tombstone) | 0.025 to 0.044 lb. a.i./a (1.6 to 2.8 fl. oz.) |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) A higher rate should provide the longest protection against larval damage. |
| Indoxacarb (Steward) | 6.7 to 11.3 fl. oz./acre |
| Lambda-cyhalothrin (numerous products) | 0.02 to 0.03 lb. a.i./acre. Data reviewed so far indicates that the higher rate should provide the longest protection against larval damage. |
| Lambda-cyhalothrin plus chlorantraniliprole (Voliam Xpress) | 6.0 to 9.0 fl. oz./acre |
| Methomyl (Lannate) | LV 3 pints/acre, SP 1 lb/acre |
| Phosmet* (Imidan) | LV 3 pints/acre, SP 1 lb/acre. |
| Permethrin (multiple products) | 0.2 lb. a.i./acre. Results in Kansas research trials have been variable. |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 10.0 fl. oz./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz./acre). Data are limited, but the higher rate should provide the longest protection against larval damage. |

*Treatments listed are mainly used for treating alfalfa weevil larvae; products with an asterisk are also recommended for adult alfalfa weevil control.

Clover Leaf Weevil Management Options

| Insecticide | Rate |
|--|--|
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 19 to 38 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 5.0 to 11.75 fl. oz./acre |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.) (Declare: 1.02 to 1.54 fl. oz./acre) |
| Lambda-cyhalothrin (numerous products) | 0.02 to 0.03 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 10.0 fl. oz./acre |

the spring, reaching a quarter-inch in length in about three weeks. Most damage occurs before the first cutting; however, failure to obtain adequate control of larvae can result in adult populations that 'bark' the stalks of plants after cutting, impeding regrowth and killing plants in very dry conditions. Treatment decisions should be based on the stem-count decision method. Carefully break off 30 to 50 stems selected randomly from across the field and shake them individually into a deep-sided bucket. See the *Alfalfa Weevil Stem Count Decision Guide* on page 3 to determine the best course of action. Alfalfa prices ranged from \$150-\$300/ton in 2013. Although thresholds should be lower in response to higher prices, sampling is still necessary to justify treatment. For more on alfalfa weevil management, see MF2999, *Alfalfa Weevils*.

The Kansas Department of Agriculture issued a special local needs registration (24c) for several insecticides for fall application against adult alfalfa weevils. See the

labels for Stallion, Cobalt, and Warrior II with Zeon Technology. The registration of Steward for alfalfa weevil provides growers a control alternative that is more selective for beneficial insects compared to organophosphate or pyrethroid materials.

Clover Leaf Weevil

Damage may occur from March through May. Larvae are green with a white stripe down the middle of the back and a thin pink line along the margins. The larval head capsule is brown, whereas alfalfa weevil larvae have black head capsules. Larvae are approximately a half-inch long at maturity. Mature clover leaf weevil larvae are noticeably larger than mature alfalfa weevil larvae. Feeding occurs mostly at night and larvae hide in the soil around the base of plants during the day.

A fungal disease usually keeps the population under control. Diseased grubs turn yellow and die. Control measures for clover leaf weevil are justified when infestations average five or more healthy grubs per crown.

Worms

Army Cutworm

Damage occurs in late January, February, March, and sometimes in April. This pest is usually more of a problem in south central Kansas, especially if dry conditions retard growth. Worms may destroy small plants. Foliage damage can reduce harvest from the first cutting of older alfalfa.

Detecting the infestation before foliage is destroyed is critical for control success. If possible, controls should be applied when larvae are above ground. Seedling stands suffer the most damage. Proper sampling requires sifting soil through a coarse mesh screen in at least five places in the field.

Treat when two or more larvae per square foot are present in seedling fields, or four or more per square foot are found in established fields. If a majority of larvae are 1¼ inch or longer they are about to pupate and treatment is not justified.

Army Cutworm Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.0065 to 0.0125 lb. a.i./a (0.8 to 1.6 fl. oz.) |
| Chlorantraniliprole (Prevathon) | 14.0 to 29.0 fl. oz./acre |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre. Control has been most consistent at rates of 1.5 to 2 pints/acre. |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 13 to 26 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 2.5 to 11.75 fl. oz./acre |
| Cyfluthrin (Tombstone) | 0.08 to 1.6 fl. oz./acre (0.013 to 0.025 lbs. ai/acre) |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.0075 to 0.0125 lb. a.i./acre (1.92 to 3.20 fl. oz.)(Declare: 0.77 to 1.28 fl. oz acre) |
| Lambda-cyhalothrin (numerous products) | 0.015 to 0.025 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 10.0 fl. oz./acre |
| Permethrin (multiple products) | 0.05 to 0.25 lb. a.i./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |

Spotted Alfalfa Aphid Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 13 to 26 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 9.25 to 11.75 fl. oz./acre |
| Dimethoate (Dimethoate or Dimate) | 0.25 to 0.5 lb. a.i./acre |
| Flupyradifurone (Sivanto Prime) | 7.0 to 14.0 fl. oz/acre |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Lambda-cyhalothrin (numerous products) | 0.02 to 0.03 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 6.0 to 10.0 fl. oz./acre |
| Methomyl (Lannate) | LV 1.5 to 3 pints/acre, SP 0.5 to 1 lb./acre |
| Permethrin (multiple products) | 0.05 to 0.2 lb. a.i./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |

Summer and Fall Pests

Aphids

Cowpea Aphid

These dark-colored aphids generally feed near the tips of infested stems and have been reported throughout most of the alfalfa growing season. For more information see cowpea aphid under spring pests or MF2865, *Cowpea Aphid*.

Spotted Alfalfa Aphid

This 1/16-inch-long, greenish-yellow to straw-colored aphid has rows of tiny dark spots on its back. It favors hot, dry conditions and is found on the undersides of leaves. Susceptible varieties may be severely damaged by little more than one aphid per seedling, but host-plant resistance can reduce damage. Insecticides should be applied when two or three aphids per seedling are present. In established alfalfa, higher populations are required for treatment. On 10-inch tall alfalfa, treatment generally is not needed

until 50 aphids per stem are present. On 20-inch tall alfalfa, twice as many aphids per stem justify treatment.

Blister Beetles

At least seven species of blister beetles may be found in Kansas alfalfa. Beetles may be present in all hay cuttings, but more commonly occur in the second, third, and fourth cuttings. Horses have an adverse, sometimes fatal reaction when fed hay containing crushed blister beetles. Species vary considerably in their content of the toxin cantharidin. Chances of having blister beetles in hay can be reduced by avoiding the use of conditioners, crimpers, or crushers on the mid-June through September cuttings, or by not using these cuttings as horse feed. No practices eliminate the possibility of hay being infested with blister beetles. Even after insecticide treatments, beetles can re-enter fields. Growers should be vigilant for blister beetle aggregations and avoid working or cutting fields when these are observed.

Learn more about problems associated with blister beetles at: www.entomology.k-state.edu/extension/insect-information/crop-pests/alfalfa/blister-beetles.html.

Grasshoppers

Grasshoppers may destroy foliage from May until frost. It is easier to control nymphs than adults. Young stands less than 6 inches high or the post-cutting regrowth of established plantings may need to be protected with an insecticide, especially if moisture is limited. Repeated applications may be required because labeled products have short residual properties.

Treatment of non-field border areas with suitably registered products may be warranted if grasshoppers begin moving into the field as vegetation bordering alfalfa matures and dries down. The extended interval associated with growing and harvesting seed alfalfa can elevate the importance of controlling grasshopper damage to protect developing blossoms and seedpods.

Grasshopper Management Options

Field Sprays

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 0.0175 to 0.025 lb. a.i./acre (2.8 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.0155 to 0.022 lb. a.i./a (2.0 to 2.8 fl. oz.) |
| Carbaryl (Sevin) | 0.5 to 1.5 lb. a.i./acre |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 7 to 13 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 9.25 to 11.75 fl. oz./acre |
| Dimethoate (Dimate and others, formerly Cygon) | 0.5 lb. a.i./acre |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.) (Declare: 1.02 to 1.54 fl. oz./acre) |
| Indoxacarb (Steward EC) | 0.045 - 0.11 lb. ai. (4.6-11.3 fl. oz. / acre) |
| Lambda-cyhalothrin (numerous products) | 0.02 to 0.03 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 6.0 to 10.0 fl. oz./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.0175 to 0.025 lb. a.i./acre (2.8 to 4.0 fl. oz.) |

Potato Leafhopper

These are small (1/8-inch long), yellow-green, wedge-shaped insects that move sideways, jump, or fly when disturbed. Nymphs and adults damage alfalfa during midsummer. Injured plants typically exhibit v-shaped yellowing of the leaf tips (hopper-burn). Damage may be substantial in years when large migrations move northward from southern regions; the insect does not overwinter in Kansas. More attention needs to be devoted to scouting for and managing this pest since controls need to be applied before the onset of significant yellowing. Stunted, yellowed plants are less valuable for livestock feed because of reduced protein levels. If required, one spray applied to stubble is usually adequate to control leafhoppers on regrowth. Suggested treatment guidelines

are found in the table below. Sample values represent the average number of leafhoppers per sweep from at least 20 pendulum sweeps per location, gathered from at least five representative locations per field. If infestations are not detected before alfalfa becomes yellowed and stunted, then it is advised to swath to remove eggs before applying an insecticide. Where treatment is justified, the lowest recommended rates have often proven effective and re-infestation seldom occurs. Various seed companies sell varieties with resistance to potato leafhoppers. Check with seed suppliers for resistant varieties adapted to Kansas conditions.

Seed Chalcid

Damage occurs during June, July, and August. No satisfactory control exists for

Potato Leafhopper Thresholds

| Stem length (inches) | Average number of leafhoppers per sweep |
|----------------------|---|
| 3 or less | 0.2 |
| 6 | 0.5 |
| 8 to 10 | 1.0 |
| 12 to 14 | 2.0 |

this tiny insect, which sometimes destroys seed. Control usually is inconclusive or ineffective because the oviposition period is of long duration compared to residual activity of products with relatively short preharvest intervals. Small emergence holes can be found on infested seeds.

Potato Leafhopper Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.0065 to 0.0125 lb. a.i./a (0.8 to 1.6 fl. oz.) |
| Carbaryl (Sevin) | 1 lb. a.i./acre |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 7 to 13 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 5.0 to 11.75 fl. oz./acre |
| Cyfluthrin (Tombstone) | 0.025 to 0.044 lb. a.i./a (1.6 to 2.8 fl. oz.) |
| Dimethoate (Dimethoate or Dimate) | 0.25 to 0.5 lb. a.i./acre |
| Flupyradifurone (Sivanto Prime) | 7.0 to 14.0 fl. oz/acre |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.0075 to 0.0125 lb. a.i./acre (1.92 to 3.20 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Indoxacarb (Steward) | 9.2 to 11.3 fl. oz./acre |
| Lambda-cyhalothrin (numerous products) | 0.015 to 0.025 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 8.0 fl. oz./acre |
| Permethrin (multiple products) | 0.1 to 0.2 lb. a.i./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |

Worms

Alfalfa Caterpillar

The larvae are green worms with a white stripe along each side of their bodies. They attain a length of 1¼ to 1½ inches, and on close inspection appear to have velvety skin. They are usually held in check by naturally occurring parasites and diseases, and infestations seldom reach economic levels. Damaging populations are most likely in southwest Kansas in fields that stand five or more weeks between cuttings. Control measures are justified when there are 10 worms per sweep of the net, unless cutting will occur in the next few days.

Beet Armyworm

Beet armyworm larvae can vary from light green to nearly black. They have four pairs of abdominal prolegs and a dark head

capsule. Many fine, white, wavy lines run along the back, and a broader stripe occurs along each side. There is usually a distinctive dark spot on each side, just above the second pair of true legs. Females lay eggs in masses, covering them with hairs and scales. Eggs hatch in a few days and larvae feed for about three weeks, sometimes spinning slight webs over the foliage.

Beet armyworms apparently do not overwinter in Kansas and have not been a problem until late summer or early fall. These foliage feeders usually are not a serious problem on established stands unless there are enough to severely defoliate plants. More severe problems occur in recently planted fields where seedlings may be lost when larvae clip them off near the soil surface. Economic infestations are similar to army cutworms – possibly

four to five per square foot on established stands and one to two per square foot on seedling stands. Late fall infestations often disappear soon after the first hard freeze, but this is often difficult to predict. Beet armyworms are difficult to control, and options are limited.

Fall Armyworm

Infestations are most likely to occur in late summer to early fall before frost (September through October). Fall armyworm larvae have four black spots arranged at the corners of an imaginary square located near the top rear of the worm's body. One to two worms per square foot can destroy seedling alfalfa, and populations of 10 to 15 per square foot have been observed to destroy 12- to 14-inch alfalfa. Treatment is not advised unless the majority of larvae are less than ¾ inch long.

Alfalfa Caterpillar Management Options

| Insecticide | Rate |
|--|--|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.0125 to 0.022 lb. a.i./acre (1.6 to 2.8 fl. oz.) |
| Carbaryl (Sevin) | 1 lb. a.i./acre |
| Chlorantraniliprole (Prevathon) | 8.0 to 20.0 fl oz/acre |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 13 to 26 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 5.0 to 11.75 fl. oz./acre |
| Cyfluthrin (Tombstone) | 0.025 to 0.044 lb. a.i./acre (1.6 to 2.8 fl. oz.) |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.0075 to 0.0125 lb. a.i./acre (1.92 to 3.20 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Indoxacarb (Steward) | 6.7 to 11.3 fl. oz./acre |
| Lambda-cyhalothrin (numerous products) | 0.015 to 0.025 lb. a.i./acre |
| Methomyl (Lannate) | LV 1.5 to 3 pints/acre, SP 0.5 to 1 lb./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 10.0 fl. oz./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 10.0 fl. oz./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |

Beet Armyworm Management Options

| Insecticide | Rate |
|---|---|
| Alpha-cypermethrin (Fastac CS) | 2.8 to 3.8 fl. oz./acre |
| Beta-cyfluthrin (Baythroid XL) | 0.0125 to 0.022 lb. a.i./acre (1.6 to 2.8 fl.oz.) |
| Chlorantraniliprole (Prevathon) | 14.0 to 20.0 fl. oz./acre |
| Cyfluthrin (Tombstone) | 0.025 to 0.044 lb. a.i./a (1.6 to 2.8 fl. oz.) |
| Indoxacarb (Steward) | 6.7 to 11.3 fl. oz./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 10.0 fl. oz./acre |
| Methomyl (Lannate) | LV 1.5 to 3 pints/acre, SP 0.5 to 1 lb./acre |

Fall Armyworm Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 2.8 to 3.8 fl. oz./acre |
| Beta-cyfluthrin (Baythroid XL) | 0.0125 to 0.022 lb. a.i./acre (1.6 to 2.8 fl. oz.) |
| Carbaryl (Sevin) | 1 lb. a.i./acre |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 19 to 38 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 9.25 to 11.75 fl. oz./acre |
| Cyfluthrin (Tombstone) | 0.025 to 0.044 lb. a.i./a (1.6 to 2.8 fl. oz.) |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Lambda-cyhalothrin (numerous products) | 0.02 to 0.03 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 10.0 fl. oz./acre |
| Methomyl (Lannate) | LV 1.5 to 3 pints/acre, SP 0.5 to 1 lb./acre |
| Permethrin (multiple products) | 0.05 to 0.2 lb. a.i./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.0175 to 0.025 lb. a.i./acre (2.8 to 4.0 fl. oz.) |

Variegated Cutworm

This climbing cutworm has four or five white, somewhat diamond-shaped spots (one per segment) on the top center of the back. Producers should look for this pest at the same time they are checking for growth on secondary buds while scouting fields to time the first cutting. If large populations are discovered, it may be advisable to delay cutting a few days to allow the majority of larvae to pupate.

Foliage feeding in an established planting should be less detrimental than repeated feeding on regrowth after cutting. Seventy-five percent of total larval food consumption occurs in the final stage before pupation. Larvae often concentrate beneath the windrows, so relatively sparse fieldwide populations can cause severe damage to the area beneath the windrow if harvest is delayed. Action levels have been revised upward based on research completed in Iowa. Controls are recommended when at least two worms per square foot are present after the hay has been cut – provided most are not expected to pupate in the next three to four days. Windrows must be baled and bales removed before the field is sprayed.

Garden Webworms

Webworms are slender, greenish, black-spotted caterpillars. On the side of each segment of older larvae are three dark spots, each possessing one to three bristle-like hairs. A light stripe runs down the middle of the back. Webworms overwinter as pupae in the soil. There are at least four generations annually. Larvae are usually most abundant in late July to mid-August, but may cause damage through September. Early cutting will often eliminate the problem. However, if the crop is more than two weeks from cutting, and 25 to 30 percent of the terminals are becoming webbed, sprays in sufficient gallonage and pressure to thoroughly cover and penetrate the foliage may be justified.

Endangered Species

The U.S. Environmental Protection Agency (EPA) has established interim measures for protecting endangered species in seven Kansas counties: Barton, Clark, Comanche, Meade, Reno, Rice and Stafford. Currently, the program is aimed at protecting the interior least tern and the piping plover. While this program is now voluntary, it could become mandatory in the future. More information can be obtained from K-State Research and Extension offices in the counties mentioned.

Biological Control

Biological control is an important part of any insect management system. For more information on how biological control fits into alfalfa insect management programs see MF918, *Alfalfa Weevil Management in Kansas: II. Non-Chemical Controls*: www.ksre.ksu.edu/historicpublications/pubs/mf918.pdf. Also, MF2222, *Biological Control of Insect Pests on Field Crops in Kansas*: <https://www.bookstore.ksre.ksu.edu/pubs/MF2222.pdf>.

The Worker Protection Standard

The Worker Protection Standard (WPS) is a series of federal regulations pertaining to pesticides used for agricultural plant production on farms, forests, nurseries, and greenhouses. Users of agricultural pesticides or employers of agricultural workers or pesticide handlers, must comply with the federal Worker Protection Standard.

Learn more by visiting the EPA at: www.epa.gov/pesticide-worker-safety/pesticide-worker-protection-standard-how-comply-manual. Or contact your local K-State Research and Extension office to request a copy of the manual, *How to Comply with the 2015 Revised Worker Protection Standard for Agricultural Pesticides: What Owners and Employers Need to Know*: www.pesticideresources.org/wps/htc/htcmanual.pdf.

Variegated Cutworm Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 0.014 to 0.025 lb. a.i./acre (2.2 to 3.8 fl. oz./acre) |
| Beta-cyfluthrin (Baythroid XL) | 0.0065 to 0.0125 lb. a.i./a (0.8 to 1.6 fl. oz.) |
| Chlorpyrifos (numerous products) | Check label, but generally 1 to 2 pints/acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 13 to 26 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 2.5 to 11.75 fl. oz./acre |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.0075 to 0.0125 lb. a.i./acre (1.92 to 3.2 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Lambda-cyhalothrin (numerous products) | 0.015 to 0.025 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 10.0 fl. oz./acre |
| Methomyl (Lannate) | LV 3/4 to 3 pts./acre, SP 0.25 to 1 lb./acre |
| Permethrin (multiple products) | 0.05 to 0.2 lb. a.i./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |

Garden Webworm Management Options

| Insecticide | Rate |
|--|---|
| Alpha-cypermethrin (Fastac CS) | 2.8 to 3.8 fl. oz./acre |
| Beta-cyfluthrin (Baythroid XL) | 0.0125 to 0.022 lb. a.i./acre (1.6 to 2.8 fl. oz.) |
| Carbaryl (Sevin) | 1 to 1.5 lb. a.i./acre |
| Chlorpyrifos plus lambda-cyhalothrin (Cobalt Advanced) | 13 to 26 fl. oz./acre |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | 5.0 to 11.75 fl. oz./acre |
| Cyfluthrin (Tombstone) | 0.025 to 0.044 lb. a.i./a (1.6 to 2.8 fl. oz.) |
| Gamma-cyhalothrin (Proaxis, Declare) | 0.0075 to 0.0125 lb. a.i./acre (1.92 to 3.2 fl. oz.) (Declare: 1.02 to 1.54 fl. oz/acre) |
| Lambda-cyhalothrin (numerous products) | 0.015 to 0.025 lb. a.i./acre |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | 5.0 to 8.0 fl. oz./acre |
| Permethrin (multiple products) | 0.05 to 0.2 lb. a.i./acre |
| Zeta-cypermethrin (Mustang MAXX, etc.) | 0.014 to 0.025 lb. a.i./acre (2.24 to 4.0 fl. oz.) |

Alfalfa Insecticide Use Instructions

| Insecticide | Special Instructions — These notes are intended to help producers make preliminary decisions on chemicals to be used on their crops. However, growers and applicators should read pertinent sections of the label before final selection or application. |
|---|--|
| Alpha-cypermethrin* (Fastac CS) | A maximum of 3.8 fl. oz./acre (0.025 lb. a.i./acre) may be applied per cutting and a maximum of 11.4 fl. oz./acre (0.075 lb. a.i./acre) per season. PHI is 3 days. Do not use any products containing cypermethrin and zeta-cypermethrin during a crop season when using Fastac EC. |
| Beta-cyfluthrin* (Baythroid XL) | Signal word on label is WARNING. Extremely hazardous to fish and aquatic invertebrates. Do not apply this product or allow it to drift to blooming crops or weeds on which bees are actively foraging. Minimum application volume (water) 10 GPA ground and 2 GPA aerial application. Chemigation is allowed by label. Maximum of 3.2 fl. oz./ acre (0.025 lb. a.i./acre) per cutting. Maximum of 5.6 fl. oz./ acre (0.044 lb. a.i./ acre) per cutting for alfalfa or 2.8 fl. oz./acre (0.022 lb. a.i./acre) per cutting on mixed-stands of alfalfa and intentionally-grown grasses. |
| Carbaryl (Sevin) | This carbamate insecticide is sold by several companies and in different formulations. Check the product label to make sure it is approved for the intended use. Signal word on label: CAUTION or WARNING depending on formulation. BEE CAUTION: Do not apply or allow to drift to blooming crops or weeds if bees are visiting the treatment area. Carbaryl is extremely hazardous to aquatic invertebrates, so do not apply directly over water. Some phytotoxicity is possible and may cause bleaching of tender alfalfa foliage. Most labels recommend the use of 25 to 40 gallons of water with ground equipment to ensure adequate coverage. Refer to specific product labels for information on chemigation. Apply only once per cutting. REI is 12 hours. Do not apply within 7 days of harvest or grazing. |
| Chlorantraniliprole (Prevathon) | Make one application per cutting and no more than 4 applications per acre per crop. Do not apply more than 60 fl. oz. or 0.2 lb. a.i. of chlorantraniliprole-containing products per acre per year. REI is 4 hours. PHI is 0 hours. For grasshoppers add methylated Seed Oil (MSO) at 1% v/v. Apply when grasshoppers are mostly 2nd to 3rd instar. Once grasshopper ingest treated foliage there will be rapid feeding cessation, though full mortality may take a week or more. Do not make more than two applications in a row before rotating to a registered insecticide with a different mode of action. |
| Chlorpyrifos* (numerous products including Chlorpyrifos, Eraser, Govern, Lorsban, Nufos, Pilot, Warhawk, and Whirlwind) | Signal word on label is WARNING. Do not apply more than once per cutting or four times per year. For aerial applications use 2 to 5 gallons of water per acre. For best coverage when using ground application, a minimum of 20 gallons of water per acre with hollow cone nozzles is recommended. Chemigation is allowed. See label for more information. To avoid contamination of irrigation tail water, do not flood irrigate within 24 hours following an application of chlorpyrifos. Highly toxic to bees exposed to direct treatment. Some phytotoxic symptoms may be observed on young, tender, rapidly growing alfalfa. REI is 24 hours. Do not cut or graze treated alfalfa within seven days after applications of 0.25 lb. a.i./acre, 14 days after applications of 0.5 lb. a.i./ acre, or within 21 days after application exceeding 0.5 lb a.i./acre. |
| Chlorpyrifos plus lambda-cyhalothrin* (Cobalt Advanced) | The signal word on the label is DANGER. It is highly toxic to bees exposed to direct treatment on alfalfa. Do not flood irrigate for 24 hours following application. Do not cut or graze treated alfalfa within 7 days after application of 7 to 13 fl. oz. per acre of Cobalt, within 14 days after application of 13 to 26 fl. oz. per acre, or within 21 days after application of rates above 26 fl. oz. per acre. Do not make a second application of Cobalt or another product containing chlorpyrifos within 10 days of first application. REI is 24 hr. |
| Chlorpyrifos plus zeta-cypermethrin (Stallion) | A new product registration that is a combination of chlorpyrifos (2.72 lb./gal.) plus zeta-cypermethrin (0.272 lb./gal.). REI is 24 hrs. PHI for cutting or grazing is 7 days. |
| Cyfluthrin (Tombstone) | Signal word on label is WARNING. For control or suppression of many common insect pests. Extended residual activity due to helios technology. REI is 12 hours. PHI is 7 days. See label for directions. |
| Dimethoate* (Dimate and others, formerly Cygon) | This organophosphate insecticide is available from various suppliers and in various formulations. Signal word on label: WARNING or DANGER, depending on formulation. Highly toxic to bees. Do not apply to alfalfa in bloom. Do not apply directly to water; runoff may be hazardous to aquatic organisms. Chemigation allowed on some labels. Apply only once per cutting. REI is 48 hours. Do not apply within 10 days of harvest or pasturing. |
| Flupyradifurone (Sivanto Prime) | PHI is 7 days. Minimum interval between applications is 10 days. Minimum application volumes is 10 gallons/acre (ground); 3 gallons/acre (aerial). Do not apply more than 0.365 lb flupyradifurone (28.0 fl oz of Sivanto prime) per acre per calendar year on alfalfa, regardless of product or formulation. |

Alfalfa Insecticide Use Instructions

| Insecticide | Special Instructions — These notes are intended to help producers make preliminary decisions on chemicals to be used on their crops. However, growers and applicators should read pertinent sections of the label before final selection or application. |
|--|---|
| Gamma-cyhalothrin* (Proaxis) | This microencapsulated pyrethroid insecticide is labeled restricted use due to toxicity to fish and aquatic organisms. Signal word on label: CAUTION. Apply in a minimum of 2 gallons per acre by air or 10 gallons per acre by ground. When foliage is dense and/or pest populations are high, 5 to 10 gallons per acre by air or 20 gallons per acre by ground and higher label use rates are recommended. Do not apply more than 0.015 pound active ingredient (0.24 pint) per acre per cutting. Do not apply more than 0.06 pound active ingredient (0.96 pint) per acre per season. Apply only to fields planted to pure stands of alfalfa. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area. REI is 24 hours. PHI is 1 day for forage and 7 days for hay. |
| Gamma-cyhalothrin* (Declare) | Declare is a concentrated formulation of gamma-cyhalothrin. Restricted use product. Signal word on label: CAUTION. Apply in a minimum of 2 gallons per acre by air or 10 gallons per acre by ground. When foliage is dense and/or pest populations are high, 5 to 10 gallons per acre by air or 20 gallons per acre by ground and higher label use rates are recommended. Do not apply more than 0.015 pound active ingredient (1.54 fl oz) per acre per cutting. Do not apply more than 0.06 pound active ingredient (6.15 fl oz) per acre per season. REI is 24hrs. PHI 1 day for forage and 7days for hay. |
| Indoxacarb (Steward 1.25 SC) | This insecticide carries the signal word of CAUTION. Toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply to blooming crops or weeds while bees are actively visiting the treatment area. Steward EC helps conserve certain beneficial arthropods including parasitic wasps, pirate bugs, and others. It can be applied by air using a minimum of 3 gallons of water per acre or by ground equipment with a minimum of 5 gallons of water per acre. Higher gallonage provides better coverage and performance. Use no more than 11.3 fl oz. or 0.11 lbs. ai. per cutting. REI is 12 hours, and PHI is 7 days. |
| Lambda-cyhalothrin* (numerous products including Warrior II with Zeon Technology, Silencer, Taiga Z, and Lambda T) | This pyrethroid insecticide is labeled restricted use due to toxicity to fish and aquatic organisms. Signal word on label: WARNING. Apply by ground or air using sufficient water to obtain full coverage of foliage. Use a minimum of 2 gallons of water per acre by air. REI is 24 hours. PHI is 1 day for forage or 7 days for hay. Apply only to pure stands of alfalfa. |
| Lambda-cyhalothrin plus chlorantraniliprole (Besiege) | This product is a combination of two insecticides with activity against both chewing and sucking insects. It is highly toxic to bees exposed to direct treatment or to residues on blooming crops and weeds. PHI is 1 day for forage and 7 days for hay. |
| Methomyl* (Lannate) | This carbamate insecticide is labeled restricted use due to high acute toxicity to humans. Signal words on label: DANGER–POISON. Toxic to fish and wildlife. Drift and runoff from treated areas may be hazardous to aquatic organisms. Highly toxic to bees. Do not apply or allow to drift to blooming crops or weeds if bees are visiting the treatment area. Do not apply through any type of irrigation system. Do not apply to dormant or semi-dormant alfalfa when minimum daily temperature is less than 50°F. REI is 48 hours. PHI is 7 days. See label for other restrictions. |
| Permethrin* (Arctic, Ambush and Pounce) | This pyrethroid insecticide is labeled restricted use due to toxicity to fish and aquatic organisms. Signal word on label CAUTION or WARNING depending on formulation. Use a minimum of 10 gallons of finished spray per acre by ground application and a minimum of 1 gallon of finished spray if applied by air. Can be chemigated; refer to label for details. REI is 12 hours. PHI for 0.1 lb. a.i./acre or less is 0 days. Above 0.1 lb. a.i./acre a 14-day PHI is required. Do not apply more than 0.2 lb. a.i./acre per cutting. |
| Phosmet* (Imidan) | This organophosphate insecticide carries the signal word WARNING on its label. It is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Extremely toxic to fish. Apply in a minimum of 3 gallons of water by air, or 20 to 75 gallons of water with conventional ground equipment. Can be chemigated. Only one application per cutting. REI is 12 hours. PHI is 7 days. |
| Zeta-cypermethrin* (Mustang MAXX, etc.) | This pyrethroid insecticide is labeled restricted use due to its toxicity to fish and aquatic invertebrates. Signal word on label: CAUTION. Apply in a minimum of 2 gallons of finished spray per acre by aerial equipment or 10 gallons per acre by ground equipment. Can be chemigated. Refer to label for more information. REI of 12 hours. Application may be made up to three days before cutting or grazing or up to seven days for harvesting seed. Maximum use 0.05 lb. a.i./acre or 8 fl. oz./acre per cutting or one application of Stallion at 11.75 fl. oz. + one application of Mustang Maxx at 4 fl. oz. per cutting and 0.15 lb. a.i./acre per season or 24 fl. oz. of Mustang Maxx or equivalent combination of Stallion and Mustang Maxx equaling 0.15 lbs a.i./acre per season. Do not make applications less than 7 days apart. |

* Restricted Use Pesticide

Sarah Zukoff, R. Jeff Whitworth, J.P. Michaud, Holly N. Davis, and Brian P. McCornack, Department of Entomology

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