

SECTION Y.

CONTROL OF PROBLEM WEEDS

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This section gives information about specific weeds that may be troublesome to control. Herbicides and/or rates listed cannot necessarily be used on cropland. Rates of application and restrictions vary depending on crop or site. Do not apply to a crop or site not listed on the label.

Non-cropland is greenspace where plants are not harvested by humans or animals for food, feed, or fiber; roadsides, for example.

Highly volatile esters of 2,4-D are not permitted. Low-volatile (LV) esters are restricted in some parts of Washington.

Caution This handbook is not intended to be a complete guide to herbicide use. Before using any chemical, read the label recommendations on the container. Before a chemical can be recommended for a specific use, it must be thoroughly tested. Following the recommendation on the manufacturer's label can prevent many problems arising from the incorrect use of a chemical.

Alyssum, hoary (*Berteroa incana*)

2,4-D amine

Rate Broadcast treatment: 3 to 4 lb ae/a

Time Apply in spring to rosettes prior to bolting.

Remarks Repeated applications will be needed to fully control plants arising from the seedbank.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

metsulfuron (Escort and others)

Rate 0.5 oz ai/a (0.5 to 1 oz/a)

Time Apply in spring to rosettes prior to bolting.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Archangel, yellow (*Lamiastrum galeobdolon*)

glyphosate

Rate Spot treatment at 2.5%: mix 3.2 fl oz of 3 lb ae glyphosate formulation with each gal of water in a backpack sprayer.

Time Apply to actively growing yellow archangel foliage.

Remarks Re-treatment may be necessary. Add nonionic surfactant if not included in the formulation. Rain within 6 hours after application may reduce effectiveness. Allow at least 7 days after application before tillage or mowing of sprayed foliage. Combinations with imazapyr or triclopyr at the rates below have shown good results in testing in western Washington.

Caution Glyphosate is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Arsenal, Habitat, or others)

Rate Spot treatment at 1%: mix 1.5 fl oz of Habitat with each gal of water.

Time Apply to actively growing yellow archangel foliage.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Re-treatment may be necessary. Rain within 6 hours after application may reduce effectiveness. Allow at least 7 days after application before tillage or mowing of sprayed foliage.

Caution Imazapyr is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

triclopyr ester (Garlon 4) or triclopyr amine (Garlon 3A) or triclopyr + 2,4-D (Crossbow)

Rate Spot treatment at 1.5%: mix 2 fl oz of Garlon 4, Garlon 3A, or Crossbow with each gal of water.

Time Apply to actively growing yellow archangel foliage.

Remarks Re-treatment may be necessary. Rain within 6 hr after application may reduce effectiveness. Allow at least 7 days after application before tillage or mowing of sprayed foliage.

Caution Use on rights-of-way, industrial sites, and for forestry (release and site preparation). Crossbow can be used on permanent pasture and rangeland, up to 1.5 lb ae/a. Observe all grazing and harvesting restrictions.

Site of action (all) Group 4: synthetic auxin

Chemical family (triclopyr) pyridine; (2,4-D) phenoxy acetic acid

Arum, Italian (*Arum italicum*)

Remarks Although PNW data are preliminary, metsulfuron, sulfometuron, glyphosate, aminocyclopyrachlor, and imazapyr appear promising in initial trials.

Site of action (metsulfuron, sulfometuron, imazapyr) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (aminocyclopyrachlor) Group 4: synthetic auxin

Chemical family (metsulfuron, sulfometuron) sulfonylurea; (imazapyr) imidazolinone; (glyphosate) none generally accepted; (aminocyclopyrachlor) pyridine

Babysbreath (*Gypsophila paniculata*)

aminopyralid + metsulfuron (Opensight, Chaparral)

Rate 2.5 to 3 oz product/a

Time Apply preemergence in the fall or postemergence in spring to seedlings or rosettes.

Site of action (metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor; (aminopyralid) Group 4: synthetic auxin

Chemical family (metsulfuron) sulfonylurea; (aminopyralid) pyridine

chlorsulfuron (Telar and others)

Rate 0.75 to 0.195 oz ai/a (1 to 2.6 oz/a).

Time Apply in spring to rosettes or to bolting plants with green basal leaves.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture.

Caution Avoid drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

dicamba (Banvel and others)

Rate 0.75 to 1.5 lb ae/a (1.5 to 3 pints/a)

Time Apply in spring to rosettes or to bolting plants with green basal leaves.

Remarks Dicamba is most effective at higher rates.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

glyphosate

Rate 2.25 lb ae/a (3 quarts/a of 3 lb ae/gal product).

Time Apply in spring to rosettes or bolting plants with green basal leaves.

Remarks Add nonionic surfactant if not included in the formulation. Allow at least 7 days after application before tillage.

Caution Glyphosate is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted.

imazapic (Plateau)

Rate 0.125 to 0.188 lb ae/a (8 to 12 fl oz/a).

Time Apply in spring to rosettes or bolting plants with green basal leaves.

Remarks Add 0.25% by volume of nonionic surfactant or 1.5 to 2 pints/a methylated seed oil or crop oil concentrate to spray mixture.

Caution Avoid drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate 0.6 to 1.2 oz ai/a (1 to 2 oz/a).

Time Apply in spring to rosettes or to bolting plants with green basal leaves.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture.

Caution Avoid drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Barberry, common (*Berberis vulgaris*)

Remarks Although PNW data are preliminary, foliar-applied imazapyr and cut-stem treatments of imazapyr, picloram, or triclopyr + 2,4-D gave good results in initial trials.

Site of action (imazapyr) Group 2: acetolactate synthase (ALS) inhibitor; (2,4-D, picloram, triclopyr) Group 4: synthetic auxin

Chemical family (imazapyr) imidazolinone; (2,4-D phenoxy acetic acid; (picloram, triclopyr) pyridine

Beancaper, Syrian (*Zygophyllum fabago*)

Remarks Control is unknown, although metsulfuron appears promising in initial trials. Other data suggest glyphosate at 1.5 lb ae/a and picloram at 1 lb ae/a are effective.

Site of action (metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (picloram) Group 4: synthetic auxin

Chemical family (metsulfuron) sulfonylurea; (glyphosate) none generally accepted; (picloram) phenoxy acetic acid

Bermudagrass (*Cynodon dactylon*)

fluazifop (Fusilade DX)

Rate 0.25 to 0.375 lb ai/a (1 to 1.5 pints/a)

Time Apply to actively growing bermudagrass with 4- to 8-inch runners.

Remarks Apply with 1% (v/v) crop oil concentrate or 0.25% (v/v) nonionic surfactant. Acts very slowly, taking at least 2 weeks and often 4 weeks to show effectiveness. Do not apply to stressed grasses. If weeds regrow, reapply at 0.1875 to 0.375 lb ai/a.

Caution Do not use crop oil concentrate if treating bermudagrass in ornamentals. Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

glyphosate

Rate 3.75 lb ae/a

Time Apply to actively growing bermudagrass with seed heads.

Remarks Re-treatment may be necessary. Rain within 6 hr after application may reduce effectiveness. Allow at least 7 days after application before tillage.

Caution Glyphosate is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted.

Biddy-biddy (*Acaena novae-zelandiae*)

Remarks Control is unknown. No herbicides are currently recommended.

Bindweed, field or perennial morningglory (*Convolvulus arvensis*)

2,4-D (for suppression) amine

Rate Broadcast treatment: 2 to 3 lb ae/a

Time Apply at bud growth stage or at summer fallow in early August.

Remarks Use 2,4-D to help reduce bindweed stand 60 to 80% and prevent seedling establishment. It is important to apply 2,4-D every year; skipping an application gives bindweed a chance to recover. During the grain year, apply 2,4-D to growing winter wheat. After wheat matures, apply 2,4-D with a sprayer mounted on the combine, or apply after combining.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to broadleaf weeds in spring.

Remarks Adjuvants can be used, these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

dicamba (Banvel, Rifle, or Clarity) or dicamba + 2,4-D (for suppression)

Rate 0.5 to 1 lb ae/a dicamba; or 0.5 to 1 lb ae/a dicamba + 1 to 2 lb ae/a 2,4-D

Time Apply during fallow, before planting and when weeds are actively growing.

Remarks Rates are to suppress field bindweed.

Caution Refer to label for crop rotation restrictions. Avoid drift to sensitive crops.

Site of action (both) Group 4: synthetic auxin

Chemical family (dicamba) benzoic acid; (2,4-D) phenoxy acetic acid

dicamba (Banvel, Rifle, or Clarity) or dicamba + 2,4-D (for control)

Rate 1 to 2 lb ae/a dicamba; or 1 to 2 lb ae/a dicamba + 1 to 2 lb ae/a 2,4-D

Time Apply in late summer or fall before killing frost.

Remarks Control is best when weeds are actively growing and in postbloom stage. Make follow-up application in spring to control seedlings.

Caution See label for in-crop use and rotation restrictions. Avoid drift to sensitive crops.

Site of action (both) Group 4: synthetic auxin

Chemical family (dicamba) benzoic acid; (2,4-D) phenoxy acetic acid

glyphosate

Rate 3 to 3.75 lb ae/a

Time Apply at full bloom to early seed stage of maturity. Application on fall regrowth may provide some control.

Remarks Cover foliage thoroughly but avoid spray runoff. Re-treatments may be needed for complete control. Control improves if the treated area is tilled 2 to 3 weeks after treatment.

Caution Glyphosate controls grasses as well as other vegetation in treated areas.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate + 2,4-D (Landmaster BW)

Rate 0.378 to 0.67 lb ae/a (54 oz/a Landmaster)

Time Apply in fallow or postharvest to bindweed runners at least 10 inches long. Use 1% solution to spot treat with high-volume, spray-to-wet applications. Tilling after treatment may improve control.

Remarks In fallow, cultivate until July 1; then allow weeds to grow to treatment stage.

Caution Avoid drift to sensitive crops.

Site of action (glyphosate) Group 9: inhibits EPSP synthase; (2,4-D) Group 4: synthetic auxin

Chemical family (glyphosate) none generally accepted; (2,4-D) phenoxy acetic acid

glyphosate + dicamba (Banvel, Rifle, or Clarity)

Rate 1.5 lb ae/a glyphosate + 0.5 lb ae/a dicamba

Time Apply mid- to late-bloom but before seed matures. Applying to fall regrowth may give some control.

Remarks Use this tank-mix during summer fallow before planting small grains.

Caution Crop may be somewhat injured if dicamba is applied within 45 days of planting. Glyphosate controls grasses as well as other vegetation in treated areas.

Site of action (glyphosate) Group 9: inhibits EPSP synthase; (2,4-D) Group 4: synthetic auxin

Chemical family (glyphosate) none generally accepted; (dicamba) benzoic acid

imazapic (Plateau)

Rate 0.125 to 0.188 lb ai/a

Time Apply after 25% bloom through fall to actively growing bindweed.

Remarks Add 1 quart/a methylated seed oil.

Caution Note crop rotation restrictions before using.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort)

Rate 0.6 to 1.2 oz ai/a (1 to 2 oz/a)

Time Apply to actively growing bindweed in bloom stage.

Remarks Treatment is suppressive. Use a nonionic or silicone surfactant to improve control.

Caution Do not allow spray drift to sensitive crops. This rate is only for non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 1 lb ae/a

Time Apply in the growing season on non-cropland when bindweed is visible. Timing is not critical, but results are most consistent if bindweed is in early bud to full bloom.

Remarks Apply as a coarse, low-pressure spray in sufficient volume to cover adequately. For control in fallow, refer to Winter Wheat—Nonirrigated East of the Cascades in this handbook.

Caution A **restricted-use herbicide**. Picloram is registered only on rangeland and permanent pastures and on fallow grainland east of the Cascades. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to picloram. Do not plant these crops until an adequately sensitive bioassay or chemical test shows that no picloram is detectable in the soil. Extend treatment 10 ft beyond the infestation. Do not use in diversified cropping areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

quinclorac (Paramount)

Rate 6 oz ai/a (8 oz/a)

Time Apply in fall before frost to actively growing bindweed with stems at least 4 inches long.

Remarks Must add methylated seed oil at 1 to 2 pints/a or crop oil concentrate at 2 pints/a. Plant uptake is through foliage and roots. Rain after application is important for soil uptake.

Caution Note crop rotation restrictions before using. Do not exceed 12 oz ai/a per calendar year.

Site of action Group 4: synthetic auxin

Chemical family Quinoline carboxylic acid

Blackberry vines, wild (*Rubus* spp.)

aminocyclopyrachlor + metsulfuron methyl (Streamline)

Rate 3.8 to 4.5 oz/a aminocyclopyrachlor + 1.2 to 1.4 oz/a metsulfuron (9.5 to 11.5 oz/a of product)

Time Apply to actively growing woody plants.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water. There are several application methods that dictate the amount of product to be mixed with the

carrier, so consult the label. Controls many herbaceous species, in addition to woody species.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Conifers can be injured, these include ponderosa pine, Douglas fir, Norway spruce, and white pine. Other trees that can be injured include aspen, Chinese tallow, cottonwoods, honey locust, magnolia, poplars, redbud, silver maple, and willow. Applications to stressed plants may reduce control. Do not allow spray to drift off target.

Site of action Group 4 synthetic auxin (aminocyclopyrachlor) Group 2: ALS inhibitor (metsulfuron methyl)

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (metsulfuron methyl) Sulfonylurea

glyphosate

Rate Broadcast: use 2.25 to 3 lb ae/a. Spot treat: use 1% to 1.5% solutions.

Time Apply in September to October when canes are actively growing and after berries are formed. Fall treatments must be made before a killing frost.

Remarks Fall spray treatment symptoms may not show before frost. Re-treatment may be necessary for complete control. Trailing blackberry is more difficult to control.

Caution Glyphosate controls grasses in the treated area as well as other vegetation.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

metsulfuron (Escort and others)

Rate 0.3 to 0.6 oz ai/a (0.5 to 1 oz/a)

Time Apply to fully leafed-out vegetation before fall leaf coloration.

Remarks Constantly agitate while mixing product in water. Add 0.25% by volume of nonionic or silicone surfactant to spray mixture. Good coverage is essential. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 1 lb ae with 50 gal of water for spot treatment sprays

Time Apply in late spring after leaves are fully developed.

Remarks Foliage must be thoroughly wet. Reapplication will be required as regrowth occurs.

Caution **Most formulations are restricted-use herbicides.** Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to picloram. Do not use picloram in diversified cropping areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr ester (Garlon 4) or triclopyr amine (Garlon 3A) or triclopyr + 2,4-D (Crossbow)

Rate Spot treatment: mix 3 lb ae Garlon 4 or 3.75 lb ae Garlon 3A with 100 gal water, or 1 pint Crossbow in 12 gal water. Broadcast: use 1 to 4 lb ae/a Garlon 4, or 1.5 to 4.5 lb ae/a Garlon 3A, or 1 to 2 gal/a Crossbow.

Time Apply when plants are actively growing. For dormant application, mix Garlon 4 in diesel oil or in water with 3% of an oil substitute.

Remarks Foliage must be thoroughly wet.

Caution Use on rights-of-way, industrial sites, and for forestry (release and site preparation). Crossbow can be used on permanent pasture and rangeland, up to 1.5 lb ae/a. Observe all grazing and harvesting restrictions.

Site of action (all) Group 4: synthetic auxin

Chemical family (triclopyr) pyridine; (2,4-D) phenoxy acetic acid

Blackgrass (*Alopecurus myosuroides*)

Remarks Fenoxaprop, flufenacet, pendimethalin, pinoxaden, pyroxulam, and triallate are used in cereal crops. Grass herbicides (clethodim, fluazifop, quizalofop, and sethoxydim) and glyphosate may also be effective. See specific crop section for these herbicides in cropland recommendations.

Site of action (clethodim, fenoxaprop, fluazifop, pinoxaden, quizalofop, sethoxydim) Group 1: acetyl CoA carboxylase (ACCase) inhibitors; (pyroxulam) Group 2: acetolactate synthase (ALS) inhibitor; (pendimethalin) Group 3: microtubule assembly inhibitor; (triallate) Group 8: lipid synthesis inhibitor (not ACCase); (glyphosate) Group 9: inhibits EPSP synthase; (flufenacet) Group 15: inhibits very long chain fatty acids

Chemical family (clethodim, sethoxydim) cyclohexanedione; (fenoxaprop, fluazifop, quizalofop) aryloxyphenoxy propionate; (flufenacet) oxyacetamide; (glyphosate) none generally accepted; (pendimethalin) dinitroaniline; (pinoxaden) phenylpyrazolin; (pyroxulam) triazolopyrimidine sulfonamide; (triallate) thiocarbamate

Blueweed or viper's bugloss (*Echium vulgare*) and Paterson's curse (*Echium plantagineum*)

2,4-D amine

Rate Broadcast treatment: 2 lb ae/a (2.1 quarts/a)

Time Apply in spring to seedlings. Treatments from mid-summer to autumn may help control more established plants.

Remarks 2,4-D is usually not able to fully control these species, so combining with other products is generally recommended for full control.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

chlorsulfuron (Telar and others)

Rate Escort: 0.75 to 1.125 oz ai/a (1 to 1.5 oz/a)

Time Apply preemergence in autumn, or postemergence to seedlings in spring. Treatments from mid-summer to autumn may help control more established plants.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Resistance of blueweed to sulfonyleurea herbicides has

been documented in Australia, so combination with other herbicides of different mode of action is recommended to delay onset of resistance.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

glyphosate

Rate Broadcast: 0.21 to 0.77 lb ae/a (6 to 22 fl oz/a). Spot treat: use 1% to 2% solutions.

Time Apply from late spring to midsummer prior to flowering.

Remarks Treat all emerged foliage, but prior to runoff. Add nonionic surfactant if not included in the formulation.

Caution Glyphosate is nonselective and other vegetation will be injured or killed.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

metsulfuron (Escort and others)

Rate 0.3 to 0.6 oz ai/a (0.5 to 1 oz/a)

Time Apply in spring to seedlings. Treatments from mid-summer to autumn may help control more established plants.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Repeat applications will likely be necessary to achieve full control. Resistance of blueweed to sulfonyleurea herbicides has been documented in Australia, so combination with other herbicides of different mode of action is recommended to delay onset of resistance.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

picloram (Tordon)

Rate 4 to 8 fl oz ae/a (1 to 2 pints/a)

Time Apply preemergence in autumn, or postemergence to seedlings in spring. Treatments from mid-summer to autumn may help control more established plants.

Remarks Treat all emerged foliage, but prior to runoff.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to picloram. Do not use picloram in diversified cropping areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Blueweed, Texas (*Helianthus ciliaris*)

dicamba (Banvel, Rifle, or Clarity)

Rate 2 to 4 lb ae/a

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

clopyralid (Stinger or Transline) or glyphosate or MCPA (various products) or picloram (Tordon) or 2,4-D (various trade names)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action (clopyralid, MCPA, 2,4-D, and picloram) Group 4: synthetic auxin; (glyphosate) Group 9: inhibits EPSP synthase

Chemical family (clopyralid and picloram) pyridine; (glyphosate) none generally accepted; (MCPA and 2,4-D) phenoxy acetic acid

imazapyr (Arsenal)

Rate 1 lb ae/a

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Brackenfern, western (*Pteridium aquilinum*)**asulam (Asulox)**

Rate 1.6 to 3.3 lb ai/a

Time When bracken is in full frond.

Remarks Apply on uncultivated land, reforestation sites, and Christmas tree plantations only. Asulam has a half-life of 6 to 14 days in soil.

Caution See label for precautions.

Site of action Group 18: inhibits DHP synthase step

Chemical family Carbamate

dicamba (Banvel, Rifle, or Clarity)

Rate 4 to 8 lb ae/a

Time Apply in late winter before fronds emerge.

Remarks Management for maximum crop competition aids control. Will not control grasses.

Caution Avoid drift to sensitive crops. Clover stands may be reduced or eliminated in pastures.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

glyphosate

Rate 2.25 to 3 lb ae/a or a 1 to 1.5% solution when using hand-held equipment

Time When bracken fronds are at least 18 inches long.

Remarks Adequate foliar coverage is necessary.

Caution Glyphosate controls grasses in the treated area as well as other vegetation.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

Brome, false (*Brachypodium sylvaticum*)

fluazifop (Fusilade)

Rate 2 to 4 oz ai/a (8 to 16 fl oz/a)

Time Apply in spring to control seedlings, and treat established plants through summer until fall.

Remarks Two to three years of treatment will be necessary to achieve control. Fine leaf fescues are tolerant to fluazifop. Native broadleaves should not be injured by fluazifop.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

glyphosate

Rate Broadcast: 2.25 to 3.7 lb ae/a; spot treatment: 1.5% solution

Time Apply to green leaves in midsummer to autumn.

Remarks Adequate foliar coverage of false-brome is necessary, and repeat applications may be required to achieve full control. Add nonionic surfactant if not included in the formulation. Late summer treatments after native plants are dormant are preferred to minimize injury.

Caution Glyphosate is nonselective and injures or kills other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

hexazinone (Velpar)

Rate Broadcast: 2 lb ai/a (1 gal/a)

Time Apply preemergence in the spring.

Remarks Hexazinone is normally used in sequence with glyphosate applied in late summer (see above). Early spring hexazinone application controls newly germinating seedlings.

Caution Hexazinone is a restricted-use herbicide. Do not contaminate water.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazinone

sethoxydim (Poast)

Rate 3 to 4.5 oz ai/a (1 to 1.5 pints/a)

Time Apply in spring to control seedlings, and treat established plants through summer until fall.

Remarks Two to three years of treatment will be necessary to achieve control. Fine leaf fescues are tolerant to sethoxydim. Native broadleaves should not be injured by sethoxydim.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

Broom, Scotch (*Cytisus scoparius*), French (*Genista monspessulana*), Portuguese (*Cytisus striatus*), and Spanish (*Spartium junceum*)**glyphosate**

Rate 1.5 to 3 lb ae/a or 1.5 to 2% solution for handgun sprayer application.

Time Apply to actively growing plants in the spring.

Remarks See Forestry section of this handbook for information on control in conifers. Adding a recommended surfactant improves results.

Caution Also controls grasses and other plants needed to compete with Scotch broom seedlings.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

triclopyr ester (Garlon 4) or triclopyr amine (Garlon 3A) or triclopyr + 2,4-D LV ester (Crossbow)

Rate 0.5 to 1.5% concentration of Garlon 4 or Crossbow, or 1 to 1.5% concentration of Garlon 3A

Time Apply any time plants are actively growing. Garlon 4 and Crossbow can be used for basal bark applications any time of year.

Remarks Foliage must be thoroughly wet. For Garlon 3A, it is especially important to use a high volume of water (100 gal/a or more).

Caution Garlon products are registered for use on rights-of-way, industrial sites, and forestry (release and site preparation). Crossbow can be used on permanent pastures and rangeland up to 1.5 lb ae/a. Observe all grazing and harvesting restrictions.

Site of action (all) Group 4: synthetic auxin

Chemical family (triclopyr) pyridine; (2,4-D) phenoxy acetic acid

Bryony, white (*Bryonia alba*)

glyphosate

Rate Full strength for cut stem treatments.

Time Apply any time of year, including when plants are dormant or actively growing.

Remarks Cut plants at 3 to 4 inches below the crown and apply adequate product to wet the freshly-cut surface of the root. Foliar treatment of white bryony is difficult because it twines over desirable vegetation. If white bryony vines are separated from supporting vegetation, it may allow for selective foliar treatment with glyphosate.

Caution Glyphosate is nonselective, so other vegetation coming into contact with the herbicide may be injured or killed.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

Buffalobur (*Solanum rostratum*)

diflufenzopyr + dicamba (Overdrive)

Rate 0.175 to 0.35 lb ae/a (4 to 8 oz/a)

Time Apply to actively growing plants.

Remarks For improved uptake if weeds are under moisture or temperature stress, use a nonionic surfactant or a methylated seed oil.

Caution Do not plant any crop within 30 days of application. Do not exceed 10 oz/a of Overdrive per season.

Site of action (diflufenzopyr) Group 19: inhibits indoleacetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) semicarbazone; (dicamba) benzoic acid

glyphosate or clopyralid (Stinger or Transline) or picloram (Tordon)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action (glyphosate) Group 9: inhibits EPSP synthase; (clopyralid and picloram) Group 4: synthetic auxin

Chemical family (glyphosate) none generally accepted; (clopyralid and picloram) pyridine

Bugloss, annual (*Anchusa arvensis*) and small or common (*Anchusa officinalis*)

Remarks Although PNW data are preliminary, initial data indicate that 2,4-D and 2,4-D + dicamba may provide some control when applied prior to flowering and mixed with nonionic surfactant.

Site of action (2,4-D, dicamba) Group 4: synthetic auxin

Chemical family (2,4-D) phenoxy acetic acid; (dicamba) benzoic acid

Bulrush, small-fruited (*Scirpus microcarpus*), softstem (*Scirpus validus*), and ricefield (*Schoenoplectus mucronatus*)

2,4-D LV ester

Rate 3 lb ae of 2,4-D ester in 100 gal water. Use LV ester formulation plus 3 gal diesel or stove oil for spot treatment.

Time Apply to growing plants. Respraying is necessary for complete control.

Remarks Foliage must be thoroughly wet.

Caution Avoid drift to sensitive crops and desirable vegetation.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

Burdock, common (*Arctium minus*)

2,4-D LV ester or 2,4-D amine

Rate 2 lb ae/a

Time Before flower buds develop.

Remarks Plants should be actively growing at time of treatment.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminopyralid (Milestone)

Rate 1 to 1.5 oz ae/a (4 to 6 fl oz/a Milestone)

Time Apply to actively growing plants in the rosette.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

diflufenzopyr + dicamba (Overdrive)

Rate 0.175 to 0.35 lb ae/a (4 to 8 oz/a)

Time Apply to actively growing plants.

Remarks For improved uptake if weeds are under moisture or temperature stress, use a nonionic surfactant or a methylated seed oil.

Caution Do not plant any crop within 30 days of application. Do not exceed 10 oz/a of Overdrive per season.

Site of action (diflufenzopyr) Group 19: inhibits indoleacetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) semicarbazone; (dicamba) benzoic acid

triclopyr + clopyralid (Redeem R&P)

Rate 1.5 to 2 pints/a

Time Apply when weeds are actively growing.

Remarks Add a nonionic surfactant at the surfactant manufacturer's recommended rate. Apply in at least 10 gal/a water by ground.

Caution Do not exceed 4 pints/a per year. Avoid drift to desirable vegetation. Note label restrictions on overseeding or reseeding.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) pyridine

Bursage, skeletonleaf (*Ambrosia tomentosa*)**2,4-D**

Rate 1.5 to 2 lb ae/a

Time Apply after tilling 3 to 4 inches deep and when regrowth is 4 to 6 inches tall.

Remarks If not tilled, treat in spring and fall. Two to three annual re-treatments may be needed for complete control.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

picloram (Tordon)

Rate 1 lb ae/a

Time Apply when plants are fully leaved and actively growing.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. At rates above 0.5 lb ae/a (1 quart/a), apply only as spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Bursage, woolyleaf (*Ambrosia grayi*)**dicamba (Banvel, Rifle, or Clarity)**

Rate 2 to 4 lb ae/a

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

imazapyr (Arsenal)

Rate 1 lb ae/a

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Buttercup, creeping (*Ranunculus repens*)**aminocyclopyrachlor + chlorsulfuron (Perspective)**

Rate 1.2 to 1.8 oz/a aminocyclopyrachlor + 0.5 to 0.7 oz/a chlorsulfuron (3 to 4.5 oz/a of product)

Time Apply to actively growing vegetation.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

diflufenzopyr + dicamba (Overdrive)

Rate 0.175 to 0.35 lb ae/a (4 to 8 oz/a)

Time Apply to actively growing plants.

Remarks For improved uptake if weeds are under moisture or temperature stress, use a nonionic surfactant or a methylated seed oil.

Caution Do not plant any crop within 30 days of application. Do not exceed 10 oz/a of Overdrive per season.

Site of action (diflufenzopyr) Group 19: inhibits indoleacetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) Semicarbazone; (dicamba) Benzoic acid

MCPA LV ester or MCPA amine

Rate 1.5 lb ae/a

Time Apply when the buttercup is growing well.

Remarks Avoid drift to sensitive crops and desirable vegetation.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

Butterflybush (*Buddleja davidii*)

Remarks Although PNW data are preliminary, imazapyr and glyphosate provided good control in initial trials when applied as cut stem treatments.

Site of action (imazapyr) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase

Chemical family (imazapyr) imidazolinone; (glyphosate) none generally accepted

Camelthorn (*Alhagi maurorum*)

aminocyclopyrachlor + metsulfuron (Streamline)

Rate 7.5 to 11.5 oz/a

Time Apply to actively growing vegetation.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v.

Caution Do not apply to the root zone of desirable trees and shrubs. May injure or kill some grass species.

Site of action (aminocyclopyrachlor) Group 4 Synthetic auxin; (metsulfuron) Group 2: Acetolactate synthase (ALS) inhibitor

Chemical family (aminocyclopyrachlor) Pyridine; (metsulfuron) Sulfonylurea

aminocyclopyrachlor + imazapyr + metsulfuron (Viewpoint)

Rate 16 to 20 oz/a

Time Apply to actively growing vegetation.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v.

Caution Do not apply to the root zone of desirable trees and shrubs. May injure or kill some grass species.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (imazapyr, metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminocyclopyrachlor) Pyridine; (imazapyr) Imidazolinone; (metsulfuron) Sulfonylurea

imazapyr (Arsenal)

Rate 0.5 to 1 lb ae/a (3 to 4 pints/a)

Time Apply to actively growing vegetation.

Remarks Add 0.25% by volume of nonionic surfactant, or 1 to 2 pints/a methylated seed soil or crop oil concentrate to spray mixture. Re-treatment may be necessary.

Caution Imazapyr is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate 0.6 to 1.8 oz ai/a (1 to 3 oz/a)

Time Apply to actively growing vegetation.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.5 to 1 lb ae/a

Time Apply when plants are fully leaved and actively growing.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. At rates above 0.5 lb ae/a (1 quart/a), apply only as spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Canarygrass, reed (*Phalaris arundinacea*) and ribbongrass (*Phalaris arundinacea* var. *picta*)

fluazifop (Fusilade DX)

Rate 0.25 to 0.375 lb ai/a (1 to 1.5 pints/a)

Time Apply to actively growing reed canarygrass.

Remarks Apply with 1% v/v crop oil concentrate or 0.25% v/v nonionic surfactant. Acts very slowly, taking at least 2 weeks and often 4 weeks to show effectiveness. Do not apply to stressed grasses. If weed regrows, repeat application.

Caution Do not use crop oil concentrate if treating reed canarygrass in ornamentals. Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

glyphosate

Rate 1.2 to 2.25 lb ae/a

Time Apply to actively growing plants at early heading or in fall from mid-September to after first light frost.

Remarks Check label regarding using a surfactant.

Caution Glyphosate controls other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Habitat or Arsenal)

Rate 0.5 to 1 lb ae/a

Time Apply in boot stage through fall, when plant is actively growing.

Remarks Habitat is labeled for aquatic sites. Arsenal is labeled for rangeland, pasture and non-cropland use only. Always add the appropriate surfactant.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

sulfometuron (Oust)

Rate 2.25 to 3.75 ai/a (3 to 5 oz/a)

Time Preemergence to early postemergence.

Remarks Recommended for use on non-cropland only. Do not apply to frozen ground. Constantly agitate while mixing in spray solution. Add 0.25% v/v nonionic surfactant to increase activity

of postemergence applications. Apply with ground equipment in at least 15 gal/a carrier.

Caution Keep sulfometuron out of cropland. Use equipment dedicated to non-cropland uses only. Do not treat powdery, dry soils or light, sandy soils if rain is not likely after treatment.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Cape-ivy (*Delairea odorata*)

clopyralid (Transline)

Rate Spot treatment: 0.5% solution.

Time Apply to actively growing vegetation.

Remarks Mix with 0.25% by volume nonionic surfactant and apply to all exposed foliage. Repeat applications may be required to achieve full control.

Caution Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to clopyralid. Do not use in diversified cropping areas.

Site of action Group 4 synthetic auxin

Chemical family Pyridine

glyphosate

Rate Spot treatment: 1 to 2% solution of 3 lb ae/gal product.

Time Apply to green foliage in late summer to early fall.

Remarks Adequate foliar coverage of cape-ivy is necessary, and repeat applications may be required to achieve full control. Add nonionic surfactant if not included in the formulation. Late summer treatments after native plants are dormant are preferred to minimize injury.

Caution Glyphosate is nonselective and injures or kills other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

triclopyr (Garlon 4)

Rate Spot treatment: 0.5 to 1% solution.

Time Apply to actively growing vegetation.

Remarks Mix with 0.25 to 0.5% by volume nonionic surfactant and apply to all exposed foliage. Repeat applications may be required to achieve full control.

Caution Garlon 4 is an ester formulation; do not drift onto sensitive crops. Do not contaminate water.

Site of action Group 4 synthetic auxin

Chemical family Pyridine

Carrot, wild or Queen Anne's lace (*Daucus carota*)

chlorsulfuron (Telar)

Rate 0.75 oz ai/a (1 oz/a of the 75% Telar)

Time Apply early postemergence to actively growing plants.

Remarks Using a nonionic surfactant increases effectiveness.

Caution Apply only to pasture, range, Conservation Reserve Program (CRP), and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

flazasulfuron (Mission)

Rate 0.033 to 0.045 lb ai/a (2.14 to 2.85 oz/a Mission)

Time Pre- and postemergence. Apply to plants less than 4 inches tall.

Remarks Must be activated with 0.25 to 0.5 inch of water for preemergence control. Preemergence efficacy is best when applied to bare soil. Do not disturb the soil after activation. Use an adjuvant for postemergent applications.

Caution A 25-foot buffer must be maintained between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (forested areas, riparian areas), freshwater habitats (lakes, rivers, sloughs), and estuarine/marine habitats.

Site of action Group 2: inhibition of the enzyme acetolactate synthase

Chemical family Sulfonylurea

MCPA

Rate 1 lb ae/a

Time Apply in spring or fall when wild carrot is actively growing but before bolting.

Remarks Seedlings are easier to control than older plants. Treat annually to control seedlings.

Caution Avoid spray drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

metsulfuron (Ally and others)

Rate Ally: 0.12 to 0.18 oz ai/a (0.2 to 0.3 oz/a)

Time Apply early postemergence to actively growing plants.

Remarks Using a nonionic or silicone surfactant increases effectiveness.

Caution Consult labels for crops on which each product can be used.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Cattail, common (*Typha latifolia* and related species)

2,4-D ester

Rate 6 lb ae per 100 gal of spray solution for spot treatments. Add crop oil, diesel oil, or surfactant to increase wetting.

Time Apply before cattail heads appear in spring.

Remarks Foliage must be thoroughly wet. 2,4-D does not control as well as glyphosate but is less expensive. 2,4-D must be reapplied to give satisfactory control.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

glyphosate

Rate 3 lb ae/a

Time Apply to mature cattails after heads are formed and before frost.

Remarks Allow 7 days or longer before clipping or tillage operations. Use additional surfactant.

Caution Glyphosate controls grasses as well as other vegetation in treated areas.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Habitat)

Rate 0.5 to 1 lb ae/a

Time Apply after cattail head appears in the boot or after head emerges and before killing frost.

Remarks Add suitable adjuvant to spray solution.

Caution Do not apply in the root zone of desirable trees. Treated water cannot be used for irrigation for 120 days.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Celedine, lesser (*Ficaria verna*)

Remarks Although PNW data are preliminary, metsulfuron, glyphosate, and imazapyr appear promising in initial trials. Must be treated in early spring as lesser celandine goes dormant by late spring.

Site of action (imazapyr, metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase

Chemical family (imazapyr) imidazolinone; (metsulfuron) sulfonyleurea; (glyphosate) none generally accepted

Chervil, bur (*Anthriscus caucalis*)**aminocyclopyrachlor + chlorsulfuron (Perspective)**

Rate 1.2 to 1.8 oz/a aminocyclopyrachlor + 0.5 to 0.7 oz/a chlorsulfuron (3 to 4.5 oz/a of product)

Time Apply to actively growing vegetation.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonyleurea

metsulfuron (Escort and others)

Rate 0.3 to 0.6 oz ai/a (0.5 to 1 oz/a)

Time Apply to fully leafed-out vegetation before fall leaf coloration.

Remarks Constantly agitate while mixing product in water. Add 0.25% by volume of nonionic or silicone surfactant to spray

mixture. Good coverage is essential. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

triasulfuron (Amber)

Rate 0.28 to 0.56 oz/a Amber

Time Apply to actively growing plants in the fall or spring.

Remarks If native perennial species in the carrot family are present, consider a fall application at the lower rate.

Caution Orchardgrass, red fescue and ryegrasses can be injured by triasulfuron. Preharvest interval is 30 days for hay. There are crop rotational restrictions, see label.

Site of action Group 2: inhibits Acetolactate synthase

Chemical family Sulfonyleurea

Chervil, wild (*Anthriscus sylvestris*)**glyphosate**

Rate 2.25 lb ae/a

Time Apply to actively growing plants from bud to early flower.

Remarks Glyphosate is nonselective and will kill or injure vegetation that might compete with new chervil seedlings.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Arsenal)

Rate 0.75 lb ai/a

Time Apply to actively growing plants from bud to early flower.

Remarks Add an appropriate surfactant

Caution Use on rangeland, pasture, and non-cropland only.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Cinquefoil, sulfur (*Potentilla recta*)**aminocyclopyrachlor + chlorsulfuron (Perspective)**

Rate 4.75 to 8 oz/a

Time Apply to sulfur cinquefoil in the pre-bud stage of growth.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v.

Caution Do not apply to the root zone of desirable trees and shrubs. May injure or kill some grass species.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (chlorsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminocyclopyrachlor) Pyridine; (chlorsulfuron) Sulfonyleurea

aminocyclopyrachlor + metsulfuron (Streamline)

Rate 4.75 to 9 oz/a

Time Apply to sulfur cinquefoil in the pre-bud stage of growth.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v.

Caution Do not apply to the root zone of desirable trees and shrubs. May injure or kill some grass species.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (metsulfuron) Group 2: acetotactate synthase (ALS) inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (metsulfuron) Sulfonylurea

aminopyralid (Milestone)

Rate 1 to 1.75 oz ae/a (4 to 7 fl oz/a)

Time Apply to actively growing plants before the bud stage of growth.

Remarks A nonionic surfactant at a volume of 0.25% enhances control under adverse environmental conditions.

Caution Do not let spray drift onto desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

glyphosate

Rate 1.1 to 2.25 lb ae/a.

Time Apply to sulfur cinquefoil in the pre-bud stage of growth.

Remarks Adequate foliar coverage of sulfur cinquefoil is necessary, and repeat applications may be required to achieve full control. Add nonionic surfactant if not included in the formulation.

Caution Glyphosate is nonselective and injures or kills other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

metsulfuron (Escort and others)

Rate 0.6 to 1.2 oz ai/a (1 to 2 oz/a)

Time Apply in spring during the rosette stage of growth.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.4 oz ae/a

Time Apply when plants are fully leaved and actively growing or in late fall.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. At rates above 0.5 lb ae/a (1 quart/a), apply only as spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr (Garlon 4)

Rate 0.5 to 1 lb ae/a (1 to 2 pints/a).

Time Apply in spring during the rosette stage of growth.

Remarks Mix with 0.25 to 0.5% by volume nonionic surfactant and apply to all exposed foliage.

Caution Garlon 4 is an ester formulation; do not drift onto sensitive crops. Do not contaminate water.

Site of action Group 4 synthetic auxin

Chemical family Pyridine

Clematis, oriental (*Clematis orientalis*) and old man's beard (*Clematis vitalba*)

Remarks Although PNW data are preliminary, imazapyr, picloram, and glyphosate appear promising in initial trials.

Site of action (imazapyr) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (picloram) Group 4: synthetic auxin

Chemical family (imazapyr) imidazolinone; (glyphosate) none generally accepted; (picloram) pyridine

Cocklebur, common (*Xanthum strumarium*) and spiny (*Xanthium spinosum*)

2,4-D

Rate 0.95 to 1.9 lb ae/a (2 to 4 pints/a)

Time Apply to seedlings in spring when plants are growing rapidly.

Remarks Good coverage is necessary to achieve control.

Caution Do not drift to sensitive crops.

Site of action Group 4 synthetic auxin

Chemical family Phenoxy acetic acid

aminopyralid (Milestone)

Rate 0.75 to 1.25 oz ae/a (3 to 5 fl oz/a)

Time Apply to seedlings in spring when plants are actively growing.

Remarks Manure management of grazing animals may be necessary depending on the site; see label for details.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid (Transline)

Rate 1.5 to 3.75 oz ae/a (4 to 10 fl oz/a).

Time Apply to seedlings in spring when plants are actively growing.

Caution Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to clopyralid. Do not use in diversified cropping areas.

Site of action Group 4 synthetic auxin

Chemical family Pyridine

dicamba (Banvel and others)

Rate 0.25 to 0.75 lb ae/a (0.5 to 1.5 pints/a)

Time Apply to seedlings in spring when plants are actively growing.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

fluroxypyr (Vista)

Rate 3.4 oz ae/a (11 oz/a)

Time Apply to seedlings in spring when plants are actively growing.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

glyphosate

Rate 1.1 to 2.25 lb ae/a.

Time Apply to seedlings in spring when plants are actively growing.

Remarks Adequate foliar coverage of cocklebur is necessary. Add nonionic surfactant if not included in the formulation.

Caution Glyphosate is nonselective and injures or kills other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapic (Plateau)

Rate 1 to 1.5 oz ae/a (4 to 6 fl oz/a)

Time Apply preemergence or postemergence to actively growing cocklebur.

Remarks Add 0.25% by volume of nonionic surfactant, or 1.5 to 2 pints/a methylated seed soil or crop oil concentrate to spray mixture.

Caution Some grass species are sensitive to imazapic; see label for details.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

imazapyr (Arsenal, Habitat)

Rate 0.75 to 1 lb ae/a (3 to 4 pints/a)

Time Apply preemergence or postemergence to actively growing cocklebur.

Remarks Add 0.25% by volume of nonionic surfactant, or 1 to 2 pints/a methylated seed soil or crop oil concentrate to spray mixture.

Caution Imazapyr is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate 0.2 to 0.3 oz ai/a (0.33 to 0.5 oz/a)

Time Apply to seedlings in spring when plants are actively growing.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 4 to 8 fl oz ae/a

Time Apply to seedlings in spring when plants are actively growing.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. At rates above 0.5 lb ae/a (1 quart/a), apply only as spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

sulfosulfuron (Outrider)

Rate 0.56 to 1 oz ai/a (0.75 to 1.33 oz/a)

Time Apply to seedlings in spring when plants are actively growing.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture.

Caution Avoid contacting sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

triclopyr (Garlon 3A or 4)

Rate 1 lb ae/a.

Time Apply to seedlings in spring when plants are actively growing.

Caution Garlon 4 is an ester formulation; do not drift onto sensitive crops. Do not contaminate water.

Site of action Group 4 synthetic auxin

Chemical family Pyridine

Coltsfoot, European (*Tussilago farfara*)

Remarks Although PNW data are lacking, some reports suggest glyphosate at 2% is effective.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

Comfrey (*Symphytum officinale*)

Comfrey was a food and feed crop, but has become weedy in gardens and fields of the Pacific Northwest. Naturally aggressive spread is accelerated by tillage that moves plant parts. A 1970s experiment in western Oregon determined the activity of several herbicides on comfrey. Relatively high rates were used, but only a few herbicides were effective. Most problems with comfrey are in gardens, so use caution in recommending any herbicide. One of the few options is to repeatedly (about every 3 weeks) remove plants down as far as practical below the soil surface.

Herbicides that gave good control were bromacil and terbacil at 6 lb ai/a; picloram at 1 lb ae/a; 2,4-D ester at 2 lb ae/a; triclopyr at 2 lb ae/a; and clopyralid at 4 lb ae/a. These rates gave nearly complete control of a new planting. Older plants might be more difficult to control.

Cordgrass, common (*Spartina anglica*), dense-flowered (*Spartina densiflora*), saltmeadow (*Spartina patens*), and smooth (*Spartina alterniflora*)

glyphosate (Rodeo and others)

Rate 2 to 3.75 lb ae/a broadcast, 2% to 5% solution through hand-held equipment, or 33% solution with wiper applicators

Time Apply to actively growing cordgrass any time from late June until first killing frost.

Remarks Treat at least 6 hr before tidewater will cover plants. Debris and silt on cordgrass reduce performance. It may be necessary to wash plants before application. Add approved nonionic surfactant at 1 to 2 quarts/100 gal spray mix or 10% by volume with wiper applicators.

Caution With hand-held equipment, do not spray to point of runoff.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Habitat and others)

Rate 1 to 1.5 lb ae/a

Time Apply to actively growing cordgrass, usually mid-June until killing frost.

Remarks Add suitable adjuvant to spray solution.

Caution Do not apply in the root zone of desirable trees. Treated water cannot be used for irrigation for 120 days.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Crazyweed (*Oxytropis* spp.)

metsulfuron (Escort and others)

Rate Escort: 0.3 oz ai/a (0.5 oz/a)

Time Apply to actively growing plants.

Remarks Using a nonionic or silicone surfactant increases effectiveness. Application sites differ between products, see label.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.25 lb ae/a

Time Apply from early bud to bloom. Plants should be actively growing at the time of application.

Remarks Plants are poisonous to livestock. To be used on rangeland or permanent grass pastures.

Caution Most formulations are restricted-use herbicides.

Do not graze until plants dry up after application. Avoid drift to sensitive crops. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to these herbicides. Do not use picloram in diversified crop areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Cress, hoary or whitetop (*Lepidium draba*), hairy (*Lepidium appelianum*), and lens-podded (*Lepidium chalepensis*)

2,4-D LV ester or 2,4-D amine

Rate 2 to 3 lb ae/a in non-cropland and 1 lb ae/a as a selective treatment

Time Apply early in cress growth stage; control is minor after bud stage. In cereals, apply 2,4-D before weeds reach boot stage.

Remarks When possible, use 2,4-D on whitetop plants before plowing fields in spring. Re-spray in fall if new growth appears.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.2 to 1.8 oz/a aminocyclopyrachlor + 0.5 to 0.7 oz/a chlorsulfuron (3 to 4.5 oz/a of product)

Time Apply to actively growing vegetation.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

chlorsulfuron (Telar)

Rate 0.75 oz ai/a (1 oz/a of 75% ai Telar)

Time Apply at prebloom to bloom growth stage or to rosettes in fall.

Remarks Using an 80% ai surfactant increases effectiveness.

Caution Apply only to pasture, range, Conservation Reserve Program (CRP), and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

imazapic (Plateau)

Rate 0.125 to 0.188 lb/a

Time Apply after blossoms open (full bloom) until plants desiccate. Fall rosettes also may be treated.

Remarks Add 1 quart/a methylated seed oil.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate Escort: 0.6 oz ai/a (1 oz/a) of the 60% ai

Time Apply at prebloom to bloom growth stage or to rosettes in fall.

Remarks Using a nonionic or silicone surfactant increases effectiveness. Application sites differ between products; consult label.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Crupina, common (*Crupina vulgaris*)**aminocyclopyrachlor + chlorsulfuron (Perspective)**

Rate 4.75 to 8 oz/a

Time Apply to seedlings in spring when plants are actively growing.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v.

Caution Do not apply to the root zone of desirable trees and shrubs. May injure or kill some grass species.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (chlorsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid ; (chlorsulfuron) Sulfonylurea

aminopyralid + metsulfuron (Opensight)

Rate 3 to 3.3 oz/a

Time Apply to seedlings in spring when plants are actively growing.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v.

Caution May injure or kill some grass species.

Site of action (aminopyralid) Group 4 synthetic auxin; (metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminopyralid) Pyrimidine carboxylic acid ; (metsulfuron) Sulfonylurea

chlorsulfuron (Telar and others)

Rate 0.75 to 0.195 oz ai/a (1 to 2.6 oz/a).

Time Apply to seedlings in spring when plants are actively growing.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture.

Caution Avoid drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

clopyralid (Transline)

Rate 2 oz ae/a (0.33 pints/a).

Time Apply as a split application to common crupina foliage in fall and spring.

Remarks Most effective on young plants.

Caution Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to clopyralid. Do not use in diversified cropping areas.

Site of action Group 4 synthetic auxin

Chemical family Pyridine

dicamba (Banvel and others)

Rate 0.5 lb ae/a (1 pint/a)

Time Apply to seedlings in spring when plants are actively growing.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

metsulfuron (Escort and others)

Rate 0.3 to 0.6 oz ai/a (0.5 to 1 oz/a)

Time Apply to seedlings in spring when plants are actively growing.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 4 to 8 oz ae/a

Time Apply to seedlings in spring when plants are actively growing.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. At rates above 0.5 lb ae/a (1 quart/a), apply only as spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Cucumber, wild (*Marah oreganus*)

Wild cucumber is a perennial vine that regrows each year from an enormous root. The plant spreads by seed, not by root fragments. The harmful effect of wild cucumber is mostly a result of the top growth that crowds, shades, and deforms the crops. Any type of physical control has temporary results because of the food storage in the root. This food reserve also means that if herbicides are to be effective, they must move to the root and block production of new shoots. Any control plan should call for treatment for several years. Recommendations that follow are based on limited research at Oregon State University.

dicamba (Banvel, Rifle, or Clarity)

Rate 1 to 2 lb ae/a or 1% concentration for application with a handgun sprayer.

Time Apply when cucumber is growing rapidly in late spring or early summer.

Remarks Expect 80 to 100% control 1 year after treatment.

Caution Dicamba seriously reduces seed production of grasses or grain crops if applied at the wrong growth stage. Do not use 2-lb rate on large areas if a crop is growing in the field.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

glyphosate

Rate 1.5 lb ae/a or 0.5 to 1% solution for application with a handgun sprayer.

Time Apply when the cucumber is growing rapidly in late spring or early summer.

Remarks In two experiments, plants treated with glyphosate had no regrowth 1 year later.

Caution Glyphosate is a nonselective herbicide.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

picloram (Tordon)

Rate 0.5 lb ae/a or 0.5% concentration for application with a handgun sprayer.

Time Apply when cucumber is growing rapidly in the late spring or early summer.

Remarks Expect 80 to 100% control 1 year after treatment.

Caution Most formulations are restricted-use herbicides.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr (Garlon)

Rate 1 lb ae/a or 0.5% concentration for application with a handgun sprayer.

Time Apply when cucumber is growing rapidly in late spring or early summer.

Remarks Tests with the ester form had excellent results 1 year later. At 0.5 lb ae/a, results were less clear, but two of three plots had good results.

Caution See label for registered sites for triclopyr products' use.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr + 2,4-D (Crossbow)

Rate 0.5 lb + 1 lb ae/a (2 quarts/a Crossbow) or 1% concentration for handgun sprayer application.

Time Apply when cucumber is growing rapidly in late spring or early summer.

Remarks In two of three plots, results were good 1 year after treatment. Results were poor in the third plot.

Caution Check the Crossbow label to determine registered sites and rates.

Site of action (both) Group 4: synthetic auxin

Chemical family (triclopyr) pyridine; (2,4-D) phenoxy acetic acid

Daisy, oxeye (*Leucanthimum vulgare*)

aminopyralid (Milestone)

Rate 1 to 1.75 oz ae/a (4 to 7 fl oz/a)

Time Apply preemergence in winter to early spring, or in spring to actively growing plants before the bud stage of growth.

Caution Do not let spray drift onto desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 3 to 4.5 oz/a

Time Apply in spring from rosette to flowering stage of growth.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v.

Caution Do not apply to the root zone of desirable trees and shrubs. May injure or kill some grass species.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (chlorsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminocyclopyrachlor) pyridine; (chlorsulfuron) sulfonylurea

aminopyralid + metsulfuron (Opsight)

Rate 2.5 to 3.3 oz/a

Time Apply in spring from rosette to flowering stage of growth.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v.

Caution May injure or kill some grass species.

Site of action (aminopyralid) Group 4 synthetic auxin; (metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminopyralid) Pyrimidine carboxylic acid ; (metsulfuron) Sulfonylurea

chlorsulfuron (Telar and others)

Rate 0.75 to 0.195 oz ai/a (1 to 2.6 oz/a).

Time Apply in autumn to new rosettes, or to rosettes in spring before bolting.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture.

Caution Avoid drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

clopyralid (Transline)

Rate 4 to 8 oz ae/a (0.67 to 1.33 pints/a).

Time Apply in spring from rosette to bud stage of growth.

Caution Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to clopyralid. Do not use in diversified cropping areas.

Site of action Group 4 synthetic auxin

Chemical family Pyridine

clopyralid + 2,4-D amine (Curtail)

Rate 2 to 3 quarts/a

Time Apply in spring from rosette to bud stage of growth.

Remarks Consult label for specific site registrations.

Caution Product injures or kills sensitive broadleaf forages. Do not contaminate water.

Site of action (both) Group 4: synthetic auxin

Chemical family (clopyralid) pyridine; (2,4-D) phenoxy acetic acid

dicamba (Banvel and others)

Rate 0.5 to 1 lb ae/a (1 to 2 pints/a)

Time Apply in spring when plants are actively growing.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

glyphosate

Rate 1.5 to 3 lb ae/a.

Time Apply in spring from rosette to bud stage of growth.

Remarks Adequate foliar coverage of oxeye daisy is necessary. Add nonionic surfactant if not included in the formulation.

Caution Glyphosate is nonselective and injures or kills other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Arsenal, Habitat)

Rate 0.5 to 0.75 lb ae/a (2 to 3 pints/a)

Time Apply preemergence or postemergence to actively growing oxeye daisy.

Remarks Add 0.25% by volume of nonionic surfactant, or 1 to 2 pints/a methylated seed soil or crop oil concentrate to spray mixture.

Caution Imazapyr is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate 0.3 to 0.6 oz ai/a (0.5 to 1 oz/a)

Time Apply in spring to actively growing plants, or to new rosettes in the fall.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 6 to 8 oz ae/a

Time Apply in spring to actively growing plants, or to new rosettes in the fall.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. At rates above 0.5 lb ae/a (1 quart/a), apply only as spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Devil's-claw (*Proboscidea louisiana*)

2,4-D (various products)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

Dock, curly (*Rumex crispus*) and broadleaf (*Rumex obtusifolius*)

2,4-D or dicamba (Banvel, Rifle, or Clarity) or picloram (Tordon)

Rate A mixture of each product 1 lb ae/50 gal of water for spot treatments

Time Apply before flower elongation.

Remarks Repeated treatments needed to control regrowth. Dicamba is effective on curly dock but not on broadleaf dock. Picloram is effective on both species and is registered for use on grazing and non-cropland.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to these herbicides. Do not use picloram in diversified crop areas.

Site of action (all) Group 4: synthetic auxin

Chemical family (2,4-D) phenoxy acetic acid; (dicamba) benzoic acid; (picloram) pyridine

2,4-DB amine or 2,4-D ester (Butyrac or Butoxone)

Rate 1 to 1.5 lb ae/a

Time Apply before flower stalk elongates. Repeated applications are necessary.

Remarks This treatment is selective on legumes and grass crops.

Caution Spray 30 days before feeding forage. Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminopyralid (Milestone)

Rate 1 to 1.5 oz ae/a (4 to 6 fl oz/a)

Time Apply to actively growing plants before the bud stage of growth.

Remarks A nonionic surfactant at 1 to 2 quarts/100 gal of spray enhances control under adverse environmental conditions.

Caution Do not let spray drift onto desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

chlorsulfuron (Telar)

Rate 0.75 oz ai/a (1 oz/a)

Time Apply to young, actively growing weeds.

Remarks Do not apply to frozen ground. Constantly agitate while mixing in spray solution. Add 0.25% v/v nonionic surfactant to the spray mixture. Apply with ground equipment in at least 10 gal/a carrier.

Caution Avoid contact with sensitive crops. Labeled for pasture, range, Conservation Reserve Program (CRP), and non-cropland use only. Do not treat powdery, dry soils or light, sandy soils unless rain is likely after treatment.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

glyphosate

Rate 2.25 to 3.75 lb ae/a

Time Apply at early heading.

Remarks Glyphosate is a foliar-active herbicide.

Caution Glyphosate controls grasses as well as other vegetation in treated areas.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

metsulfuron (Ally and others)

Rate Ally: 0.06 to 0.12 oz ai/a (0.1 to 0.2 oz/a)

Time Apply to young, actively growing weeds.

Remarks Do not apply to frozen ground. Constantly agitate while mixing in spray solution. Add 0.25% v/v nonionic or silicone surfactant to the spray mixture.

Caution Avoid contacting sensitive crops. Consult labels for crops on which each product can be used. Do not treat powdery, dry soils or light, sandy soils unless rain is likely after treatment.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

sulfometuron (Oust)

Rate 2.25 oz ai/a (3 oz/a)

Time Apply preemergence to early postemergence.

Remarks Recommended for use on non-cropland only. Rate depends on annual rainfall. Do not apply to frozen ground. Constantly agitate while mixing in spray solution. Add 0.25% v/v nonionic surfactant to increase activity of postemergence applications. Apply with ground equipment in at least 15 gal/a carrier.

Caution Keep sulfometuron methyl out of cropland. Equipment used to apply this material should be dedicated to non-cropland uses only. Do not treat powdery, dry soils or light, sandy soils unless rain is likely after treatment.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Dodder (*Cuscuta* spp.)—in forage alfalfa**pendimethalin (Prowl H₂O)**

Rate 1.9 to 3.8 lb ai/a

Time Apply to dormant, established alfalfa before dodder germinates.

Remarks Besides dodder, treatment controls most annual grasses and certain broadleaf weeds as they germinate. Controls most annual grasses and several broadleaf weeds, including dodder, as they germinate. Incorporation with rain or sprinkler irrigation enhances control. Will not control emerged weeds.

Caution Do not apply to seedling alfalfa. Preharvest interval is 50 days for hay or forage. Do not exceed 4 quarts/a product per year. Refer to label for crop rotation restrictions.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

Dodder (*Cuscuta* spp.)—general infestations in seed alfalfa fields**pendimethalin (Prowl, Prowl H₂O, Stealth)**

Alfalfa for seed only

Rate 2 to 4 lb ai/a

Time Apply to established alfalfa between January 15 and April 30 but before dodder germinates.

Remarks Active special local needs labels include ID-140003 and OR-140006 for Prowl H₂O. Besides dodder, treatment controls most annual grasses and certain broadleaf weeds as they germinate. Processed seed must be labeled "Not for human or animal consumption" at the processing plant, and all seed screenings must be disposed of in a way that they cannot be distributed or used for food or feed.

Caution Use only on alfalfa grown for seed. Do not apply to seedling alfalfa. Do not graze or harvest alfalfa for hay after application. Do not use screenings from seed processing as feed for livestock. Do not use harvested seed for sprouting.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

pronamide (Kerb)

Rate 1 to 2 lb ai/a. Apply 1.5 to 2 lb ai/a in furrow-irrigated or rill-irrigated fields and 1 to 1.5 lb ai/a in flood-irrigated fields.

Time Apply in spring before dodder germinates. On furrow-irrigated fields, follow a shallow incorporation by irrigation within 7 days. On flood-irrigated fields, follow application by flooding within 1 to 3 days.

Remarks Field treatment seldom controls dodder 100%. Scout fields for dodder patches and spot treated them.

Caution A restricted-use herbicide. Pronamide controls grasses in alfalfa fields.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Benzamide

Dodder (*Cuscuta* spp.)—general infestations in carrot seed fields

pendimethalin (Prowl H2O)

Carrots for seed only

Rate 0.5 to 2 lb ai/a

Time Apply after the last normal cultivation (layby) as a directed spray.

Remarks Use 3 to 4 pints/a to control dodder. Apply directly to soil between rows. Spray should not contact carrot plants. Lay-by applications can be in carrots previously treated with herbicides registered for use in carrots. Prowl most effectively controls weeds if adequate rain or irrigation follows within 7 days.

Caution Do not use on peat or muck soils. Do not plant winter wheat or winter barley in fall after Prowl application at rates above 3 pints/a. Do not feed or graze carrots after application. Do not use screenings from seed processing as feed for livestock.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

Fennel, common (*Foeniculum vulgare*)

2,4-D amine

Rate Spot treatment: 0.25 to 0.5% solution

Time Apply in spring to fully-grown leaves but prior to flowering.

Remarks 2,4-D is usually not able to fully control common fennel, so combining with other products is generally recommended. Retreatment will likely be necessary.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

glyphosate

Rate 2.8 lb ae/a.

Time Apply in spring to fully-grown leaves but prior to flowering.

Remarks Adequate foliar coverage of fennel foliage is necessary. Add nonionic surfactant if not included in the formulation.

Caution Glyphosate is nonselective and injures or kills other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

triclopyr (Garlon 3A or 4)

Rate Broadcast treatment: 1 to 2 lb ae/a; spot treatment: 0.5 to 1% solution.

Time Apply in spring to fully-grown leaves but prior to flowering.

Caution Garlon 4 is an ester formulation; do not drift onto sensitive crops. Do not contaminate water.

Site of action Group 4 synthetic auxin

Chemical family Pyridine

Fieldcress, Austrian (*Rorippa austriaca*)

2,4-D (various products)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

Fluvelin, sharpshoot (*Kickxia elatine*)

Seedlings of this soft, hairy annual are upright, but as plants mature they develop prostrate stems. Leaves on stems resemble those of bindweed, but fluvelin is in the snapdragon family. It has pale yellow flowers with a narrow spur and a purple upper lip. This weed is spreading into cropland throughout the Willamette Valley of Oregon and is of particular concern in spring-planted tall fescue grown for seed among other grass grown for seed species. Roundleaf fluvelin (*Kickxia spuria*) is present in southern Oregon and may be more invasive than sharpshoot fluvelin. Both species probably react similarly to herbicides.

Remarks Control is difficult, although tribenuron methyl tank mixes with oxyfluorfen or 2,4-D plus dicamba appear promising in grass grown for seed efficacy trials. Use only the 0.008 lb ai/a rate on tall fescue and perennial ryegrass and low rates of oxyfluorfen ranging from 0.03 to 0.046 lb ai/a (2 to 3 oz/a Goal 2XL or Galigan 2E). Apply when the sharpshoot fluvelin is no larger than a half-dollar in size and prior to stem elongation.

Site of action (tribenuron) Group 2: acetolactate synthase (ALS) inhibitor; (oxyfluorfen) Group 14: protoporphyrinogen oxidase inhibitor; (dicamba and 2,4-D) Group 4: synthetic auxin.

Chemical family (tribenuron methyl) sulfonylurea; (oxyfluorfen) diphenylether; (dicamba) benzoic acid; (2,4-D and MCPA) phenoxy acetic acid;

Four-O'Clock, wild (*Mirabilis nyctaginea*)

2,4-D (various products)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

imazapic (Plateau)

Rate 0.5% solution as a spot treatment

Remarks Use a 1% v/v methylated seed oil as an adjuvant.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Garlic, wild (*Allium vineale*)

2,4-D LV ester

Rate 1 to 2 lb ae/a

Time Early spring, preferably mid-April, before garlic is more than 8 inches tall. Re-spray annually to achieve effective control.

Remarks 2,4-D LV ester is selective in cereals and grasses. It is very important to re-spray annually for several years to effectively reduce the garlic stand. This plant produces small dormant bulbs that germinate over several years.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.2 to 1.8 oz/a aminocyclopyrachlor + 0.5 to 0.7 oz/a chlorsulfuron (3 to 4.5 oz/a of product)

Time Apply to actively growing vegetation.

Remarks Adjuvants can be used, these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes and also basin wildrye.

Site of action Group 4 synthetic auxin (aminocyclopyrachlor)
Group 2: ALS inhibitor (chlorsulfuron)

Chemical family Phenoxy acetic acid (aminocyclopyrachlor);
sulfonyleurea (chlorsulfuron)

chlorsulfuron (Telar)

Rate 0.75 oz ai/a (1 oz/a)

Time Apply preemergence or early postemergence in the spring.

Remarks Use a surfactant for postemergence sprays.

Caution Do not let spray drift onto sensitive crops. Labeled for use on pasture, range, Conservation Reserve Program (CRP), and non-crop sites only.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

dicamba (Banvel, Rifle, or Clarity)

Rate 1 to 2 lb ae/a

Time Early spring, preferably March or early April.

Remarks Dicamba at the 1-lb rate usually will not seriously injure seed production of grass or grain crops. The 2-lb treatment gives more complete garlic control.

Caution Dicamba may temporarily sterilize soil west of the Cascades.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

metsulfuron (Ally and others)

Rate Ally: 0.3 oz ai/a (0.5 oz/a)

Time Apply to actively growing plants in spring when wild garlic is less than 12 inches tall with 2 to 4 inches of new growth.

Remarks Using a nonionic or silicone surfactant will increase effectiveness.

Caution Consult labels for crops where each product can be used.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

thifensulfuron + tribenuron (Harmony Extra)

Rate 0.38 to 0.45 oz ai/a (0.5 to 0.6 oz/a)

Time When wild garlic is less than 12 inches tall.

Remarks Control is best on actively growing wild garlic plants when air temperature is 60°F or warmer.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

Mustard, garlic (*Alliaria petiolata*)

Remarks A biennial plant, garlic mustard forms a basal rosette of leaves the first season and sends up a flower stalk producing hundreds of seeds in the second season. It begins spring growth at low temperatures, earlier than many other plants. Preventing seed production from mature bolted plants should be the primary focus of control measures. Hand-pulling plants is an effective control method and should be used to as a follow-up to chemical methods whenever possible. After working in an area where this plant is growing, boots, clothing, equipment, and vehicles should be cleaned to avoid transporting seeds.

glyphosate

Rate 2.0% solution of 3 lb ae/gal product, with 1.0% by volume nonionic surfactant

Time Apply in spring prior to flowering or in late fall.

Remarks To control seedlings and rosettes, a 1.0 to 2.0% solution is adequate; the higher rate should be used on plants that have bolted. Glyphosate will not control garlic mustard plants that are well into or beyond flowering stage; these plants will have time to develop mature seed before the herbicide stops their growth.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

triclopyr (Garlon 3A, Vastlan and others)

Rate 1.0 to 2.0% solution of 3 lb/gal product or 1.5% solution of 4 lb/gal product, with 1.0% by volume nonionic surfactant or crop oil concentrate

Time Apply spring or fall.

Remarks Triclopyr is more effective than glyphosate on already-flowering plants.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

metsulfuron (Escort and others)

Rate 0.5 to 1.0 ounce/a of 60% ai product (0.3 to 0.6 oz ai/a) or 1.0 gram product/gal for spot treatment.

Time apply spring or fall, when plants are actively growing.

Remarks For use on pasture and rangeland, conifer and hardwood plantations, and non-crop sites such as rights-of-way, ditchbanks of dry drainage ditches, and industrial sites. Metsulfuron may be used alone or in a tank-mix with either glyphosate or triclopyr, each at its labeled rate. Application sites differ between products; consult labels.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

imazapic (Plateau)

Rate 4 to 6 oz of product/a or for spot treatments a 0.25 to 1.5% solution (0.3 to 1.9 oz product/gal)

Time May be applied preemergence or postemergence.

Remarks For use on native grasses and wildflowers, pastures, rangeland, non-crop areas including rights-of-way, and conifer site preparation. Many wildflowers are tolerant to the 4.0 oz/a rate.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

imazapyr (Arsenal, Habitat and others)

Rate 1% solution of 2 lbs ae/gal product for spot application (1.3 oz product/gal)

Time Apply when plants are actively growing.

Remarks For use on forestry sites, grass pasture and rangeland, non-crop agricultural areas, industrial sites, non-agricultural areas (such as airports, highway, railroad and utility rights-of-way, sewage disposal areas, etc.), and natural areas (such as wildlife habitats, recreation areas, campgrounds trailheads, and trails). Application sites differ between products; consult labels. Habitat is for use on specified aquatic sites, but only by federal or state agency personnel or applicators who are certified for aquatic pest control and are authorized by the state or local government.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

imazapyr + metsulfuron (Lineage Clearstand)

Rate 3 to 6 oz/a

Time Apply when plants are actively growing.

Remarks For use on conifer plantations, pasture and rangeland, wildlife management areas, and non-agricultural areas including ditch banks or dry drainage ditches, rights-of-way, and industrial sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (imazapyr) Imidazolinone; (metsulfuron) sulfonylurea

aminopyralid + metsulfuron (Opensight, Chaparral)

Rate 3.3 oz product/a

Time Apply in the spring and early summer to rosette or bolting plants or in the fall to seedlings and rosettes.

Remarks For use on grass pastures, rangeland, natural areas (such as wildlife management areas, wildlife openings, wildlife habitats, recreation areas, campgrounds, trailheads and trails) and grazed areas around these sites. Do not use plant material treated with this product for mulch or compost.

Site of action Group 4: synthetic auxin; Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminopyralid) Pyridine; (metsulfuron) Sulfonylurea

MCPA + fluroxypyr + dicamba (Change Up)

Rate 1.25 to 3 pints product/a or 0.46 to 1.10 fl oz product/1,000 sq ft or 0.75 to 2.0 oz product/gal for spot spray to wetting

Time Apply when plants are actively growing.

Remarks For use on ornamental lawns and turf, sod, and non-crop areas such as fencerows, hedgerows, roadsides, ditches, rights-of-way, utility power lines, railroads, airports and industrial sites.

Site of action Group 4: synthetic auxin

Chemical family (MCPA) Phenoxy acetic acid; (fluroxypyr) Pyridine; (dicamba) Benzoic acid

MCPA + fluroxypyr + triclopyr (Battleship III)

Rate 3 to 4 pints product/a or 1.1 to 1.5 oz product per 1,000 sq ft

Time Apply when plants are actively growing.

Remarks For use in ornamental turf, including residential turf, golf courses, sod farms and grass grown for seed.

Site of action Group 4: synthetic auxin

Chemical family (MCPA) Phenoxy acetic acid; (fluroxypyr and triclopyr) Pyridine

2,4-D + fluroxypyr + dicamba (Escalade and E-2)

Rate 2 to 5 pints product/a for non-turf areas (2 to 3 pints product/a for turfgrass) or 2.25 fl oz product/1,000 sq ft (0.75 to 1.10 fluid oz product/1,000 sq ft)

Time Apply anytime between the time when plants come into full leaf (spring) to when plants begin to go dormant. Best results are obtained when plants are young and actively growing.

Remarks For use in ornamental lawns and turf grasses, including sod farms, and non-crop sites such as rights-of-way, roadsides, industrial sites, fence rows, non-irrigation ditch banks, farmstead, recreational areas, and parks. E-2 is also for use on pastures, including those grown for hay or silage, and rangelands.

Site of action Group 4: synthetic auxin

Chemical family (2,4-D) Phenoxy acetic acid; (fluroxypyr) Pyridine; (dicamba) Benzoic acid

2,4-D + MCPP + 2,4-DP (Spoiler)

Rate 3 to 4 pints product/a or 1.1 to 1.5 fl oz product/1,000 sq ft (on cool season grasses)
2.5 to 3.5 pints product/a (on non-crop)

Time Apply from when plants come into full leaf until they start to go dormant. Best results when weeds are young and actively growing

Remarks For use on ornamental turf such as lawns, parks, cemeteries and golf courses; on sod farms; and on non-crop areas such as fencerows, hedgerows, roadsides, ditches, rights-of-way, utility power lines, railroads, airports and industrial sites.

Site of action Group 4: synthetic auxin

Chemical family (all) Phenoxy acetic acid

triclopyr + MCPA + 2,4-DP (Vengeance Plus)

Rate 1.6 to 3.2 pints product/a or 0.73 to 1.10 fl oz product/1,000 sq ft

Time Apply to plants that are actively growing.

Remarks For use in ornamental lawns and turf grasses, sod farms, and non-crop areas including rights-of-way, roadsides, fencerows, hedgerows, non-irrigation ditch banks, railroads, industrial management sites, and airports.

Site of action Group 4: synthetic auxin

Chemical family (triclopyr) Pyridine; (MCPA and 2,4-DP) Phenoxy acetic acid

2,4-D + quinclorac + dicamba (Quincept)

Rate 7 to 8 pints product/a or 2.6 to 2.9 fl oz product/1,000 sq ft

Time Apply to plants that are actively growing.

Remarks For use on ornamental turf including lawns or grounds around residential and commercial establishments, multi-family dwellings, military and other institutions, parks, airports, roadsides, schools, picnic grounds, athletic fields, houses of worship, cemeteries, golf courses and sod farms.

Site of action Group 4: synthetic auxin

Chemical family (2,4-D) Phenoxy acetic acid ; (quinclorac) Quinoline carboxylic acid; (dicamba) Benzoic acid

imazapyr + aminocyclopyrachlor + metsulfuron (Viewpoint)

Rate 13 to 20 oz product/a or for spot application 2.6 to 4.0 oz product/5 gal

Time Apply preemergence or early postemergence when plants are actively germinating or growing.

Remarks For use on non-agricultural areas (such as airports, highway, railroad and utility rights-of-way, sewage disposal areas, etc.); uncultivated agricultural areas (such as farmyards, fuel storage areas, fencerows, non-irrigation ditchbanks, barrier strips, etc.); industrial sites (such as lumberyards, pipeline and tank farms, etc.); and natural areas (such as wildlife habitats). Do not use plant material treated with this product for mulch or compost.

Site of action Group 2: acetolactate synthase (ALS) inhibitor (imazapyr and metsulfuron); Group 4: synthetic auxin (aminocyclopyrachlor)

Chemical family (imazapyr) Imidazolinone; (aminocyclopyrachlor) Pyrimidine; (metsulfuron) Sulfonylurea

aminocyclopyrachlor + metsulfuron (Streamline)

Rate 4.75 to 9.5 oz product/a or for spot application 0.95 to 1.9 oz product/5 gal

Time Apply preemergence or early postemergence when seeds are germinating and seedlings are actively growing.

Remarks For non-crop use, including industrial turfgrass. Do not use plant material treated with this product for mulch or compost.

Site of action Group 2: acetolactate synthase (ALS) inhibitor (metsulfuron); Group 4: synthetic auxin (aminocyclopyrachlor)

Chemical family (aminocyclopyrachlor) Pyrimidine; (metsulfuron) Sulfonylurea

Geranium, shiny (*Geranium lucidum*) and herb Robert (*Geranium robertianum*)

Remarks Although PNW data are preliminary, glufosinate, glyphosate, imazapic, imazapyr, metsulfuron, sulfometuron, and triclopyr + 2,4-D gave promising results in initial trials.

Site of action (imazapyr, imazapic, metsulfuron, sulfometuron) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (triclopyr, 2,4-D) Group 4, synthetic auxin; Group 10: glutamine synthase inhibitor

Chemical family (imazapyr, imazapic) imidazolinone; (metsulfuron, sulfometuron) sulfonylurea; (glyphosate) none generally accepted; (2,4-D) Phenoxy acetic acid; (triclopyr) Pyridine; (glufosinate) Phosphinic acid

Goatgrass, jointed (*Aegilops cylindrica*), barbed (*Aegilops triuncialis*), and ovate (*Aegilops ovata*)

glyphosate

Rate 0.38 to 0.75 lb ae/a

Time Apply to actively growing plants emerged before boot stage.

Remarks Use along field edges and other non-cropped areas to prevent spread into bordering fields. Can be used as a spot treatment in certain crops (refer to label).

Caution Glyphosate is not selective.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapic (Plateau)

Rate 0.063 to 0.188 lb/a

Time Apply preemergence for best results.

Remarks Use lower rates for dry climates and low leaf litter and higher rates as moisture increases and/or leaf litter increases. Selective to most native grasses. Higher rates may suppress seed of some cool-season grasses.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

sulfometuron (Oust)

Rate 1 to 1.5 oz ai/a (1.33 to 2 oz/a)

Time Apply in fall or in late winter before jointed goatgrass is 3 inches tall.

Remarks Selective to wheatgrass and smooth brome. Other desirable grasses may be stunted, stressed, or injured. Consult the label before using.

Caution Use on non-cropland such as roadsides. Do not let spray to drift onto sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Goatsrue (*Galega officinalis*)

2,4-D amine or LV ester

Rate 1.9 lb ae/a (2 quarts/a)

Time Apply in early to midsummer when plants are in bud stage to full flower stage of growth.

Remarks 2,4-D is usually not able to fully control goatsrue, so combining with other products is generally recommended. Retreatment will likely be necessary.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminopyralid (Milestone)

Rate 1.25 oz ae/a (5 fl oz/a)

Time Apply in early to midsummer when plants are in bud stage to full flower stage of growth.

Caution Do not let spray drift onto desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 4 to 6 oz/a

Time Apply in early to midsummer when plants are in bud stage to full flower stage of growth.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v.

Caution Do not apply to the root zone of desirable trees and shrubs. May injure or kill some grass species.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (chlorsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminocyclopyrachlor) pyridine; (chlorsulfuron) sulfonyleurea

aminopyralid + metsulfuron (Opensight)

Rate 2.5 to 3.3 oz/a

Time Preemergence in autumn, or in spring to rosettes.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v.

Caution May injure or kill some grass species.

Site of action (aminopyralid) Group 4 synthetic auxin; (metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminopyralid) Pyridine; (metsulfuron) Sulfonyleurea

chlorsulfuron (Telar and others)

Rate 0.75 oz ai/a (1 oz/a).

Time Apply in early to midsummer when plants are in bud stage to full flower stage of growth.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture.

Caution Avoid drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

dicamba (Banvel and others)

Rate 2 lb ae/a (2 quarts/a)

Time Apply in early to midsummer when plants are in bud stage to full flower stage of growth.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

imazapyr (Arsenal, Habitat)

Rate 8 oz ae/a (2 pints/a)

Time Apply in early to midsummer when plants are in bud stage to full flower stage of growth.

Remarks Add 0.25% by volume of nonionic surfactant, or 1 to 2 pints/a methylated seed soil or crop oil concentrate to spray mixture.

Caution Imazapyr is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate 0.6 oz ai/a (1 oz/a)

Time Apply in early to midsummer when plants are in bud stage to full flower stage of growth.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Application sites differ between products; consult labels.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

picloram (Tordon)

Rate 0.5 oz ae/a

Time Apply in early to midsummer when plants are in bud stage to full flower stage of growth.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. At rates above 0.5 lb ae/a (1 quart/a), apply only as spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Gorse (*Ulex europeus*)

Control gorse in two stages. First, control established plants. Second, control new plants emerging from seeds that may have been resting in the soil for as long as 30 years. The most effective control program usually combines herbicides, burning, and cultivation or mowing. Establishing competitive pasture species, forest trees, or other crops helps resist gorse invasion as well as other weeds. A publication on the biology and control of gorse (*Gorse*, PNW 379, revised July 2001) is available from the Extension Service. When using herbicides, it is crucial to thoroughly wet foliage. Best timing is after bloom drop, but applications at other times usually give good control also.

2,4-D LV ester (several products)

Rate 0.75 to 1.5 lb ae/a or 0.5 to 1% concentration for handgun sprayer application.

Time Apply to actively growing plants after bloom drop in the spring.

Caution Do not let spray drift onto agricultural crops. Do not graze dairy animals within 7 days after application.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + metsulfuron methyl (Streamline)

Rate 3.8 to 4.5 oz/a aminocyclopyrachlor + 1.2 to 1.4 oz/a metsulfuron (9.5 to 11.5 oz/a of product)

Time Apply to actively growing woody plants.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water. There are several application methods that dictate the amount of product to be mixed with the carrier, so consult the label. In addition to woody species, controls many herbaceous species.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Conifers can be injured, these include ponderosa pine, Douglas fir, Norway spruce, and white pine. Other trees that can be injured include aspen, Chinese tallow, cottonwoods, honey locust, magnolia, poplars, redbud, silver maple, and willow. Applications to stressed plants may reduce control. Do not allow spray to drift off target.

Site of action Group 4 synthetic auxin (aminocyclopyrachlor)
Group 2: ALS inhibitor (metsulfuron methyl)

Chemical family Phenoxy acetic acid (aminocyclopyrachlor); sulfonyleurea (metsulfuron methyl)

dicamba (Banvel, Rifle, or Clarity)

Rate 0.75 to 1.5 lb ae/a or 0.5% to 1% concentration for handgun sprayer application.

Time Apply to actively growing plants after bloom drop in the spring.

Caution No waiting period between treatment and grazing for nonlactating animals (see label for restrictions on dairy animals). Remove meat animals from treated areas 30 days before slaughter. Rates above 2 lb ai/a may temporarily injure many grass species. Newly seeded grass (see label) may be injured at rates above 0.75 lb ai/a. Do not exceed 8 lb ai/a per season. Kills legumes.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

glyphosate

Rate 1.5 to 3 lb ae/a or 1.5 to 2% solution for handgun sprayer application.

Time Apply to actively growing plants after bloom drop in the spring.

Remarks Adding a recommended surfactant improves results.

Caution Glyphosate kills grasses and most other desirable species needed to compete with new gorse plants.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

metsulfuron (Escort and others)

Rate Escort: use 0.6 oz ai/a (1 oz/a)

Time Apply to actively growing plants after bloom drop in spring.

Remarks Include a silicon-based surfactant. Application sites differ among products; consult labels.

Caution Do not let spray drift onto agricultural crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonyleurea

picloram (Tordon)

Rate 0.5% concentration for application with a handgun sprayer.

Time Apply to actively growing plants after bloom drop in the spring.

Remarks Adding a suitable surfactant at 0.25 to 0.5% will improve results.

Caution Most formulations are restricted-use. Refer to labels for grazing restrictions. Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr ester (Garlon 4 or Remedy) or triclopyr amine (Garlon 3A) or triclopyr + 2,4-D ester (Crossbow)

Rate 0.5% to 2% concentration for application with a handgun sprayer.

Time Apply to actively growing plants after bloom drop in the spring. Garlon 4 and Crossbow can be used for basal bark applications any time of year.

Remarks Adding 0.25% to 0.5% of a suitable surfactant to Garlon 3A improves results. No surfactant is needed with Garlon 4 or Remedy. Use the higher rates on larger plants and on solid stands of old plants.

Caution Garlon products are registered for use on rights-of-way, industrial sites, and forestry (release and site preparation). Crossbow and Remedy can be used on permanent pastures and rangeland up to 1.5 lb ae/a. Observe all grazing and harvesting restrictions.

Site of action Group 4: synthetic auxin

Chemical family (triclopyr) Pyridine; (2,4-D) Phenoxy acetic acid

Gumweed (*Grindelia squarrosa*)

2,4-D LV ester

Rate 2 lb ae/a

Time Apply in early spring when new growth and seedlings are fully emerged.

Remarks After plants reach the bloom stage, control decreases.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

dicamba (Banvel, Rifle, or Clarity)

Rate 0.5 lb ae/a

Time Apply in early spring from emergence to flower bud stage.

Remarks May be mixed with 2,4-D to get better control.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

metsulfuron (Escort and others)

Rate Escort: use 0.6 to 1.2 oz ai/a (1 to 2 oz/a)

Time Apply to actively growing gumweed in the spring.

Remarks Using a silicone or nonionic surfactant enhances control. Application sites differ among products at the above rates; consult labels.

Caution Do not let spray drift onto sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.25 lb ae/a

Time Apply in early spring after plants have emerged.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Avoid drift to potatoes, beans, and many other sensitive broadleaf crops. Do not contaminate water. Do not use picloram in diversified crop areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Halogeton (*Halogeton glomeratus*)

2,4-D LV ester

Rate 1 to 2 lb ae/a

Time Apply in early spring when plants are actively growing before bloom stage.

Remarks Halogeton is poisonous to livestock. Chemical control is effective but will be futile unless desirable plants occupy the site immediately.

Caution Following application, do not graze until after plants dry up.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.2 to 1.8 oz/a aminocyclopyrachlor + 0.5 to 0.7 oz/a chlorsulfuron (3 to 4.5 oz/a of product)

Time Apply to actively growing vegetation.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

imazapic (Plateau)

Rate 0.063 to 0.188 lb/a

Time Apply preemergence or early postemergence.

Remarks For postemergence timing, use at least 0.094 lb/a plus a surfactant. Selective to most native grasses. Higher rates may suppress seed of some cool-season grasses.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate Escort: 0.45 oz ai/a (0.75 oz/a)

Time Apply to actively growing halogeton.

Remarks Use a surfactant. Application sites differ among products at the above rate; consult labels.

Caution Do not let spray drift onto sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Hawkweed, mouseear (*Hieracium pilosella*)

2,4-D (various products) or MCPA (various products) or clopyralid (Transline)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action (all) Group 4: synthetic auxin

Chemical family (2,4-D and MCPA) phenoxy acetic acid; (clopyralid) pyridine

Hawkweed, orange (*Hieracium aurantiacum*), meadow (*Hieracium caespitosum*), and other non-native species and hybrids

2,4-D (various products)

Rate 1.43 to 1.9 lb ae/a

Time Apply to growing hawkweed before buds form.

Remarks These species may need re-treating and/or the higher rate even under ideal conditions.

Caution Product injures or kills sensitive broadleaf forages. Do not contaminate water.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminopyralid (Milestone)

Rate 1 to 1.5 oz ae/a (4 to 6 fl oz/a Milestone)

Time Apply to actively growing plants in the bolting stage of growth. Fall treatments are not effective.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid (Transline or Stinger)

Rate 0.25 to 0.375 lb ae/a (0.66 to 1 pint/a)

Time Apply after most basal leaves emerge but before buds form. Fall treatments are not effective.

Remarks Consult labels for specific site registrations.

Caution Product injures or kills sensitive broadleaf forages. Do not contaminate water.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid + 2,4-D amine (Curtail)

Rate 2 quarts/a Curtail

Time Apply after most basal leaves emerge but before buds form. Fall treatments are not effective.

Remarks Consult label for specific site registrations.

Caution Product injures or kills sensitive broadleaf forages. Do not contaminate water.

Site of action (both) Group 4: synthetic auxin

Chemical family (clopyralid) pyridine; (2,4-D) phenoxy acetic acid

dicamba (Banvel, Rifle, or Clarity)

Rate 2 lb ae/a (2 quarts/a)

Time Apply to growing hawkweed before flowering.

Remarks Re-treat as needed but do not exceed 2 lb ae/a per season.

Caution This product will injure or kill sensitive broadleaf forages. Do not contaminate water. See label for timing restrictions for lactating dairy animals. Remove animals for slaughter from treated areas at least 30 days before slaughter.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

picloram (Tordon 22K)

Rate 0.25 lb ae/a (1 pint/a)

Time Apply after most basal leaves emerge but before buds form. Fall treatments also may be effective, but research is limited.

Remarks Consult label for specific site registrations.

Caution Product will injure or kill sensitive broadleaf forages. Do not contaminate water.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr + clopyralid (Redeem R&P)

Rate 3 to 4 pints/a

Time Apply when weeds are actively growing.

Remarks Add a nonionic surfactant at surfactant manufacturer's recommended rate. Apply in at least 10 gal/a water by ground.

Caution Do not exceed 4 pints/a per year. Do not allow drift to desirable vegetation. Note label restrictions on overseeding or reseeding.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) Pyridine

Hawthorn, English (*Crataegus monogyna*)

Remarks Although PNW data are lacking, cut stem applications with glyphosate, triclopyr, or imazapyr will likely be effective.

Site of action (imazapyr) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (triclopyr) Group 4: synthetic auxin

Chemical family (imazapyr) imidazolinone; (glyphosate) none generally accepted; (triclopyr) pyridine

Heath, Spanish (*Erica lusitanica*)

Remarks Although PNW data are lacking, glyphosate, metsulfuron, picloram, and triclopyr are used for control of Spanish heath in New Zealand.

Site of action (metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (picloram, triclopyr) Group 4: synthetic auxin

Chemical family (metsulfuron) Sulfonylurea; (glyphosate) none generally accepted; (picloram, triclopyr) Pyridine

Hemlock, poison (*Conium maculatum*)

2,4-D or MCPA

Rate 1.5 lb ae/a

Time Apply in seedling to rosette stage of growth.

Remarks Most effective soon after plants emerge. Adding a wetting agent may enhance control.

Caution Do not graze treated area until plants have dried up after spraying.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to broadleaf weeds in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

glyphosate

Rate 0.75 lb ae/a

Time Apply to actively growing plants before they begin to bolt.

Remarks Glyphosate is nonselective and will injure or kill grass that might compete with new hemlock seedlings.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate (Roundup Pro Concentrate)

Rate Inject 5 ml of a 5% v/v solution into each leaf cane

Time Inject with a hand-held device into one leaf cane per plant, 10 to 12 inches above root crown.

Remarks Mark each plant when injecting it, to avoid re-treating.

Caution Non-Crop use only. Total of all treatments must not exceed 8.5 quarts/a of Roundup Pro Concentrate or 1,600 plants/a.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

metsulfuron (Escort and others)

Rate Escort: 0.6 oz ai/a (1 oz/a)

Time Apply to actively growing plants.

Remarks Use a nonionic surfactant or silicone surfactant. Application sites differ between products; consult labels.

Caution Prevent drift to sensitive plants. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Henbane, black (*Hycocyamus niger*)**dicamba (Banvel)**

Idaho only

Rate 0.125 to 0.375 lb ai/a (1 to 3 pints/a Banvel)

Time Apply when plants are in rosette stage of growth. Use higher rates when treating dense or tall vegetative growth.

Remarks This is a Sandoz Agro, Inc. 2(ee) recommendation for use only within Idaho.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

metsulfuron (Escort and others)

Rate Escort: 0.3 to 0.45 oz ai/a (0.5 to 0.75 oz/a)

Time Apply to actively growing plants.

Remarks Using a nonionic or silicone surfactant will increase effectiveness. Application sites differ between products; consult label.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.25 to 0.5 lb ai/a (1 to 2 pints/a Tordon)

Time Apply in spring when actively growing before full bloom, or in late summer.

Remarks Tank mix 1 lb ae/a of 2,4-D with the lower rate of picloram.

Caution Most formulations are restricted-use herbicides. Do not apply if circumstances favor movement from treatment site.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Hogweed, giant (*Heracleum mantegazzianum*)**glyphosate**

Rate 1.5 lb ae/a

Time Apply in spring during the bolting stage.

Remarks Avoid physical contact with the plant.

Caution Controls grasses as well as other vegetation in treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate (Roundup Pro Concentrate)

Rate Inject 5 ml of a 5% v/v solution into each leaf cane.

Time Inject with a hand-held device, into one leaf cane per plant 12 inches above root crown.

Remarks Mark each plant when injecting it, to avoid re-treating the same plant.

Caution Non-crop use only. Total of all treatments must not exceed 8.5 quarts/a of Roundup Pro Concentrate or 1,600 plants/a.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapic (Plateau)

Rate 0.188 lb ai/a

Time Apply in spring during the bolting stage.

Remarks Avoid physically contacting plant when applying. Add an appropriate adjuvant to spray mix.

Caution Consult label on where Plateau can be used. Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Holly, English (*Ilex aquifolium*)

Methods of control include pulling, and herbicides applied to cut stumps, cut surfaces (such as hack and squirt), by injection into the stem, and as (topical) basal bark/stem treatments (12 to 15 inches above ground cut). Pulling is partially effective if stems are very small. Refer to the forestry section (M) in this handbook for more complete discussion about specific application methods and rates..

glyphosate

Rate 0.75 to 1.5 lb ae/a

Time Fall and late spring

Remarks 50% control if applied to frilled stems. Cut stump treatments may result in excessive sprouting with very poor long-term control. Fall treatment most effective. Injection and hack and squirt applications of glyphosate into stems may be more effective in the spring than in the fall

Site of action Group 9: inhibits EPSP synthase

Chemical family Glycine

imazapyr (Arsenal, Chopper, Ez-Ject Copperhead Herbicide Shells)

Rate Cut stump treatment: undiluted

Cut Surface Applications (hack and squirt): 1 ml of 50% solution at intervals of 3 to 4 inches between cuts

Injection: 1 ml of dilute solution in each injection, separated by no more than 3 inches.

Time Fall or late spring

Remarks Very effective If injected into stem. No more than 1.5 lb ae/a/yr (96 fluid oz/a).

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

triclopyr (Element 4, Garlon 4 or Garlon 3A)

Rate Cut stump treatment: Undiluted

Cut Surface Applications (hack and squirt): 1 ml of 50 to 100% solution at intervals of 3 to 4 inches between cuts.

Basal bark treatment: 20 to 30% solution in oil (low volume) or 1 to 5 % solution in oil (high volume)

Injection: 1/2 to 1 ml of undiluted Garlon 3A at intervals of 3 to 4 inches between centers of the injector wound

Time Fall and late spring

Remarks Applying triclopyr to frilled stems is very effective in both seasons. May be applied at a rate of up to 6 lb ae of triclopyr per acre per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Horsebrush, gray or spineless (*Tetradymia canescens*)

2,4-D LV ester

Rate 2.5 lb ae/a

Time Apply in early spring when plants are actively growing.

Remarks Spot treatment only. Re-treatments are necessary to control this resprouting species. Mechanical treatments must control roots 4 to 6 inches deep.

Caution This plant is poisonous. Do not graze treated areas until plants have dried up after 2,4-D application.

Site of action Group 4: synthetic auxin.

Chemical family Phenoxy acetic acid

Horsetail, field (*Equisetum arvense*)

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

chlorsulfuron (Telar)

Rate 1 to 1.5 oz ai/a (1.33 to 2 oz/a)

Time May be applied preemergence or early postemergence.

Remarks Do not apply to frozen ground. Maintain constant agitation while mixing in spray solution. Add 0.25% v/v nonionic surfactant to the spray mixture. Application rates up to 1 oz ai/a (1.33 oz/a allowed on pasture, rangeland, and Conservation Reserve Program (CRP) sites. Rates above 1 oz ai/a (1.33 oz/a) allowed only on non-cropland.

Caution Avoid contact with sensitive crops. Do not treat powdery, dry soils and light, sandy soils unless rain is likely after treatment.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

dichlobenil (Casoron)

Rate 4 lb ai/a granular formulation

Time Apply in winter or early spring, when moisture is available to leach chemical into soil. In landscape plantings, apply any time and place bark mulch over the treated area to reduce volatilization.

Remarks Good selective control in many fruits and ornamental plants. Use as a follow-up, supplemental treatment if horsetail resists many soil-applied herbicides. Can apply over labeled ornamental plants or conifer tree nurseries. Apply midwinter immediately before a cold rain to reduce volatility and enhance weed suppression. Weigh and distribute uniformly exact quantities over precisely measured areas. Oregon results over 9 years suggest that perennial weeds can be suppressed with 4-, 3-, and 2-lb ai/a rates applied in 3 consecutive years. Grazing livestock is prohibited. (Inhibits cellulose and cell wall formation.)

Caution See label for precautions on ornamental species and varieties tolerant of dichlobenil.

Site of action Group 20: inhibits cell wall synthesis Site A

Chemical family Nitrile

MCPA

Rate 1 to 2 lb ae/a

Time Apply when horsetail fully emerges and before grain or grass is in boot stage.

Remarks Gives 20 to 30% reduction in field horsetail stands with each spray application. Re-treatments are necessary and may be most effective with more than one application per year. The second application can be to the stubble after harvesting grain fields.

Caution Apply once or twice per year until horsetail is controlled. Skipping a year means losing the control gained up to that time.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

Horseweed (Marestail) (*Conyza canadensis*)

2,4-D LV ester

Rate 1 lb ae/a

Time Apply when horseweed is in the seedling to rosette stage of growth.

Remarks Plants should be actively growing at time of treatment.

Caution Avoid drift to sensitive crops and desirable vegetation. This product will injure or kill sensitive broadleaf plants.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

aminopyralid (Milestone)

Rate 1 to 1.5 oz ae/a (4 to 6 fl oz/a Milestone)

Time Apply to actively growing plants.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid (Stinger or Transline)

Rate 0.125 to 0.188 lb ae/a

Time Apply to actively growing plants up to the five-leaf stage.

Remarks See label for registered sites.

Caution Consult label for crop rotation restrictions before using these products. Several crops may be injured up to 4 years after application.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

dicamba (Banvel, Rifle, or Clarity)

Rate 0.25 lb ae/a

Time Apply in the seedling to rosette stage.

Remarks Plants should be actively growing at time of application.

Caution Avoid drift to sensitive crops and desirable vegetation. This product will injure or kill sensitive broadleaf plants.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

diflufenzopyr + dicamba (Distinct)

Rate 4 oz/a

Time Apply in the seedling to rosette stage.

Remarks Plants should be actively growing at time of application.

Caution Avoid drift to sensitive crops and desirable vegetation. This product will injure or kill sensitive broadleaf plants.

Site of action (diflufenzopyr) Group 19: inhibits indole acetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) Semicarbazone; (dicamba) Benzoic acid

flumioxazin (Chateau or Payload)

Rate 2 to 6 oz ai/a (4 to 12 oz/a). Rate depends on application timing and soil type and organic matter.

Time May be applied preemergence or postemergence to small, actively growing horseweed.

Remarks Preemergence treatments require rain to move into the soil. Can be used in several crops.

Caution Note recropping restriction intervals on the label.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family N-phenylphthalimide

glyphosate

Rate 0.75 to 1.5 lb ae/a

Time Apply while horseweed is actively growing and less than 12 inches tall.

Remarks Glyphosate-resistant horseweed is reported throughout the United States.

Caution Controls grasses as well as other vegetation in treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

Houndstongue (*Cynoglossum officinale*)

2,4-D LV ester

Rate 2 lb ae/a

Time Early spring to actively growing plants before they bloom.

Remarks Sticky seeds can contaminate wool. Mowing before seed production helps alleviate wool contamination.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

imazapic (Plateau)

Rate 0.125 to 0.188 lb/a

Time Apply to actively growing plants.

Remarks Use lower rates if rosettes are small; increase rate if rosettes are large or bolting. Selective to most native grasses. Higher rates may suppress seed of some cool-season grasses.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate Escort: 0.6 oz ai/a (1 oz/a)

Time Any time plants are growing well.

Remarks Application sites differ between products; see labels.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.5 lb ae/a

Time Any time plants are growing well.

Remarks Reported to give fair to good control.

Caution Most formulations are restricted-use herbicides.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Indigobush (*Amorpha fruticosa*)

Remarks Although PNW data are preliminary, aminopyralid, clopyralid, glyphosate, imazapyr, and triclopyr + 2,4-D applied as cut stem treatments gave promising results in initial trials. Foliar application of clopyralid also resulted in excellent control.

Site of action (imazapyr) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (2,4-D, aminopyralid, clopyralid, triclopyr) Group 4: synthetic auxin

Chemical family (imazapyr) imidazolinone; (glyphosate) none generally accepted; (2,4-D) phenoxy acetic acid; (aminopyralid, clopyralid, triclopyr) pyridine

Iris, wild (*Iris spp.*)

2,4-D LV ester

Rate 5 lb ae 2,4-D in 100 gal water

Time Apply in the early bloom stage.

Remarks Foliage must be thoroughly wet.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

glyphosate

Product labeled for aquatic sites

Rate 5% solution of a 4 lb ae (5.4 lb ai) glyphosate

Time Apply prebloom or in the fall.

Remarks Use a nonionic surfactant recommended for aquatic sites

Caution Glyphosate is nonselective and may injure or kill desirable species.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapic (Plateau)

Rate 0.188 lb ae/a

Time Apply postemergence at the late boot or bloom stage.

Remarks Use a methylated seed oil at 1 quart/a; do not exceed 25 gal/a spray volume.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

imazapyr (Habitat)

Rate 0.75% v/v product

Time Apply prebloom or in the fall.

Remarks Use a surfactant the label recommends.

Caution Before use, note rotation and other restrictions on label

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate Escort: 0.6 ai/a (1 oz/a)

Time Apply to actively growing plants.

Remarks Use a surfactant to increase effectiveness. Application sites differ among products; consult labels.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Ivy, common or English (*Hedera helix*)**triclopyr amine (Garlon 3A, Brush-B-Gone, or Brush Killer) or triclopyr ester (Garlon 4, Pathfinder, or Vinex) or glyphosate (Accord, Glypro, or Rodeo)**

Rate at least 41% active ingredient (3 lb ae or 4 lb ai) glyphosate

Remarks Basal bark application: apply 33% dilution of triclopyr or glyphosate to exposed stems after stripping the leaves from stems near ground level.

Cut stem application (most effective method): cut each vine stem close to the ground and treat freshly cut surfaces (preferably within 5 minutes) with a 33% solution of triclopyr amine or glyphosate mixed in water. Do not dilute products such as Brush-B-Gone and Brush Killer. Roundup Pro Concentrate (50.2% formulation) may be diluted with water.

Foliar application From summer to fall, foliar-apply a 2 to 5% solution of triclopyr ester mixed in water with a nonionic surfactant. Fully coat foliage. Some control may be possible with glyphosate as a 2 to 4% dilution using at least a 41% (3 lb ae or 4 lb ai glyphosate), but repeat applications will probably be necessary. Broadcast applications of triclopyr will cause less damage to desirable grasses.

Manual and mechanical Pull vines on the ground by hand and discard. Cut vines will root easily. Cut climbing vines near the ground, then pry the vines from the tree or structure. Once the vines are cut they will eventually die and fall from the tree, usually after the first extended hot and dry period. Occasionally vines will be embedded in the trunk of the tree. This makes control by both hand and chemicals very difficult; continual removal of sprouts will be needed.

Site of action (triclopyr) Group 4: synthetic auxin; (glyphosate) Group 9: inhibits EPSP.

Chemical family (triclopyr) pyridine; (glyphosate) none generally accepted

Jimsonweed (*Datura stramonium*)**2,4-DB (Butyrac) or alachlor (Lasso) or atrazine (AAtrex) or bromoxynil (Buctril) or clomazone (Command) or clopyralid (Stinger or Transline) or diuron (Karmex) or glyphosate or metolachlor (Dual) or metribuzin (Sencor) oxyfluorfen (Goal) or paraquat (Gramoxone Max) or picloram (Tordon) or terbacil (Sinbar)**

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action (alachlor and metolachlor) Group 15: unknown; (atrazine, metribuzin, and terbacil) Group 5: photosystem II inhibitor; (bromoxynil) Group 6: photosystem II inhibitor; (clomazone) Group 13: inhibits DOXP synthase; (clopyralid, picloram, and 2,4-DB) Group 4: synthetic auxin; (diuron) Group 7: photosystem II inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (oxyfluorfen) Group 14: protoporphyrinogen oxidase inhibitor; (paraquat) Group 22: photosystem I electron diverter

Chemical family (alachlor and metolachlor) chloroacetamide; (atrazine) triazine; (bromoxynil) nitrile; (clomazone) isoxazolidone; (clopyralid and picloram) pyridine; (diuron) urea; (glyphosate) none generally accepted; (metribuzin) triazinone; (oxyfluorfen) diphenylether; (paraquat) bipyridilium; (terbacil) uracil; (2,4-DB) phenoxy acetic acid

Johnsongrass (*Sorghum halepense*)**fenoxaprop (Acclaim or Horizon)**

Rate 0.15 to 0.25 lb ai/a

Time Apply to actively growing seedlings with two to five leaves. Larger plants are more difficult to control. Apply to rhizome Johnsongrass that is 24 to 60 inches tall and growing actively.

Remarks Rhizome Johnsongrass is only suppressed. Do not apply within 3 weeks after mowing.

Caution Do not use a crop oil or surfactant.

Site of action Group 1: acetyl CoA carboxylase (ACCCase) inhibitor

Chemical family Aryloxyphenoxy propionate

fluazifop (Fusilade DX)

Rate 0.25 to 0.375 lb ai/a (2 to 3 pints/a)

Time Apply to actively growing Johnsongrass 8 to 18 inches tall but before boot stage.

Remarks Apply with 1% v/v crop oil concentrate or 0.25% v/v nonionic surfactant. Fluazifop acts very slowly, taking at least 2 weeks and often 4 weeks to show effectiveness. Do not apply to stressed grasses. If weed regrows, repeat application at 0.187 to 0.375 lb ai/a.

Caution Do not use crop oil concentrate if treating Johnsongrass in ornamentals. Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

glyphosate

Rate 2.25 lb ae/a

Time Apply at heading time to actively growing plants.

Remarks Rain within 6 hr after application may reduce effectiveness. Spray to cover but not to point of runoff.

Caution Glyphosate controls other grasses and vegetation in treated areas.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapic (Plateau)

Rate 0.188 lb ae/a

Time Apply postemergence, at the late-boot or bloom stage.

Remarks Use a methylated seed oil at 1 quart/a; do not exceed 25 gal/a spray volume.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

imazapic + glyphosate (Journey)

Rate 21 to 32 oz/a

Time Apply postemergence to grass when it is 18 to 24 inches at the whorl.

Remarks Add a suitable surfactant to the spray mix. See label for details.

Caution Before using, note crop rotation restrictions.

Site of action (imazapic) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase

Chemical family (imazapic) imidazolinone; (glyphosate) none generally accepted

MSMA (Bueno or Trans-Vert)

Rate 2.25 lb ai/a

Time This herbicide is foliar-active; apply to rapidly growing foliage.

Remarks Use with caution on or near ornamentals (see label). Can mix with 2,4-D for broader control on non-cropland. MSMA is inactivated by soil surface adsorption.

Caution Keep liquid or dust away from eyes. Wash eyes immediately with water if exposed.

Site of action Group 17: not well understood

Chemical family Organoarsenical

sethoxydim (Poast)

Rate 0.28 to 0.47 lb ai/a (1.5 to 2.5 pints/a)

Time Apply to actively growing Johnsongrass when the plant is 15 to 25 inches tall.

Remarks Apply with 2 pints/a crop oil concentrate. Sethoxydim acts very slowly, taking at least 2 week and often 4 week to show herbicide effectiveness. Do not apply to stressed grasses. If Johnsongrass regrows, repeat application when it is 6 to 8 inches tall.

Caution Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

Knapweeds (*Centaurea* spp. and *Acrotilon repens*)

The following herbicides usually control treated plants. Plants often regrow, so plan annual applications for several years. Control of regrowth and of new seedlings is much better if a competitive crop or sod is established. A perennial grass is the logical choice because, except for glyphosate, the herbicides listed here will not kill established grasses.

2,4-D

Rate 1 to 2 lb ae/a (4 to 8 lb ae/a for Russian knapweed)

Time Apply at the early stage of flower stem elongation (late April to early May).

Remarks Treatment will control only plants emerged at time of spraying.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

aminopyralid (Milestone)

Rate 1 to 1.75 oz ae/a (4 to 7 fl oz/a Milestone). Rate of application will depend on knapweed species to be controlled.

Time Consult label for optimal timing. Diffuse and spotted knapweed: apply to actively growing plants in fall or in spring from rosette to bolting growth stages. Russian knapweed: apply in spring and summer to plants from bud to flowering stage; in fall, to dormant plants.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid (Stinger or Transline)

Rate 0.25 to 0.5 lb ae/a (0.66 to 1.33 pints/a). Labeled rates vary with crops.

Time Up to the bud stage of knapweeds.

Remarks Results are best if applied to actively growing weeds. See labels for registered sites.

Caution Consult label for crop rotation restrictions before using Stinger. Several crops may be injured up to 4 years after application.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid + 2,4-D amine (Curtail)

Rate 2 to 4 quarts/a Curtail

Time Apply after most rosettes emerge but before flower stem elongates.

Remarks Lower rate for in-crop cereal grain application; higher rates for fallow, postharvest, and Conservation Reserve Program (CRP) applications. Consult label for specific directions. CRP applications for established grass only. Apply in enough total spray volume to ensure good coverage for diffuse and spotted knapweed.

Caution Consult label for crop rotation restrictions before using product. Several crops may be injured up to 4 years after application.

Site of action Group 4: synthetic auxin

Chemical family (clopyralid) Pyridine; (2,4-D) Phenoxy acetic acid

diflufenzopyr + dicamba (Overdrive)

Rate 0.26 to 0.35 lb ae/a (6 to 8 oz/a)

Time Apply to rosettes.

Remarks Add a surfactant to the spray mix.

Caution Avoid drift to sensitive crops. Will kill legumes.

Site of action (diflufenzopyr) Group 19: inhibits indole acetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) Semicarbazone; (dicamba) Benzoic acid

glyphosate

Rate 3 lb ae/a

Time Apply to actively growing knapweed when most plants are at bud stage.

Remarks Glyphosate kills many knapweed plants but also kills grass that might compete with new knapweed seedlings. Russian knapweed is not controlled. When using glyphosate, follow by seeding with a locally adapted grass.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapic (Plateau)

Rate 0.188 lb ai/a for Russian knapweed

Time Apply in fall or early winter after Russian knapweed has grown old.

Remarks Use 1 quart/a methylated seed oil as the adjuvant. Selective to most native grasses. Higher rates may suppress seed of some cool-season grasses.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

picloram (Tordon)

Rate 0.25 to 0.5 lb ae/a (1 lb ae/a for Russian knapweed)

Time Apply in late spring before or during flower stem elongation.

Remarks A selective treatment that, at the suggested rate, will not damage perennial grasses. Treatment made in bud stage may not prevent seed production in the year of application. However, seed germination is markedly reduced.

Caution Most formulations are restricted-use herbicides. Do not contaminate water or use in diversified crop areas. Potatoes, beans, and most other broadleaf crops are sensitive to picloram.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr + clopyralid (Redeem R&P)

Rate 1.5 to 2 pints/a (2.5 to 4 pints/a for Russian knapweed)

Time Apply from rosette to early bolt stage when weeds are actively growing. Russian knapweed should be in early bud to early flower growth stage.

Remarks Add a nonionic surfactant at surfactant manufacturer's recommended rate. Apply in at least 10 gal/a water by ground.

Caution Do not exceed 4 pints/a per year. Do not allow drift to desirable vegetation. Note label restrictions on overseeding or reseeding.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) Pyridine

Knotweed, Bohemian (*Polygonum bohemicum*), Japanese (*Polygonum cuspidatum*), giant (*Polygonum sachalinense*), Himalayan (*Polygonum polystachyum*), or fleecflower**dicamba (Banvel, Rifle, or Clarity)**

Rate 0.25 lb ae dicamba mixed with 1 gal water/400 sq ft

Time Apply in late August to new regrowth since plant was cut back in June.

Remarks Apply as a basal spray to the stems at ground level.

Caution Do not apply in areas where roots of desirable plant species are growing.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

glyphosate

Rate Spot treatment: 0.06 lb ae (2.67 fl oz) glyphosate with 1 gal water

Time Apply as a coarse spray when weeds are actively growing and most are at bud to early flowering growth stage.

Remarks Spray for complete, uniform coverage but not to the point of runoff.

Caution Glyphosate is nonselective: it injures or kills any vegetation it contacts.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate (Roundup Pro Concentrate)

Rate Inject 5 ml/stem

Time Inject with a hand-held device into hollow stem of actively growing plants between second and third internodes.

Remarks Mark each stem when making the injection to avoid reapplying.

Caution Non-crop use only. Total of all treatments must not exceed 8.5 quarts/a of Roundup Pro Concentrate or 1,600 stems/a per year.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Arsenal or Habitat)

Rate 0.5 to 1 lb/a or 1% solution + 0.25% surfactant.

Time Apply in midsummer, after seedhead forms, up to killing frost.

Remarks Spray to cover plants but not to runoff. Habitat is labeled for aquatic sites.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

triclopyr ester (Garlon 4 or Remedy) or triclopyr amine (Garlon 3A) or triclopyr + 2,4-D ester (Crossbow)

Rate 0.5% to 2% concentration for application with a handgun sprayer.

Time Apply to actively growing plants in midsummer.

Remarks Adding 0.25% to 0.5% of a suitable surfactant to Garlon 3A improves results. No surfactant is needed with Garlon 4 or Remedy.

Caution Garlon products are registered for use on rights-of-way, industrial sites, and forestry (release and site preparation). Crossbow and Remedy can be used on permanent pastures and rangeland up to 1.5 lb ae/a. Observe all grazing and harvesting restrictions.

Site of action Group 4: synthetic auxin

Chemical family (triclopyr) Pyridine; (2,4-D) Phenoxy acetic acid

Kochia (*Kochia scoparia* = *Bassia scoparia*)

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 4.75 to 8 oz/a

Time Apply either preemergence or postemergence. Postemergence applications are most effective on seedlings.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v.

Caution Do not apply to the root zone of desirable trees and shrubs. May injure or kill some grass species.

Site of action (aminocyclopyrachlor) Group 4 synthetic auxin; (chlorsulfuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (aminocyclopyrachlor) Pyridine; (chlorsulfuron) Sulfonylurea

chlorsulfuron (Telar and others)

Rate 0.75 oz ai/a (1 oz/a).

Time Apply preemergence, or postemergence from seedling to bolting stage of growth.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Some kochia populations have developed resistance to this mode of action; where resistance is suspected use other herbicides or combinations.

Caution Avoid drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

dicamba (Banvel and others)

Rate 0.25 to 1 lb ae/a (0.5 to 2 pints/a)

Time Apply in spring when seedlings are actively growing.

Remarks Some kochia populations have developed resistance to this mode of action; where resistance is suspected use other herbicides or combinations.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

fluroxypyr (Vista)

Rate 2.1 to 7.7 oz ae/a (6 to 22 oz/a)

Time Apply in spring from seedling to bolting stage of growth.

Remarks Use of a methylated seed oil is recommended (see label for details). Some kochia populations have developed resistance to this mode of action; where resistance is suspected use other herbicides or combinations.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

glyphosate

Rate 1.1 to 1.7 lb ae/a.

Time Apply in spring from seedling to flowering stage of growth.

Remarks Adequate foliar coverage of kochia is necessary. Add nonionic surfactant if not included in the formulation. Some kochia populations have developed resistance to this mode of action; where resistance is suspected use other herbicides or combinations.

Caution Glyphosate is nonselective and injures or kills other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

hexazinone (Velpar)

Rate 0.5 to 1.5 lb ai/a (2 to 6 pints/a)

Time Apply preemergence in the spring.

Remarks Early spring hexazinone application controls newly germinating seedlings.

Caution Hexazinone is a restricted-use herbicide. Do not contaminate water.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazinone

imazapic (Plateau)

Rate 2 to 3 oz ae/a (8 to 12 fl oz/a).

Time Apply preemergence or postemergence to actively growing kochia.

Remarks Add 0.25% by volume of nonionic surfactant or 1.5 to 2 pints/a methylated seed oil or crop oil concentrate to spray mixture. Some kochia populations have developed resistance to this mode of action; where resistance is suspected use other herbicides or combinations.

Caution Avoid drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

imazapyr (Arsenal, Habitat)

Rate 0.5 to 1 lb ae/a (2 to 4 pints/a)

Time Apply preemergence or postemergence to actively growing kochia.

Remarks Add 0.25% by volume of nonionic surfactant, or 1 to 2 pints/a methylated seed soil or crop oil concentrate to spray mixture. Some kochia populations have developed resistance to this mode of action; where resistance is suspected use other herbicides or combinations.

Caution Imazapyr is nonselective; spray will injure or kill vegetation contacted.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate 0.6 to 1.2 oz ai/a (1 to 2 oz/a)

Time Apply in spring from seedling to flowering stage of growth.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Application sites differ between products; consult labels. Some kochia populations have developed resistance to this mode of action; where resistance is suspected use other herbicides or combinations.

Caution Avoid contacting sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

rimsulfuron (Matrix)

Rate 1 oz ai/a (4 oz/a)

Time Apply preemergence or postemergence to kochia seedlings.

Remarks Add 0.25% by volume of nonionic surfactant to spray mixture. Some kochia populations have developed resistance to this mode of action; where resistance is suspected use other herbicides or combinations.

Caution Avoid contacting sensitive crops. Primarily for noncrop sites, as many grasses are controlled by Matrix.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Kudzu (*Pueraria montana var. lobata*)

Remarks Although PNW data are lacking, clopyralid, fosamine, glyphosate, imazapyr, metsulfuron, picloram, sulfometuron, and triclopyr are used for control of kudzu in the Southeastern US.

Site of action (imazapyr, metsulfuron, sulfometuron) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (clopyralid, picloram, triclopyr) Group 4: synthetic auxin; (fosamine) Group 26, unknown

Chemical family (metsulfuron, sulfometuron) Sulfonylurea; (imazapyr) Imidazolinone; (glyphosate) none generally accepted; (clopyralid, picloram, triclopyr) Pyridine

Lawnweed (*Soliva sessilis*)

Remarks Although PNW data are lacking, isoxaben, metsulfuron, and 2,4-D + MCPP + dicamba are used for control in the Southeastern US.

Site of action (metsulfuron) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (picloram) Group 4: synthetic auxin

Chemical family (metsulfuron) sulfonylurea; (glyphosate) none generally accepted; (picloram) phenoxy acetic acid

Larkspur, tall or duncecap (*Delphinium occidentale*)

picloram (Tordon)

Rate 1 lb ae/a

Time Apply to actively growing plants from flower stalk formation to early seed development.

Remarks Poisonous plant.

Caution Most formulations are restricted-use herbicides. Do not graze until plants have dried up after spray application. Refer to label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. For rates exceeding 0.5 lb ae/a (1 quart/a), apply only as a spot treatment not to exceed 25% of an owner's acreage in a particular watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Loosestrife, garden (*Lysimachia vulgaris*)

Remarks Although PNW data are preliminary, initial results indicate that glyphosate, imazamox, imazapyr, and aminopyralid may provide effective garden loosestrife control.

Site of action (imazapyr, imazamox) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (aminopyralid) Group 4: synthetic auxin

Chemical family (imazapyr, imazamox) Imidazolinone; (glyphosate) none generally accepted; (aminopyralid) Pyridine

Lupine (*Lupinus* spp.)

2,4-D LV ester

Rate 2 lb ae/a

Time Apply at the early bud stage to actively growing plants.

Remarks Several species of lupine are poisonous to livestock.

Caution Do not graze until plants dry up after application. Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

metsulfuron (Escort)

Rate 0.9 oz ai/a (1.5 oz/a)

Time Apply to actively growing plants.

Remarks Use a surfactant to increase effectiveness. Spray to wet.

Caution Apply only to non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.25 to 0.5 lb ae/a

Time Apply to actively growing lupine at the early bud stage.

Remarks Several species of lupine are poisonous to livestock.

Caution Most formulations are restricted-use herbicides. Do not graze until plants dry up after spray applications. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. For rates above 0.5 lb ae/a (1 quart/a), apply only as a spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season. Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Lythrum, purple, or purple loosestrife (*Lythrum salicaria*) and wand loosestrife (*Lythrum virgatum*)

glyphosate (Rodeo)

Rate 1% solution with hand-held equipment

Time Apply to actively growing plants at full to late flowering stage. Seedlings may be effectively treated early in the season after a fall application to mature plants.

Remarks Use 0.5% v/v nonionic surfactant. Thoroughly wet foliage but avoid runoff.

Caution Glyphosate is nonselective. It will injure or kill vegetation it contacts.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Habitat)

Rate 0.25 to 0.5 lb ae/a

Time Apply to actively growing loosestrife after midbloom until killing frost.

Remarks Add suitable adjuvant to spray solution.

Caution Before using, note crop rotation restrictions. Do not apply to root zone of desirable trees.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate Escort: 0.6 oz ai/a (1 oz/a)

Time Apply to actively growing plants.

Remarks Using a nonionic or silicone surfactant increases effectiveness. Before using, check label to see whether product can be used on the type of site intended. Application sites differ among products; consult labels.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

triclopyr (Garlon 4 or Garlon 3A)

Rate 1.5 to 2% concentration for application with handgun sprayer.

Time When plant is in midbloom to full-bloom stage or early in season on seedlings.

Remarks Labeled for use on nonirrigation ditch banks and in seasonally dry wetlands.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Mallow, Venice (*Hibiscus trionum*)

2,4-D (various products)

alachlor (Lasso) or

bentazon (Basagran) or

bromoxynil (Buctril) or

chlorsulfuron (Glean) or

dicamba (various products) or

glyphosate (Roundup) or

metribuzin (Sencor) or

oxyfluorfen (Goal) or

paraquat (Gramoxone Max) or

picloram (Tordon)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action (alachlor) Group 15: unknown; (bentazon and bromoxynil) Group 6: photosystem II inhibitor; (chlorsulfuron) Group 2: acetolactate synthase (ALS) inhibitor; (dicamba and 2,4-D) Group 4: synthetic auxin; (glyphosate) Group 9: inhibits EPSP synthase; (metribuzin) Group 5: photosystem II inhibitor; (oxyfluorfen) Group 14: protoporphyrinogen oxidase inhibitor; (paraquat) Group 22: photosystem I electron diverter

Chemical family (alachlor) chloroacetamide; (bentazon) benzothiadiazole; (bromoxynil) nitrile; (chlorsulfuron) sulfonylurea; (dicamba) benzoic acid; (2,4-D) phenoxy acetic acid; (glyphosate) none generally accepted; (metribuzin) triazine; (oxyfluorfen) diphenylether; (paraquat) bipyridilium

Matgrass (*Nardus stricta*)

Remarks Control is unknown. In a preliminary trial, fluzifop and sethoxydim showed some activity, but did not substantially reduce stands.

Site of action (fluazifop, sethoxydim) Group 1: acetyl CoA carboxylase (ACCase) inhibitors

Chemical family (fluazifop) Aryloxyphenoxy propionate; (sethoxydim) Cyclohexanedione

Milkweed (*Asclepias speciosa*)

glyphosate

Rate 2.25 lb ae/a

Time Apply to actively growing milkweed that has reached the late bud to flower stage of growth.

Remarks After small grain harvest or mowing, let milkweed regrow to mature stage before treating. Allow 7 days or more after application before tillage.

Caution Glyphosate controls grasses as well as other vegetation in treated areas.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

picloram (Tordon)

Rate 1 lb ae/a

Time Apply at bud to early bloom to actively growing milkweed.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. Apply rates over 0.5 lb ae/a (1 quart/a) only as a spot treatment not to exceed 25% of a landowner's acreage in any given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Nightshade, silverleaf (*Solanum elaeagnifolium*)

glyphosate

Rate 2.25 lb ae/a

Time Apply to actively growing milkweed that has reached the late bud to flower stage of growth.

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action (glyphosate) Group 9: inhibits EPSP synthase; (picloram) Group 4: synthetic auxin

Chemical family (glyphosate) none generally accepted; (picloram) pyridine

imazapyr (Arsenal)

Rate 1 lb ae/a

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Nutsedge, yellow (*Cyperus esculentus*) and purple (*Cyperus rotundus*)

alachlor (Lasso or Micro-Tech)

Rate 1.5 to 4 lb ai/a

Time Use a preplant incorporation application.

Remarks Selective in corn and dry beans. Controls most annual grasses and certain annual broadleaf weeds. Absorbed mainly by germinating plant shoots; seems to inhibit protein synthesis.

Caution A restricted-use herbicide. Avoid contact with the eyes and skin.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

dichlobenil (Casoron)

Rate 150 lb/a of 4% granules

Time Apply in winter just before a period of rain, or in spring just before applying bark mulch in landscape plantings.

Remarks Incorporate by rototilling or rain. Selective in some fruits and ornamentals (see label). Apply midwinter immediately before a cold rain to reduce volatility and enhance weed suppression. Weigh and distribute uniformly exact quantities over precisely measured areas. Oregon results from over 9 years suggest perennial weeds can be suppressed with 4-, 3- and 2-lb ai/a rates applied in 3 consecutive years. Grazing livestock is prohibited. In non-crop-land areas only, up to 250 to 500 lb of 4% granules can be used for nutsedge control. Inhibits cellulose and cell wall formation.

Caution Do not breathe dust or allow contact with eyes or skin.

Site of action Group 20: inhibits cell wall synthesis Site A

Chemical family Nitrile

EPTC (Eptam)

Rate 3 to 6 lb ai/a

Time Apply before final seedbed preparation in the spring.

Remarks Incorporate immediately by disking in two directions, or rototill to distribute 2 to 3 inches deep. Apply only to soil dry on the surface, then disk immediately. Use before planting beans and potatoes. Treatment suppresses nutsedge for one season only.

Caution Incorporate 2 to 3 inches into soil immediately after application.

Site of action Group 8: lipid synthesis inhibitor but not an ACCase inhibitor

Chemical family Thiocarbamate

EPTC with safener (Eradicane or Genate) or butylate with safener (Sutan)

Rate 4 to 6.14 lb ai/a, depending on soil type and infestation; see label.

Time Apply preplant and incorporate immediately and thoroughly.

Remarks These herbicides are selective in corn. Perennial weeds must be turned under and chopped up thoroughly before treatment. See label for additional application and incorporation instructions. Suppresses emergence of new shoots from yellow nutsedge tubers but does not necessarily kill them.

Caution Do not use EPTC without safener on "Golden Jubilee" sweet corn west of the Cascades. Do not exceed 4 lb ai/a EPTC with safener on sweet corn.

Site of action (both) Group 8: lipid synthesis inhibitor but not an ACCase inhibitor

Chemical family (both) Thiocarbamate

glyphosate

Rate 2.25 lb ae/a as a broadcast spray, or a 1% solution using hand-held equipment

Time When nutsedge is actively growing in midseason but before new tubers begin to form, usually by June 15 to July 1.

Remarks Nutsedge can be reduced by encouraging active growth and applying glyphosate once or more often when several nutsedge leaves are present but before new tubers begin to form.

Caution Re-treatment is important. Glyphosate controls grasses as well as other vegetation in the treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

halosulfuron (Permit, Sandea, or SedgeHammer)

Rate 0.5 to 1 oz ai/a (0.67 to 1.33 oz/a)

Time Labels differ. For example, apply SedgeHammer to yellow nutsedge in the three- to five-leaf stage. Apply SedgeHammer in turf to yellow nutsedge in the three- to eight-leaf stage of growth.

Remarks Halosulfuron is labeled on several crops. Consult labels for stage of crop or turf growth. Add 1 to 2 quarts nonionic surfactant or crop oil concentrate per 100 gal spray solution for broadcast applications. A second halosulfuron application may be required 6 to 10 weeks after the first.

Caution Do not exceed 1.5 oz ai/a (2 oz/a) of Permit or Sandea or two applications per season. Do not exceed 0.4 oz ai/a (5.33 oz/a) of SedgeHammer or four applications per season. Note labels for information on recropping, reseeding, and site of application.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

imazapic (Plateau)

Rate 0.125 to 0.188 lb ai/a

Time Apply postemergence when plants have bolted.

Remarks Add 1 quart/a methylated seed oil; do not exceed 25 gal/a spray volume.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

S-metolachlor (Dual II Magnum or Dual Magnum)

Rate Refer to label

Time Use preplant incorporated.

Remarks Incorporate uniformly to 2 inches before planting. Use lower rates on coarse soils.

Caution May cause skin sensitization reactions in some people. Do not breathe spray mist.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

Oatgrass, tuber (*Arrhenatherum elatius* var. *bulbosum*)

glyphosate

Rate 1 to 2 lb ae/a

Time When plants are at least 15 inches tall and growing rapidly.

Remarks Established stands are controlled best by the 2-lb rate applied after May 1 to undisturbed sites. Newly sprouted corms are controlled with the 1-lb rate, but less herbicide will move into attached unsprouted corms. A single application to dormant corms gives only limited long-term control; tillage and repeated applications will be required.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

Olive, Russian (*Elaeagnus angustifolia*)

2,4-D LV ester

Rate 2 lb ae/a

Time When leaves are fully developed.

Remarks Two to three annual re-treatments may be necessary for complete control.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

2,4-D + triclopyr (Crossbow)

Rate 1.5% spray solution

Time Apply during active growth, after full leaf expansion, and when moisture and temperature are favorable.

Remarks This product also can be used in dormant stem and conventional basal applications. Refer to label for additional instructions. Re-treatment may be necessary.

Site of action (both) Group 4: synthetic auxin

Chemical family (2,4-D) pyridine; (triclopyr) phenoxy acetic acid

glyphosate

Rate 2 cc (ml) per inch of trunk diameter or 5% solution applied to foliage

Time Apply undiluted to frill cuts or apply to foliage after the Russian olive fully leaves out.

Remarks Spray to wet foliage but not to the point of runoff.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Arsenal)

Rate 2 cc (ml) per inch of trunk diameter or 0.75% solution of the 2 lb ai/gal applied to foliage

Time Apply undiluted to frill cuts or apply to foliage after the Russian olive fully leafs out.

Remarks Spray to wet foliage but do not allow spray to run off foliage.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

Parsley, hedge (*Torilis arvensis*)

simazine (Princep)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label directions.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazine

Pepperweed, perennial (*Lepidium latifolium*)

2,4-D amine

Rate 4 lb ae/a

Time Apply at the bud stage of growth.

Remarks Repeat treatments if needed. Good grass cover helps control perennial pepperweed.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

chlorsulfuron (Telar)

Rate 0.75 oz ai/a (1 oz/a)

Time Apply in fall or in spring up through bloom stage.

Remarks Adding surfactant and/or 2,4-D improves control.

Caution Do not let spray drift onto sensitive crops. Labeled for use on pasture, range, Conservation Reserve Program (CRP), and non-cropland only.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

imazapic (Plateau)

Rate 0.125 to 0.188 lb ai/a

Time Apply after blossoms open (full bloom) until plants desiccate. Fall rosettes also may be treated if moisture permits.

Remarks Lightly cover foliage with spray solution. Add 1 quart/a methylated seed oil.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort)

Rate Escort: 0.6 to 1.2 oz ai/a (1 to 2 oz/a)

Time Apply to actively growing perennial pepperweed.

Remarks Selective to grasses. Use a surfactant.

Caution Do not allow spray to drift onto sensitive crops. Apply only to non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Poison-oak and poison-ivy (*Toxicodendron* spp.)

aminocyclopyrachlor + metsulfuron methyl (Streamline)

Rate 1.9 to 3.8 oz/a aminocyclopyrachlor + 0.6 to 1.2 oz/a metsulfuron (4.75 to 9.5 oz/a of product)

Time Apply to actively growing woody plants.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water. There are several application methods that dictate the amount of product to be mixed with the carrier, so consult the label. Controls many herbaceous species, in addition to woody species.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Conifers can be injured, these include ponderosa pine, Douglas fir, Norway spruce, and white pine. Other trees that can be injured include aspen, Chinese tallow, cottonwoods, honey locust, magnolia, poplars, redbud, silver maple, and willow. Applications to stressed plants may reduce control. Do not allow spray to drift off target.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

glyphosate (E-Z-Ject)

Rate Follow label instructions on number of capsules per stem.

Time Apply when plants are actively growing at or beyond early bloom stage.

Remarks The E-Z-Ject system of application will not harm desirable species.

Caution Capsules must penetrate woody bark for control.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate

Rate 3 to 3.75 lb ae/a broadcast or apply as a 2% solution with hand-held equipment.

Time Apply when plants are actively growing at or beyond early to full bloom stage. Results are best if applied after fruit forms. Make late summer or fall treatments before leaves lose their green color. Use higher rates for plants that have reached woody stage of growth.

Remarks Treat foliage when plants are growing rapidly. In orchards, prevent spray mist from contacting foliage, green bark, suckers, or fruit of crop trees or other desirable vegetation. If spray contacts immature bark on main trunk, serious localized or translocated damage can result. Roundup is a nonresidual herbicide requiring subsequent seedling control.

Caution Controls grasses and other vegetation in treated area.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

triclopyr ester (Garlon 4) or triclopyr amine (Garlon 3A) or triclopyr + 2,4-D ester (Crossbow)

Rate Spot treat: use 3 lb ae Garlon 4 or 2.25 lb ae Garlon 3A with 100 gal water; or 1 pint Crossbow in 12 gal water. Broadcast: use 4 to 8 lb ae/a Garlon 4, or 6 to 9 lb ae/a Garlon 3A, or 1 to 2 quarts/a of Crossbow.

Time Apply when plants are actively growing.

Remarks Foliage must be thoroughly wet.

Caution Garlon products are registered for use on rights-of-way, industrial sites, and forestry (release and site preparation). Crossbow can be used on permanent pastures and rangeland up to 1.5 lb ae/a. Observe all grazing and harvesting restrictions.

Site of action (all) Group 4: synthetic auxin

Chemical family (triclopyr) pyridine; (2,4-D) phenoxy acetic acid

Pricklypear (*Opuntia polyacantha*)

picloram (Tordon)

Rate 0.25 to 0.5 lb ae/a

Time Apply in May to July. Timing is not critical.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other crops are very sensitive to picloram. Do not use in diversified cropping areas. Apply rates over 0.5 lb ae/a (1 quart/a) only as a spot treatment not to exceed 25% of a landowner's acreage in any given watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Proso millet, wild (*Panicum miliaceum*)

fenoxaprop (Acclaim or Horizon)

Rate 0.15 to 0.25 lb ai/a

Time Apply to actively growing plants with at least two leaves. Larger plants are harder to control.

Remarks Refer to product label for crops and sites on which fenoxaprop may be used.

Caution Do not use a crop oil or surfactant.

Site of action Group 1: acetyl CoA carboxylase (ACCCase) inhibitor

Chemical family Aryloxyphenoxy propionate

fluazifop (Fusilade DX)

Rate 0.09 lb ai/a (0.375 pints/a)

Time Apply to actively growing weeds 2 to 8 inches tall but before tillering or heading.

Remarks See label for crops, ad sites, and specific rates. Apply with 1% (v/v) crop oil concentrate or 0.25% (v/v) nonionic surfactant. Acts very slowly, taking at least 2 weeks and often 4 weeks to show effectiveness. Do not apply to stressed grasses.

Caution Do not use crop oil concentrate if treating in ornamentals. Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCCase) inhibitor

Chemical family Aryloxyphenoxy propionate

nicosulfuron (Accent)

Rate 0.5 to 1 oz ai/a (0.66 to 1.33 oz/a Accent)

Time Apply when wild proso millet is 1 to 4 inches tall.

Remarks Accent is registered for use in field corn and popcorn. Consult seed company representative before applying to field corn grown for seed or to any popcorn varieties.

Caution Take special precautions when using for wild proso millet control in sweet corn. Read label about applications where organophosphate insecticides have been used. Consult labels for rotation crop guidelines.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

sethoxydim (Poast)

Rate 0.19 lb ai/a (1 pint/a)

Time Apply to actively growing wild proso millet.

Remarks See label for crops, size of grass, and sites sethoxydim may be used on and for specific rates. Apply with 2 pints/a crop oil concentrate. Acts very slowly, taking at least 2 weeks and often 4 weeks to show herbicide effectiveness. Do not apply to stressed grasses.

Caution Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCCase) inhibitor

Chemical family Cyclohexanedione

topramezone (Impact)

Rate 0.0165 lb ai/a (0.75 oz/a)

Time Apply postemergence to actively growing wild proso millet that is 3 to 8 inches tall.

Remarks Controls wild proso millet and many annual broad-leaf weeds but does not provide residual control. Add methylated seed oil or crop oil concentrate at 1 to 1.5% v/v and UAN fertilizer or ammonium phosphate at 1.2 to 1.5% v/v to the spray solution. Spray-grade ammonium sulfate at 8.5 to 17 lb/100 gal of water may be substituted for the nitrogen fertilizers.

Caution Apply only once per growing season. Read label carefully to determine crops that can be planted the next year.

Site of action Group 28: inhibits 4-hydroxyphenylpyruvate-dioxygenase (4-HPPD)

Chemical family Triketone

Puncturevine (*Tribulus terrestris*)

2,4-D amine or 2,4-D LV ester

Rate 1 to 2 lb ae in 10 to 20 gal water for spot treatments.

Time Apply every 3 weeks during growing season or when new seedlings appear.

Remarks Seed will germinate throughout the summer when moisture is available.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

bentazon (Basagran) + imazamox (Raptor)

Rate 0.75 to 1 lb ai/a bentazon + 0.031 lb ai/a imazamox (4 oz/a Raptor)

Time Apply to small, actively growing puncturevine.

Remarks Controls puncturevine in snap beans where few other products are registered for use and puncturevine control is critical. Does not provide residual control of puncturevine. Tank-mixing Basagran with Raptor improves crop safety and puncturevine control. Add a nonionic surfactant or crop oil and nitrogen-based fertilizer to improve weed control.

Caution Do not apply to drought-stressed bean plants or plants with poor root development.

Site of action (bentazon) Group 6: photosystem II inhibitor; (imazamox) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (bentazon) Benzothiadiazole; (imazamox) Imidazolinone

bromacil + diuron (Krovar I DF)

Rate 8 lb ai/a (10 lb/a)

Time Apply before weeds emerge.

Remarks Rain is needed to activate this herbicide.

Caution Nonselective weed control. Do not apply where desirable plant roots extend.

Site of action Group 5: photosystem II inhibitor

Chemical family (bromacil) Uracil; (diuron) Urea

chlorsulfuron (Telar)

Rate 1 oz ai/a (1.5 oz/a)

Time Apply late fall or late winter preemergence to growth. Needs moisture to activate.

Remarks May be used selectively or tank-mixed with other selective or bareground herbicides. Use only on pasture, range, Conservation Reserve Program (CRP), and non-cropland.

Caution Do not let spray drift onto sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

fomesafen (Reflex)

Rate 1 to 2 pints/a (0.25 to 0.5 lb ai/a)

Time Pre- and postemergence, depending on crop.

Remarks Because moisture is necessary to activate Reflex in soil for residual weed control, the herbicide may be more effective if rainfall or irrigation occurs shortly after application. If adequate rainfall is not received after a Reflex application, at least 0.25 inch overhead sprinkler irrigation before weeds emerge may improve weed control. Mechanically incorporating into soil, or cultivating after applying, reduces residual weed control and is not recommended. Reflex effectiveness will be reduced if later cultural practices expose nontreated soil.

Caution Only labeled in potatoes, cucurbits, snap beans, and edamame. Potato varieties may vary in their response to Reflex.

Site of action Group 14: protoporphyrinogen oxidase (Protox) inhibitor

Chemical family Nitrophenylether

imazapic (Plateau)

Rate 0.125 to 0.188 lb ai/a

Time Apply early postemergence when plants are cracking.

Remarks Add 1 quart/a methylated seed oil; do not exceed 25 gal/a spray volume.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

MSMA (Bueno or Trans-Vert)

Rate 2 to 4 lb ai/a

Time Apply after puncturevine emerges. Best results in seedling stage of growth.

Remarks MSMA is more active above 70°F. Regrowth after rain or overhead irrigation may need respraying.

Caution Keep liquid or dust away from eyes. Wash eyes immediately with water if exposed.

Site of action Group 17: not well understood

Chemical family Organoarsenical

norflurazon (Solicam)

Rate Refer to label. Adjust rates depending on soil texture and organic matter.

Time Apply in fall to spring, before puncturevine emerges.

Remarks Remove existing weeds mechanically or by a suitable postemergent herbicide.

Site of action Group 12: bleaching; inhibits carotenoid biosynthesis

Chemical family Pyridazinone

paraquat (Gramoxone Max)

Rate 0.38 to 0.49 lb ai/a

Time Apply as a postemergence spray to puncturevine foliage.

Remarks Results are best when puncturevine is in the seedling stage. Add 8 to 16 fl oz/100 gal nonionic surfactant to spray mix. Paraquat is a contact herbicide requiring thorough spray coverage. Puncturevine emerging after application will not be controlled.

Caution A restricted-use herbicide. Do not use around homes or other areas contacted by children or pets. Do not breathe spray mist.

Site of action Group 22: photosystem I electron diversion

Chemical family Bipyridilium

topramezone (Impact)

Rate 0.0165 lb ai/a (0.75 oz/a)

Time Apply postemergence to actively growing weeds 3 to 8 inches tall.

Remarks Controls wild proso millet and many annual broad-leaf weeds but does not provide residual control. Add methylated seed oil or crop oil concentrate at 1 to 1.5% v/v and UAN fertilizer or ammonium phosphate at 1.2 to 1.5% v/v to the spray solution. Spray-grade ammonium sulfate at 8.5 to 17 lb/100 gal of water may be substituted for the nitrogen fertilizers.

Caution Carefully read the label to determine which crops can be planted the following year.

Site of action Group 28: inhibits 4-hydroxyphenylpyruvate-dioxygenase (4-HPPD)

Chemical family Triketone

Quackgrass (*Elytrigia repens*)

bromacil + diuron (Krovar I DF)

Rate 9.6 lb ai/a (12 lb/a)

Time Apply before weeds emerge.

Remarks Rain is needed to activate this herbicide.

Caution Nonselective weed control. Do not apply to areas where desirable plant roots extend.

Site of action (bromacil) Group 5: photosystem II inhibitor; (diuron) Group 7: photosystem II inhibitor

Chemical family (bromacil) uracil; (diuron) urea

dichlobenil (Casoron)

Rate 4 lb ai/a in berries; 4 to 6 lb ai/a in fruit trees and grapes

Time Apply midwinter immediately before a cold rain to reduce volatility and enhance weed suppression. Weigh and distribute uniformly exact quantities over precisely measured areas. Oregon results over 9 years suggest that perennial weeds can be suppressed with 4-, 3-, and 2-lb ai/a rates applied in 3 consecutive years. Grazing livestock is prohibited. Inhibits cellulose and cell wall formation.

Remarks Selective in trailing berries, fruit trees, and grapes.

Site of action Group 20: inhibits cell wall synthesis Site A

Chemical family Nitrile

EPTC (Eptam)

Rate 4 lb ai/a

Time Apply in early spring or fall before plowing.

Remarks This application has been promising for selective control of quackgrass in such crops as beans, potatoes, and small-seeded legumes. It does not eradicate quackgrass but does reduce growth for the season and greatly reduces amount of live roots. Before EPTC applications, soil is disked or rotated until quackgrass rhizomes are 3 to 4 inches long.

Caution Apply to soil and immediately follow with a thorough disking in two directions to uniformly incorporate 6 inches deep.

Site of action Group 8: lipid synthesis inhibitor but not an ACCase inhibitor

Chemical family Thiocarbamate

fluazifop (Fusilade DX)

Rate 0.25 to 0.375 lb ai/a (1 to 1.5 pints/a) for first application. If reapplication is needed, use 0.19 to 0.375 lb ai/a (0.75 to 1.5 pints/a).

Time Apply late spring to actively growing quackgrass 6 to 10 inches tall.

Remarks Apply with 1% v/v crop oil concentrate or 0.25% v/v nonionic surfactant. Repeat application to control established quackgrass. Acts very slowly, taking at least 2 and often 4 weeks to show effects. Do not apply to stressed grasses. Do not mix with other pesticides unless recommended on label.

Caution Do not graze treated fields.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

glyphosate

Rate Broadcast: use 1 to 2.25 lb ae/a. Nonsodded quackgrass: use 0.75 to 1.5 lb ae/a (1 to 2 quarts). Sodded quackgrass: use 1.5 to 2.25 lb ae/a (2 to 3 quarts).

Time Apply during fallow periods in cropping systems when quackgrass is in late boot to early flowering stage.

Remarks Foliage must be thoroughly wet, but avoid runoff.

Caution Glyphosate is nonselective. Re-treatment may be necessary for complete control.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

pronamide (Kerb)

Rate 2 to 3 lb ai/a

Time Apply during fall or winter when soil moisture is good and more precipitation is expected. Apply before ground freezes in the cooler areas.

Remarks Use higher application rates in heavier soil types.

Caution A restricted-use herbicide. Follow label for crop rotations.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Benzamide

Rabbitbrush (*Chrysothamnus* spp.)

2,4-D LV ester

Rate 3 lb ae/a

Time Apply when rabbitbrush has 3 inches of new spring growth.

Remarks Soil moisture should be above wilting coefficient. If Sandberg bluegrass has dried up or lost its color, soil is too dry for rabbitbrush active growth, and it is too late to spray.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

picloram (Tordon)

Rate 0.25 to 0.5 lb ae/a

Time Any time during the growing season.

Remarks A selective treatment that will not damage perennial grasses at the suggested rate.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Do not use in diversified crop areas. Potatoes, beans, and most other broadleaf crops are sensitive to picloram.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Ragweed, common (*Ambrosia artemisiifolia*) and related species

2,4-D ester

Rate 2 lb ae/a

Time Apply after all plants have emerged but before flowering.

Remarks Foliage must be thoroughly wet. Use 50 gal/a of water.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.2 to 1.8 oz/a aminocyclopyrachlor + 0.5 to 0.7 oz/a chlorsulfuron (3 to 4.5 oz/a of product)

Time Apply to actively growing plants.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

clopyralid + 2,4-D amine (Curtail)

Rate 1 to 5 quarts/a Curtail

Time Apply to actively growing weeds after most basal leaves emerge but before bud stage.

Remarks Use lower rate for in-crop cereal grain application, higher rates for fallow, postharvest, and Conservation Reserve Program (CRP) applications. Consult label for specific directions. With CRP applications, for established grass only. For best results, wait at least 20 days after application before disturbing treated areas (cultivation, mowing, fertilization with shank-type applicators) to allow for thorough translocation. Apply in enough total spray volume to ensure good coverage.

Caution Consult label for crop rotation restrictions before using product. Several crops may be injured up to 4 years after application.

Site of action (both) Group 4: synthetic auxin

Chemical family (clopyralid) Pyridine; (2,4-D) Phenoxy acetic acid

glyphosate

Rate 0.75 to 1.5 lb ae/a. Make wiper application solutions with a 10 to 33% glyphosate solution. Use a 1% glyphosate solution with hand-held and high-volume equipment.

Time Use the 0.75-lb rate when ragweed is less than 6 inches tall.

Remarks Apply to actively growing plants.

Caution Glyphosate controls grasses as well as other vegetation in treated areas.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

Ragwort, tansy (*Senecio jacobaea*)

2,4-D or picloram (Tordon) or dicamba (Banvel, Rifle, or Clarity) or 2,4-D + dicamba (Weedmaster) or triclopyr + 2,4-D (Crossbow)

Rate 1 to 2 lb ae/a 2,4-D LV ester or 2,4-D amine; or 0.25 lb ae/a picloram; or 1 lb ae/a dicamba; or 2 quarts/a Weedmaster; or 1.5 to 2 quarts/a Crossbow

Time Apply 2,4-D in spring before any flowers appear; the earlier the application in relation to plant growth, the better the control. Picloram and dicamba can be used at the flowering stage with good results. Fall applications after rains begin seed germination have proven effective also.

Remarks Respraying for more than 1 year is necessary to control late-germinating seeds. Consult labels for grazing restrictions. See also pasture and rangeland section for broadcast spray.

Caution Most picloram formulations are restricted-use herbicides. Avoid drift to sensitive crops. Do not contaminate water with picloram. Potatoes, beans, and many other broadleaf crops are sensitive to picloram. Do not use picloram in diversified cropping areas. Do not graze dairy animals within 2 weeks after application.

Site of action (all) Group 4: synthetic auxin

Chemical family (2,4-D) Phenoxy acetic acid; (picloram and triclopyr) Pyridine; (dicamba) Benzoic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

aminopyralid (Milestone)

Rate 1 to 1.25 oz ae/a (4 to 5 fl oz/a Milestone)

Time Apply to actively growing plants in the rosette.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

metsulfuron (Escort and others)

Rate Escort: 0.45 to 0.6 oz ai/a (0.75 to 1 oz/a)

Time Apply to actively growing plants.

Remarks Use a surfactant to increase effectiveness. Application sites differ among products; consult labels.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Rue, African (*Peganum harmala*)**glyphosate**

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

imazapyr (Arsenal)

Rate 0.75 to 1 lb ae/a or as a 1% solution with methylated seed oil adjuvant

Time Apply to actively growing foliage after plants bolt and through the fall.

Remarks Always add the appropriate surfactant.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort)

Rate 1.2 oz ai/a (2 oz/a)

Time Apply to actively growing plants.

Remarks Using a nonionic or silicone surfactant increases effectiveness.

Caution Apply only to non-cropland sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Rush, bog (*Juncus effusus* var. *pacificus*)**2,4-D LV ester**

Rate Use a mixture of 1.5 lb ae 2,4-D, 50 gal water, and 2 gal diesel or a nonionic surfactant for spot treatments.

Time Apply in April or May after rush has made good spring growth.

Remarks Foliage must be thoroughly wet.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

dicamba (Banvel, Rifle, or Clarity)

Rate 0.75 lb ae/a (1.5 pint/a)

Time Apply any time the plants are actively growing.

Remarks Foliage must be thoroughly wet.

Caution Dicamba will kill clovers and other desirable broadleaf plants.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

Sage, Mediterranean (*Salvia aethiopis*), meadow clary (*Salvia pratensis*), and clary sage (*Salvia sclarea*)

See *Biological Control* section in this handbook.

Sagebrush, big (*Artemisia tridentata*)**2,4-D LV ester**

Rate 2 lb ae/a

Time Timing is critical for effective control. Apply during active sagebrush growth in spring when Sandberg bluegrass flowers, phloxes are forming seed, and larkspur is flowering near stem top.

Remarks Soil moisture should be above wilting coefficient. Use oil (no lower than No. 2 diesel) for aerial application. If water is used as a carrier, add a wetting agent.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

tebuthiuron (Spike 20P)

Rate 0.1 to 1 lb ai/a (1 to 5 lb/a), depending on soil type and organic matter, or degree of control desired

Time Apply in fall east of the Cascades.

Remarks Lower rates used to reduce canopy cover. Grass may be temporarily injured. May take more than 1 year to show complete effects. No grazing restrictions.

Caution Do not apply to frozen soil. Spike will kill trees, shrubs, and some other desirable vegetation with roots extending into treated area. Consult label for precautions.

Site of action Group 7: Photosystem II inhibitor

Chemical family Substituted urea

Sagebrush, fringed (*Artemisia frigida*)

picloram (Tordon)

Rate 0.25 to 0.5 lb ae/a

Time When plants are fully emerged up to flower bud formation.

Remarks Plants should be actively growing at the time of application. To be used on rangeland or permanent grass pastures.

Caution Most formulations are restricted-use herbicides. Avoid drift to sensitive crops. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to these herbicides. Do not use picloram in diversified crop areas. Refer to label for grazing restrictions.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

St. Johnswort (*Hypericum perforatum*)

2,4-D

Rate 2 lb ae/a in 50 gal of water

Time Apply before any blossoms open, preferably on new seedlings after germination.

Remarks Repeat applications as needed. Klamath beetles are preferred to control large infestations.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

metsulfuron (Escort and others)

Rate Escort: 0.6 oz ai/a (1 oz/a)

Time Apply after weeds emerge.

Remarks Use a surfactant to increase effectiveness.

Caution Apply only to pasture, rangeland, and non-crop sites. Application sites differ among products; consult labels.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Sandbur, longspine (*Cenchrus longispinus*)

clethodim (Select or Arrow)

Rate 0.9 to 0.125 lb ai/a

Time Apply to sandbur 2 to 6 inches tall.

Remarks See label for crops and sites where clethodim may be used. If required, apply with suitable surfactant. Acts very slowly, taking at least 2 weeks and often 4 weeks to show effects. Do not apply to stressed grasses.

Caution Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCCase) inhibitor

Chemical family Cyclohexanedione

fluazifop (Fusilade DX)

Rate 0.375 lb ai/a (1.5 pints/a), depending on site

Time Apply to actively growing sandbur when 2 to 8 inches tall.

Remarks See label for crops and sites. Apply with 1% (v/v) crop oil concentrate. Acts very slowly, taking at least 2 weeks and often 4 weeks to show effects. Do not apply to stressed grasses.

Caution Do not use crop oil concentrate if treating sandbur in ornamentals. Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCCase) inhibitor

Chemical family Aryloxyphenoxy propionate

glyphosate

Rate 0.75 to 1.5 lb ae/a

Time Apply the 0.75 rate to actively growing weeds less than 6 inches tall. If weeds are above 6 inches tall, apply 1.5 lb ae/a.

Remarks Apply as postemergence spray to sandbur foliage.

Caution Glyphosate is not selective in cropland.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted.

imazapic (Plateau)

Rate 0.063 to 0.188 lb ai/a

Time Apply early postemergence.

Remarks Plateau also has some preemergence activity. Add 1 quart/a methylated seed oil.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

MSMA (Bueno or Trans-Vert)

Rate 2 to 4 lb ai/a

Time Apply after sandbur emerges.

Remarks MSMA is more active above 70°F. Regrowth after rain or overhead irrigation may need respraying. Results are best when applied in the seedling stage.

Caution Keep liquid or dust away from eyes. Wash eyes immediately with water if exposed.

Site of action Group 17: not well understood

Chemical family Organoarsenical

paraquat (Gramoxone Max)

Rate 0.38 to 0.49 lb ai/a

Time Apply as a postemergence spray to sandbur foliage.

Remarks Results are best if sandbur is in seedling stage. Add 8 to 16 fl oz/100 gal nonionic surfactant to spray mix. Paraquat, a contact herbicide, requires thorough spray coverage. Sandbur emerging after application will not be controlled.

Caution A restricted-use herbicide. Do not use around homes or other areas where children or pets might come in contact with the herbicide. Do not breathe spray mist.

Site of action Group 22: photosystem I electron diversion

Chemical family Bipyridilium

quizalofop (Assure II)

Rate 0.048 to 0.55 lb ai/a (7 to 8 fl oz/a product)

Time Apply to sandbur 2 to 6 inches tall.

Remarks See label for crops and sites. Include crop oil concentrate or nonionic surfactant as label recommends. Acts very slowly, taking at least 2 week and often 4 week to show effects. Do not apply to stressed grasses.

Caution Do not apply if rain is expected within 1 hour.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

Skeletonweed, rush (*Chondrilla juncea*)

2,4-D or MCPA

Rate 2 lb ae/a

Time Apply to rosettes in the spring immediately before or during bolting.

Remarks 2,4-D inhibits further aboveground growth but will not prevent new plant development from root buds.

Caution Re-treatment is important.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

aminopyralid (Milestone)

Rate 1.75 oz ae/a (7 fl oz/a Milestone)

Time Spring or fall when rosettes are present.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid (Transline or Stinger)

Rate 0.25 to 0.375 lb ae/a (0.66 to 1 pint/a)

Time Apply to rosette in fall or up to early bolting in spring.

Remarks Consult labels for specific site registrations.

Caution Product will injure or kill sensitive broadleaf forages. Consult label for crop rotation restrictions before using. Several crops may be injured several years after application.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

picloram (Tordon)

Rate 1 lb ae/a

Time Apply from late fall to early spring. For best results, apply just before or during bolting.

Remarks Rush skeletonweed can reduce crop yields by as much as 70%, so it is important to treat small infestations. Picloram is the most effective treatment available. Re-treatment is necessary.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to picloram; do not use in diversified crop areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Smartweed, dotted or perennial (*Polygonum punctatum*)

dicamba (Banvel, Rifle, or Clarity)

Rate 2 lb ae/a

Time Apply in March, April, May, or June.

Remarks Foliage must be thoroughly wet.

Caution Controls all legumes in pasture and can temporarily inhibit grass in newly established fields.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

picloram (Tordon)

Rate 1 lb ae/a

Time March to June.

Remarks Foliage must be thoroughly wet.

Caution Most formulations are restricted-use herbicides. Do not graze dairy animals on treated areas within 2 weeks after application. Apply rates above 0.5 lb ae/a (1 quart/a) only as a spot treatment not to exceed 25% of a landowner's acreage in a given watershed in a single season. Avoid drift to sensitive crops. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to picloram. Do not use in diversified cropping areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Snakeweed, broom (*Gutierrezia sarothrae*)

aminocyclopyrachlor + metsulfuron methyl (Streamline)

Rate 1.9 to 3.8 oz/a aminocyclopyrachlor + 0.6 to 1.2 oz/a metsulfuron (4.75 to 9.5 oz/a of product)

Time Apply to actively growing woody plants.

Remarks Adjuvants can be used; they include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water. There are several application methods that dictate the amount of product to be mixed with the carrier, so consult the label. In addition to woody species, controls many herbaceous species also.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Conifers can be injured, these include ponderosa pine, Douglas fir, Norway spruce, and white pine. Other trees that can be injured include aspen, Chinese tallow, cottonwoods, honey locust, magnolia, poplars, redbud, silver maple, and willow. Applications to stressed plants may reduce control. Do not allow spray to drift off target.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

metsulfuron (Escort and others)

Rate Escort: 0.45 oz ai/a (0.75 oz/a)

Time Apply in fall or spring.

Remarks Application sites differ among products; consult labels.

Caution Prevent drift to sensitive crops. Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.25 to 0.5 lb ae/a

Time Full leaf development to early bloom stage.

Remarks Plants should be actively growing at time of treatment.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Beans, potatoes, and many other broadleaf crops are very sensitive to picloram. Do not use in diversified cropping areas. See label for grazing restrictions. Apply rates above 0.5 lb ae/a (1 quart/a) only as a spot treatment not to exceed 25% of a landowner's acreage in a given watershed in one season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Snapdragon, dwarf (*Chaenorrhinum minus*)

Control is unknown, although DCPA (applied before snapdragon seed germinates) has been reported as effective.

Sorrel, red (*Rumex acetosella*)

dicamba (Banvel, Rifle, or Clarity)

Rate 0.5 lb ae/a

Time Apply when red sorrel has new foliage, usually November 15 to March 15. Spring application controls spring-germinating seedlings better than sprays applied earlier.

Remarks This treatment kills red sorrel seedlings and most of the old plants. It prevents surviving plants from setting seed.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

Sowthistle, perennial (*Sonchus arvensis*)

2,4-D

Rate 2 lb ae/a

Time Apply at bud stage and to regrowth 8 to 10 inches high.

Remarks Repeat applications are necessary.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminopyralid (Milestone)

Rate 0.75 to 1.25 oz ae/a (3 to 5 fl oz/a Milestone)

Time Apply to actively growing plants before the bud stage of growth.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid + 2,4-D amine (Curtail)

Rate 1 to 5 quarts/a Curtail

Time Apply after most rosettes have emerged but before bud stage.

Remarks Lower rate for in-crop cereal grain application; usually will provide only suppression. Higher rates for fallow, postharvest, and Conservation Reserve Program (CRP) applications. Consult label for specific directions. With CRP applications, for established grass only. Apply in enough total spray volume to ensure good coverage.

Caution Consult label for crop rotation restrictions before using product. Several crops may be injured up to 4 years after application.

Site of action Group 4: synthetic auxin

Chemical family (clopyralid) pyridine; (2,4-D) phenoxy acetic acid

Spurge laurel (*Daphne laureola*)

Remarks Although PNW data are preliminary, aminocyclopyrachlor, aminopyralid, glyphosate, imazapyr, and triclopyr + 2,4-D applied as cut stem treatments gave promising results in initial trials. Imazapyr and triclopyr + 2,4-D applied to foliage also resulted in good control.

Site of action (imazapyr) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (2,4-D, aminocyclopyrachlor, aminopyralid, triclopyr) Group 4: synthetic auxin

Chemical family (imazapyr) imidazolinone; (glyphosate) none generally accepted; (2,4-D) phenoxy acetic acid; (aminocyclopyrachlor, aminopyralid, triclopyr) pyridine

Spurge, leafy (*Euphorbia esula*), myrtle spurge (*Euphorbia myrsinites*), and oblong or eggleaf spurge (*Euphorbia oblongata*)

Leafy spurge is a creeping perennial that emerges each year from roots that may be exceptionally deep in soil. This weed does not survive under regular cultivation. It becomes serious when it invades pastures and rangeland. Mowing is not effective and is usually impractical. Sheep will graze leafy spurge enough to reduce competition with grass and to allow some production from the rangeland. Any control program, including herbicides, must be long term. Picloram or two or three applications of glyphosate seem to be a good starting point. Establishing a competitive grass and using 2,4-D to prevent seed production and to slow the growth of survivors are essential to return the land to full productivity.

2,4-D LV ester

Rate 1 lb ae/a helps prevent seed formation; 6 lb ae/a helps control leafy spurge infestations.

Time Use lower rates to prevent seed formation in the bud to early bloom stage. Use higher rates in early spring applications.

Remarks When mowing is possible, spray 2,4-D on new regrowth 2 week after mowing. Re-treatments will be necessary.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

dicamba (Banvel, Rifle, or Clarity)

Rate 4 to 8 lb ae/a

Time Apply in spring or early summer.

Remarks Dicamba is both soil- and foliar-active. Use on non-crop-land only at these application rates. Repeat each year as needed.

Caution Do not graze livestock in treated fields within 30 days of slaughter.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

fosamine (Krenite S)

Rate 2 gal product/100 gal water

Time Apply at flowering to actively growing plants. Apply spray to wet.

Remarks Will not kill grasses and can be used next to water. Effectiveness may be reduced if rain falls on the same day.

Caution Non-cropland use only.

Site of action Not well understood

Chemical family Organophosphorus

glyphosate

Rate 0.38 to 0.75 lb ae/a

Time Applications must be split, at 30-day intervals. For the 0.38 lb ae/a (1 pint) rate, apply 1 pint of glyphosate about June 1, July 1, and August 1. For the 0.75 lb ae/a (2 pints) rate, apply 2 pints of glyphosate about June 1 and July 1.

Remarks Three split applications (0.38 lb ae/a each) are somewhat selective, leaving some perennial grasses. These treatments are suggested when water is near the infested area or when a reseedling of grasses is planned. Applications prevent vegetative growth the year of application and will prevent seed production the second year.

Caution Re-treatment is necessary for continued control. Glyphosate is not selective.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate + 2,4-D (Landmaster BW)

Rate 54 oz/a Landmaster

Time Late summer or fall.

Remarks Apply in 3 to 10 gal of water.

Caution Glyphosate is not selective; desirable grasses will be killed at this rate.

Site of action (glyphosate) Group 9: inhibits EPSP synthase; (2,4-D) Group 4: synthetic auxin

Chemical family (glyphosate) none generally accepted; (2,4-D) phenoxy acetic acid

imazapic (Plateau)

Rate 0.125 to 0.188 lb ai/a

Time Apply in late summer or fall (mid-August through October) before spurge loses its milky sap due to drought or a killing frost.

Remarks Add 1 quart/a methylated seed oil.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

picloram (Tordon)

Rate 0.5 to 1 lb ae/a. Use higher rates in areas that are difficult to re-treat. Make a series of applications of 0.5 lb ae/a if leafy spurge is near running water or lakes.

Time Apply any time in the growing season. Re-treatments needed for several years to control seedlings.

Remarks Picloram has given excellent control with follow-up treatments. It can persist for 2 years at higher application rates.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Potatoes, beans, and many other broad-leaf crops are sensitive to picloram. Do not use in diversified crop areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Starthistle, yellow (*Centaurea solstitialis*), purple (*Centaurea calcitrapa*), and Iberian (*Centaurea iberica*)

2,4-D LV ester or 2,4-D amine

Rate 1 lb ae/a in 50 gal of water

Time Apply before flowering.

Remarks Foliage must be thoroughly wet.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.2 to 1.8 oz/a aminocyclopyrachlor + 0.5 to 0.7 oz/a chlorsulfuron (3 to 4.5 oz/a of product)

Time Apply to actively growing plants.

Remarks Adjuvants can be used and include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

aminopyralid (Milestone)

Rate 0.75 to 1.25 oz ae/a (3 to 5 fl oz/a Milestone)

Time Apply to plants at the rosette through bolting stages.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

chlorsulfuron (Telar)

Rate 1.125 oz ai/a (1.5 oz/a). Rate selection is based on weed species and soil texture.

Time For best results apply to young, actively growing weeds.

Remarks For suppression only. Do not apply to frozen ground. Constantly agitate while mixing in spray solution. Add 0.25% v/v nonionic surfactant to the spray mixture. Apply with ground equipment in at least 10 gal/a carrier.

Caution See label for tank-cleaning instructions. Use on non-cropland only.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

clopyralid (Stinger or Transline)

Rate 0.09 to 0.375 lb ae/a (0.25 to 1 pint/a). Labeled rates vary with crops.

Time After most rosettes have emerged but before bud formation.

Remarks Best applied to actively growing weeds. See labels for registered sites.

Caution See label for crop rotation restrictions before using. Several crops may be injured up to 4 years after applying.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid + 2,4-D amine (Curtail)

Rate 1 to 5 quarts/a Curtail

Time Apply after most rosettes have emerged but before bud formation.

Remarks Lower rate for in-crop cereal grain application, higher rates for fallow, postharvest, and Conservation Reserve Program (CRP) applications. See label for specifics. With CRP applications, for established grass only. Apply in enough total spray volume to ensure good coverage.

Caution See label for crop rotation restrictions before Curtail. Several crops may be injured up to 4 years after applying.

Site of action Group 4: synthetic auxin

Chemical family (clopyralid) pyridine; (2,4-D) phenoxy acetic acid

dicamba (Banvel, Rifle, or Clarity)

Rate 1 to 2 lb ae/a

Time Apply when plants are still in rosettes but before flower stems elongate.

Remarks Plants should be actively growing at time of treatment.

Caution Avoid drift to sensitive crops. Follow grazing restrictions.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

diflufenzopyr + dicamba (Overdrive)

Rate 0.26 to 0.35 lb ae/a (6 to 8 oz/a)

Time Apply to seedlings or rosettes.

Remarks Add a suitable surfactant to the spray mix.

Caution Avoid drift to sensitive crops. Will kill legumes.

Site of action (diflufenzopyr) Group 19: inhibits indole acetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) Semicarbazone; (dicamba) Benzoic acid

picloram (Tordon)

Rate 0.25 to 0.375 lb ae/a

Time In spring, to plants still in rosette through bud formation.

Remarks A selective treatment that will not damage perennial grasses at the suggested rate. Treating at bud stage can reduce weed seed viability by 95 to 100% in the year of application.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Do not use in diversified crop areas. Potatoes, beans, and many other broadleaf crops are sensitive to picloram.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr + clopyralid (Redeem R&P)

Rate 1.5 to 2.5 pints/a

Time Apply from rosette to early bolt stage when starthistle is actively growing.

Remarks Add a nonionic surfactant at surfactant manufacturer's recommended rate. Apply in at least 10 gal/a water by ground.

Caution Do not exceed 4 pints/a per year. Avoid drift to desirable vegetation. Note label restrictions on overseeding or reseeding.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) Pyridine

Sumpweed, poverty, or povertyweed (*Iva axillaris*)

dicamba (Banvel, Rifle, or Clarity)

Rate 1 lb ae/a

Time Apply when plants are actively growing.

Remarks Adding 0.5% (v/v) surfactant enhances control.

Caution Avoid spray drift. Avoid disturbing areas for 7 days after application.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

picloram (Tordon)

Rate 1 to 2 lb ae/a

Time Apply during growing season when moisture will be sufficient to carry herbicide into soil. When little moisture will be available, apply in the fall.

Caution Most formulations are restricted-use herbicides. See label for grazing restrictions. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are very sensitive to picloram. Do not use in diversified cropping areas. Apply rates above 0.5 lb ae/a (1 quart/a) only as a spot treatment not to exceed 25% of a landowner's acreage in a watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Swainsonpea or Austrian peaweed (*Swainsona salsula*)

2,4-D LV ester

Rate 2 lb ae/a

Time Apply in the early bloom stage of growth.

Remarks Re-treatment may be required.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

Tansy, common (*Tanacetum vulgare*)

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

chlorsulfuron (Telar)

Rate 0.75 to 2.25 oz ai/a (1 to 3 oz/a)

Time Apply to actively growing vegetation in the spring.

Remarks Use on non-cropland only.

Caution Do not allow spray drift to sensitive crops.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

dicamba (Banvel, Rifle, or Clarity) + picloram (Tordon)

Rate 1 to 2 lb ae/a dicamba + 0.5 lb ae/a picloram

Time Apply from early flower bud development to bloom stage.

Remarks This combination is more effective than applications of the individual products.

Caution Tordon is a restricted-use herbicide. See label for grazing restrictions. For rates above 0.5 lb ae/a (1 quart/a), apply only as a spot treatment not to exceed 25% of a landowner's acreage in a particular watershed in a single season. Avoid drift to sensitive crops. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to these herbicides. Do not use picloram in diversified crop areas.

Site of action (both) Group 4: synthetic auxin

Chemical family (dicamba) Benzoic acid; (picloram) Pyridine

metsulfuron (Escort and others)

Rate Escort: 0.6 oz ai/a (1 oz/a)

Time Apply to actively growing vegetation in the spring.

Remarks Use a surfactant at 0.25% v/v.

Caution Do not allow spray drift to sensitive crops. Apply only to pasture, rangeland, and non-crop sites. Application sites differ between products; consult labels.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Teasel, common (*Dipsacus fullonum*) and cutleaf (*Dipsacus laciniatus*)

2,4-D amine

Rate 1 lb ae/a

Time Apply to rosette stage in fall or spring.

Remarks Treating after teasel begins to bolt may not be effective.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

2,4-D amine + dicamba (Banvel, Rifle, or Clarity)

Rate 0.75 lb ae/a 2,4-D + 0.125 lb ae/a dicamba

Time Apply to rosette stage in fall or spring.

Remarks Treatments made after teasel begins to bolt may not be effective.

Caution Avoid drift to sensitive crops.

Site of action (both) Group 4: synthetic auxin

Chemical family (2,4-D) Phenoxy acetic acid; (dicamba) Benzoic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

chlorsulfuron (Telar)

Rate 0.75 oz ai/a (1 oz/a Telar)

Time For best results, apply to actively growing teasel in the rosette stage.

Remarks Constantly agitate while mixing and spraying. Add 0.25% v/v nonionic surfactant to spray mixture. Apply with ground equipment in at least 10 gal/a carrier.

Caution Registered for use on pasture, range, Conservation Reserve Program (CRP), and non-cropland only. Avoid contact with sensitive crops. Can persist in soil. Do not treat powdery, dry soils or light, sandy soils unless rain is likely soon after treatment. Do not apply to frozen ground.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

diflufenzopyr + dicamba (Overdrive)

Rate 0.26 to 0.35 lb ae/a (6 to 8 oz/a)

Time Apply to rosettes.

Remarks Add a surfactant to the spray mix.

Caution Avoid drift to sensitive crops. Will kill legumes.

Site of action (diflufenzopyr) Group 19: inhibits indole acetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) Semicarbazone; (dicamba) Benzoic acid

imazapic (Plateau)

Rate 0.125 to 0.188 lb ai/a

Time Apply to rosettes.

Remarks Add 1 quart/a methylated seed oil.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate Escort: 0.45 oz ai/a (0.75 oz/a)

Time Apply to actively growing plants.

Remarks Using a nonionic or silicone surfactant increases effectiveness. Application sites differ among products; consult labels.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

triclopyr + clopyralid (Redeem R&P)

Rate 1.5 pints/a

Time Apply when actively growing.

Remarks Add a nonionic surfactant at surfactant manufacturer's recommended rate. Apply in at least 10 gal/a water by ground.

Caution Do not exceed 4 pints/a per year. Avoid drift to desirable vegetation. Note label restrictions on overseeding or reseeding.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) Pyridine

Thistle, Canada (*Cirsium arvense*)— nonselective and/or non-cropland control

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1%v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

aminopyralid (Milestone)

Rate 1.25 to 1.75 oz ae/a (5 to 7 fl oz/a Milestone)

Time Apply in the spring to plants in the prebud stage of growth or in the fall to plant regrowth.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

chlorsulfuron (Telar)

Rate 1.125 oz ai/a (1.5 oz/a)

Time Apply postemergence. For best results, apply to thistles in the bud-bloom stage or to fall rosettes.

Remarks Do not apply to frozen ground. Constantly agitate while mixing in spray solution. Add 0.25% v/v nonionic surfactant to the spray mixture.

Caution Avoid contact with sensitive crops. For non-cropland use only. Chlorsulfuron can persist in soil; if land is to return to cropland, allow sufficient time for product to dissipate. Powdery, dry soils and light, sandy soils should not be treated if rain is not likely after treatment.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

clopyralid + 2,4-D amine (Curtail) or clopyralid (Stinger or Transline)

Rate Consult labels. Rate depends on use site.

Time Apply to actively growing thistle after most basal leaves emerge but before bud stage.

Remarks Lower rate for in-crop cereal grain application, higher rate for fallow, postharvest, non-crop, and Conservation Reserve Program (CRP) applications. See label for specifics. CRP applications are for established grass only. For best results, wait at least

20 days after application before disturbing treated areas (cultivation, mowing, fertilization with shank-type applicators) to allow thorough translocation. Apply in enough total spray volume to ensure good coverage.

Caution Consult label for crop rotation restrictions before using these products. Several crops may be injured up to 4 years after application. Do not transfer livestock from treated areas to sensitive broadleaf crop areas without first grazing 7 days on untreated pasture.

Site of action (both) Group 4: synthetic auxin

Chemical family (clopyralid) pyridine; (2,4-D) phenoxy acetic acid

dicamba (Banvel, Rifle, or Clarity)

Rate 2 lb ae/a. Spot treatment: use mixtures of 2 to 4 lb ae dicamba per 100 gal of water.

Time May be applied any time during the growing season.

Remarks Higher rates may be required in high-rain areas. Soil residues are normally for one winter in western Oregon. Apply dicamba to growing thistles; uptake is through both foliage and root system. May mix with glyphosate to apply in fall.

Caution Avoid drift to sensitive crops. Dicamba will damage or kill clovers in pastures.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

diflufenzopyr + dicamba (Overdrive)

Rate 0.26 to 0.35 lb ae/a (6 to 8 oz/a)

Time Apply in spring to the rosettes.

Remarks Add a surfactant, either nonionic or methylated seed oil, to the spray mix.

Caution Avoid drift to sensitive crops. Will kill legumes.

Site of action (diflufenzopyr) Group 19: inhibits indole acetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) semicarbazone; (dicamba) benzoic acid

glyphosate

Rate Broadcast: 1.5 to 2.25 lb ae/a; wiper: 10 to 33% solution. Hand-held and high-volume equipment: 2% solution

Time Apply when thistles are actively growing but past the bud growth stage. Fall applications must be before the first killing frost. Thistles that were mowed or tilled and have rosettes at least 6 inches wide in late summer or fall can be suppressed with 0.75 lb ae/a glyphosate plus 0.5 to 1% nonionic surfactant applied in 3 to 10 gal/a water.

Remarks Wait 3 days for maximum root translocation of glyphosate before tillage.

Caution Glyphosate controls grasses as well as other vegetation in treated areas.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

picloram (Tordon)

Rate In broadcast or boom sprayers, apply 1 lb ae/a. Mixtures normally used for spot treatments include 1 lb ae per 100 gal of water.

Time Control is best if applied to actively growing thistle after most leaves emerge but before bud stage.

Remarks Picloram is both a foliar and soil active herbicide. It will not kill perennial grasses when used according to the label.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are very sensitive to picloram. Do not use in diversified cropping areas. Do not graze dairy animals on treated areas within 2 weeks after application. For rates exceeding 0.5 lb ae/a (1 quart/a), apply only as a spot treatment not to exceed 25% of a landowner's acreage in any particular watershed in a single season.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr + clopyralid (Redeem R&P)

Rate 2.5 to 4 pints/a

Time Apply from rosette to bud stage to actively growing thistle.

Remarks Add a nonionic surfactant at surfactant manufacturer's recommended rate. Apply in at least 10 gal/a water by ground.

Caution Do not exceed 4 pints/a per year. Do not allow drift to desirable vegetation. Note label restrictions on overseeding or reseeding.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) pyridine

Thistle, Canada (*Cirsium arvense*)—selective control in crops

2,4-D

Selective treatment in grain and grass crops

Rate 1 to 1.5 lb ae/a

Time Apply at the early bud stage of thistle. May require repeated applications.

Remarks Do not apply to grass or grain crops before tiller stage or from early boot to dough stage. The 1.5 lb/a rate can injure wheat.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

2,4-D or MCPA + dicamba (Banvel, Rifle, or Clarity)

Rate 1 lb ae/a 2,4-D or MCPA and 0.125 lb ae/a dicamba

Time In wheat or barley, apply after crop begins tillering and before boot stage. May also be applied in stubble or fallow.

Remarks MCPA is usually more effective on Canada thistle. Results are best if applied to actively growing thistles.

Site of action (all) Group 4: synthetic auxin

Chemical family (2,4-D and MCPA) Phenoxy acetic acid; (dicamba) Benzoic acid

bentazon (Basagran)

Selective in corn, dry beans, peas, and mint

Rate 0.75 to 1 lb ai/a

Time When thistle is 6 to 8 inches tall. If needed, apply again in 10 to 14 days.

Remarks Light leaf speckling may occur, but crop plants generally outgrow this within 10 days. Canada thistle must be thoroughly covered. Use at least 20 gal/a of water and at least 40 psi by ground. For aerial application, use at least 5 gal/a of water and a maximum of 40 psi.

Caution Do not use near water. Avoid applying during drought or unseasonably cold weather. Expect unsatisfactory results if daytime temperatures do not reach at least 70°F during the week after applying.

Site of action Group 6: photosystem II inhibitor

Chemical family Benzothiadiazole

chlorsulfuron (Glean)

Barley, oats, wheat

Remarks To suppress Canada thistle only. See sections in this handbook on barley, oats, and wheat for use instructions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

chlorsulfuron + metsulfuron (Finesse)

Barley and wheat

Remarks To suppress Canada thistle only. See sections in this handbook on barley and wheat for use instructions.

Site of action (both) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (both) sulfonylurea

clopyralid (Stinger)

Rate 0.09 to 0.5 lb ae/a (0.25 to 1.33 pints/a). Labeled rates vary by crop.

Time Apply to actively growing weeds. For Canada thistle, apply after most basal leaves emerge but before bud stage.

Remarks For most effective control, apply as a broadcast treatment to the entire infested area.

Caution Consult label for crop rotation restrictions before using these products. Several crops may be injured up to 4 years after application. Consult labels for registered use sites. Stinger is registered for use on field corn, sugar beets, Conservation Reserve Program (CRP), grass seed, rangeland, pasture, Christmas tree, small grains, and non-crop areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

clopyralid + 2,4-D amine (Curtail)

Rate 1 to 2 quarts/a Curtail. Maximum rate depends on crop.

Time Apply 2.66 pints/a formulated product to wheat or barley after crop begins tillering and before boot stage. The 2-quart rate can be used in fallow and in grass seed crops. Canada thistle should be in the rosette to prebud growth stage.

Remarks Apply in warm weather when weeds are actively growing and soil moisture is adequate for active plant growth.

Caution Consult label for crop rotation restrictions before using product. Several crops may be injured up to 4 years after application. Do not permit dairy animals or meat animals being finished for slaughter to forage or graze treated grain fields within 1 weeks after treatment. Do not harvest hay from treated grain fields.

Site of action (both) Group 4: synthetic auxin

Chemical family (clopyralid) pyridine; (2,4-D) phenoxy acetic acid

dichlobenil (Casoron)

Selective in trailing berries, fruit trees, grapes, and ornamentals

Rate 4 lb ai/a in berries; 4 to 6 lb ai/a in fruit trees and grapes

Time Apply in winter or spring before active growth of crops or thistle before a rainy period to allow for activation and to avoid volatilization.

Remarks Apply midwinter immediately before a cold rain to reduce volatility and enhance weed suppression. Weigh and distribute uniformly exact quantities over precisely measured areas. Oregon results over 9 years suggest that perennial weeds can be suppressed with 4-, 3-, and 2-lb ai/a rates applied during 3 consecutive years. Grazing livestock is prohibited. (Inhibits cellulose and cell wall formation.)

Site of action Group 20: inhibits cell wall synthesis Site A

Chemical family Nitrile

Thistle, Italian (*Carduus pycnocephalus*), slenderflower (*Carduus tenuiflorus*), and plumeless (*Carduus acanthoides*)

clopyralid (Transline or Stinger)

Rate 0.125 to 0.25 lb ae/a (0.33 to 0.66 pint/a)

Time Apply to rosettes

Remarks Consult labels for specific site registrations.

Caution Product will injure or kill sensitive broadleaf forages. Consult label for crop rotation restrictions before using. Several crops may be injured several years after application.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

MCPA amine

Rate 1.5 lb ae/a

Time When thistle is actively growing but before bolting. Thistle rosettes wider than 6 inches may be difficult to control.

Remarks Subclover smaller than two trifoliolate leaves may be severely injured by this treatment. Other formulations may injure clover more severely. Aerial applications often produce erratic results. Results are good from applications in October through early April, but thistles may be too dormant in midwinter in some years.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

Thistle, bull (*Cirsium arvense*), milk (*Silybum marianum*), musk (*Carduus nutans*), Scotch (*Onopordum acanthium*), woolly distaff (*Carthamus lanatus*), and smooth distaff (*Carthamus baeticus*)

2,4-D

Rate 1.5 to 2 lb ae/a

Time Spring or fall.

Remarks Use fall treatments to control rosettes of these biennial weeds. Use spring treatments before flower stalk elongates.

Annual treatments are needed to control seedlings. Pasture legumes are injured or eliminated at these rates.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

aminopyralid (Milestone)

Rate 0.75 to 1.25 oz ae/a (3 to 5 fl oz/a Milestone)

Time Apply in spring or early summer to rosettes or bolting plants or in fall to seedlings and rosettes.

Remarks A nonionic surfactant at 1 to 2 quarts per 100 gal of spray enhances control under adverse environmental conditions.

Caution Do not allow drift to desirable vegetation. Many forbs (desirable broadleaf plants) can be seriously injured or killed. Do not exceed 7 fl oz/a Milestone per year.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

chlorsulfuron (Telar)

Rate 0.75 oz ai/a (1 oz/a)

Time Apply to young, actively growing weeds.

Remarks Do not apply to frozen ground. Maintain constant agitation while mixing product with water. Add 0.25% by volume of nonionic surfactant to spray mixture.

Caution Avoid contact with sensitive crops. Do not treat powdery, dry soils and light, sandy soils if rain is not likely after treatment. Labeled for use on pasture, range, Conservation Reserve Program (CRP), and non-cropland only.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

clopyralid + 2,4-D amine (Curtail)

Rate 1 to 5 quarts/a Curtail

Time Apply to actively growing thistle after most basal leaves emerge but before bud stage.

Remarks Lower rate for in-crop cereal grain application, higher rates for fallow, postharvest, and Conservation Reserve Program (CRP) applications. Consult label for specific directions. With CRP applications, for established grass only. For best results, wait at least 20 days after application before disturbing treated areas

(cultivation, mowing, fertilization with shank-type applicators) to allow thorough translocation. Apply in enough total spray volume to ensure good coverage.

Caution See label for crop rotation restrictions before use. Several crops may be injured up to 4 years after application.

Site of action (both) Group 4: synthetic auxin

Chemical family (clopyralid) Pyridine; (2,4-D) Phenoxy acetic acid

clopyralid (Stinger or Transline)

Rate 0.09 to 0.375 lb ae/a (0.25 to 1 pint/a). Labeled rates vary with crops.

Time Up to the bud stage of thistles.

Remarks Best if applied to actively growing weeds. See labels for registered sites.

Caution Consult label for crop rotation restrictions before using these products. Several crops may be injured up to 4 years after application.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

dicamba (Banvel, Rifle, or Clarity)

Rate 0.5 to 1 lb ae/a

Time Apply before flower stalk lengthens on established plants and for seedling control. Spray fall applications to control rosettes.

Remarks Repeat applications for several years to control new seedlings.

Caution Dicamba residues may be in soil for 12 to 18 months after applying. Grass tolerates dicamba at these rates.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

diflufenzopyr + dicamba (Overdrive)

Rate 0.175 to 0.35 lb ae/a (4 to 8 oz/a)

Time Apply to the rosettes.

Remarks Use higher rates on thistles that have bolted. Add a surfactant, either nonionic or methylated seed oil, to the spray mix.

Caution Avoid drift to sensitive crops. Will kill legumes.

Site of action (diflufenzopyr) Group 19: inhibits indole acetic acid transport; (dicamba) Group 4: synthetic auxin

Chemical family (diflufenzopyr) Semicarbazone; (dicamba) Benzoic acid

glyphosate + 2,4-D (Campaign)

Rate Broadcast: 16 to 32 fl oz/a. Spot treatment: 1 to 2% solution.

Time Apply to thistles in rosette stage of growth in spring or before freeze-up in fall.

Remarks This product is recommended for musk thistle control in rangeland, pasture, and non-croplands and for the control of those weeds listed on the product label.

Caution Do not graze lactating dairy animals on treated grass within 7 days after application. Animals being finished for slaughter and grazing in the treated area within 30 days of

treatment must be removed from the treated area 3 days before slaughter. Do not cut forage for hay within 30 days of application. No grazing restriction if product is used for spot treatments in less than 10% of the total grazed area.

Site of action (glyphosate) Group 9: inhibits EPSP synthase; (2,4-D) Group 4: synthetic auxin

Chemical family (glyphosate) none generally accepted; (2,4-D) phenoxy acetic acid

metsulfuron (Escort and others)

Rate Escort: 0.6 oz ai/a (1 oz/a)

Time Apply postemergence to actively growing plants.

Remarks Using a nonionic or silicone surfactant increases effectiveness. Certain biotypes of musk and Scotch thistle are more sensitive than others to metsulfuron. Application sites differ between products; consult labels.

Caution Apply only to pasture, rangeland, and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

picloram (Tordon)

Rate 0.25 lb ae/a

Time Apply in the fall before thistle bolts.

Remarks Do not use on diversified cropland. Follow-up applications will be necessary to control new seedlings and escaped plants.

Caution Most formulations are restricted-use herbicides.

Soil residuals may last over 1 year after a 0.25 lb ai/a application. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to picloram. Do not use in diversified cropping areas.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

triclopyr + clopyralid (Quali-Pro 2,D Herbicide)

Rate 1.5 to 2 pints/a

Time Apply to actively growing thistle from rosette to early bolt stage.

Remarks Add a nonionic surfactant at surfactant manufacturer's recommended rate. Apply in at least 10 gal/a water by ground.

Caution Do not exceed 4 pints/a per year. Do not allow drift to desirable vegetation. Note label restrictions on overseeding or reseeding.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) Pyridine

Toadflax, Dalmatian (*Linaria dalmatica*) and yellow (*Linaria vulgaris*)

chlorsulfuron (Telar)

Idaho and Washington only

Rate 1.5 to 2.25 oz ai/a (2 to 3 oz/a Telar)

Time Apply to actively growing yellow toadflax in the bud to bloom stage.

Remarks Suppresses yellow toadflax. Selective to grasses. Use a penetrating surfactant. Spray to wet.

Caution Do not let spray drift onto sensitive crops. Apply only to non-cropland.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

dicamba (Banvel, Rifle, or Clarity)

Rate 4 to 6 lb ae/a

Time Apply in early spring before toadflax reaches bloom stage.

Remarks Repeated applications may be necessary for complete control.

Caution Avoid drift to sensitive crops. Dicamba severely injures or kills most broadleaf plants.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

imazapic (Plateau)

Rate 0.188 lb ai/a

Time Apply in the fall when top 25% of plant is necrotic, usually after a hard frost.

Remarks Add 1 quart/a methylated seed oil to the spray mix.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

picloram (Tordon)

Rate 1 lb ae/a

Time Apply to actively growing toadflax in spring before full bloom or in late summer or fall.

Remarks A selective treatment that will not damage perennial grasses at the suggested rate.

Caution Most formulations are restricted-use herbicides. Do not contaminate water. Do not use in diversified crop areas. Potatoes, beans, and most other broadleaf crops are sensitive to picloram. This rate for spot treatment only.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

picloram (Tordon 22K) + 2,4-D

Rate 0.5 lb ae/a picloram + 1.5 lb ae/a 2,4-D

Time In spring before full bloom.

Remarks May require annual treatment for 2 to 3 years. This rate of Tordon 22K may be broadcast.

Caution Tordon is a restricted-use herbicide. See label for grazing restrictions. If rate exceeds 0.5 lb ae/a (1 quart/a), apply only as a spot treatment not to exceed 25% of a landowner's acreage in any particular watershed in a single season. Avoid drift to sensitive crops. Do not contaminate water. Potatoes, beans, and many other broadleaf crops are sensitive to these herbicides. Do not use picloram in diversified crop areas.

Site of action (both) Group 4: synthetic auxin

Chemical family (picloram) pyridine; (2,4-D) phenoxy acetic acid

Velvetgrass, German or creeping (*Holcus mollis*)

EPTC (Eptam)

Rate 4 to 6 lb ai/a. Use 6-lb rate on finer soils or on heavy mats of roots and rhizomes.

Time Apply in spring or early fall on a thoroughly prepared seedbed.

Remarks A preplant soil-incorporated herbicide that also gives excellent results when metered into irrigation water. Effective if used in conjunction with a cropping program. Total kill requires at least 2 years. Prevent seedlings from reestablishing the stand. Suggested crop programs are:

- Spray 4 to 6 lb/a in spring, and seed red clover or alfalfa on soil that has been limed and fertilized for best legume growth.
- Spray 2 to 3 lb/a in spring; seed to corn for 2 years or follow with one of the other crops listed.
- Spray 4 to 6 lb/a in fall and seed to crimson clover or fall flax. The subsequent crop should tolerate EPTC. Re-treat the second year.
- Spray 4 lb/a in spring and summer fallow; follow by seeding to winter wheat or barley and treating with diuron to kill velvetgrass seedlings.

Caution Incorporate EPTC into soil 2 to 3 inches deep immediately after application. Use sprinkler irrigation to incorporate EPTC in very dry weather.

Site of action Group 8: lipid synthesis inhibitor but not an ACCase inhibitor

Chemical family Thiocarbamate

fluazifop (Fusilade DX)

Rate 0.25 to 0.375 lb ai/a + 1% crop oil concentrate or 0.25% nonionic surfactant

Time Apply in early spring when grass is growing well.

Remarks Repeat applications may be needed to control well-established grass. Do not mix with other pesticides unless label recommends.

Caution Do not graze treated fields.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

sethoxydim (Poast)

Rate Up to 0.5 lb ai/a + 2 pints/a of an oil concentrate

Time Apply in early spring when grass is growing well. Applying after April 1 may be less effective.

Remarks Repeat applications may be needed to control well-established grass.

Caution Do not graze treated fields.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

Velvetleaf (*Abutilon theophrasti*)

2,4-D (various products)

Rate 0.25 lb ae/a

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

linuron (Lorox)

Remarks Applied postemergence, reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action Group 7: photosystem II inhibitor

Chemical family Urea

2,4-DB (Butyrac) or alachlor (Lasso) or bentazon (Basagran) or bromoxynil (Buctril) or clomazone (Command) or glyphosate (Roundup) or imazethapyr (Pursuit) or metribuzin (Sencor or Lexone) or norflurazon Solicam) or oxyfluorfen (Goal) or paraquat (Gramoxone Max) or terbacil (Sinbar)

Remarks Reported to control this plant, although data are lacking in the Pacific Northwest. Follow label instructions.

Site of action (clomazone) Group 13: inhibits DOXP synthase; (imazethapyr) Group 2: acetolactate synthase (ALS) inhibitor; (2,4-DB) Group 4: synthetic auxin; (glyphosate) Group 9: inhibits EPSP synthase; (terbacil and metribuzin) Group 5: photosystem II inhibitor; (oxyfluorfen) Group 14: protoporphyrinogen oxidase inhibitor; (alachlor) Group 15: unknown; (paraquat) Group 22: photosystem I electron diverter; (bromoxynil and bentazon) Group 6: photosystem II inhibitor but different binding behavior than Groups 5 and 7; (norflurazon) Group 12: bleaching; inhibits carotenoid biosynthesis

Chemical family (clomazone) Isoxazolidinone; (imazethapyr) Imidazolinone; (2,4-DB) Phenoxy acetic acid; (glyphosate) none generally accepted; (terbacil) Uracil; (oxyfluorfen) Diphenylether; (alachlor) Chloroacetamide; (metribuzin) triazine; (paraquat) Bipyridilium; (bromoxynil) Nitrile; (norflurazon) Pyridazinone; (bentazon) Benzothiadiazole

Waterhemlock, western (*Cicuta douglasii*)

2,4-D or MCPA

Rate 2 lb ae/a

Time Apply at bud stage of growth.

Remarks Plants are highly poisonous to both animals and humans.

Caution Do not graze treated areas until plants dry up after spraying. Avoid drift to sensitive crops.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) phenoxy acetic acid

Willow (*Salix spp.*)

2,4-D LV ester

Rate 2 to 3 lb ae/a

Time Apply when leaves are fully developed and growing.

Remarks Use oil (no lower than No. 2 diesel) for aerial application. Willows will resprout; therefore, re-treatment may be required.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

metsulfuron (Escort)

Rate Escort: 0.6 oz ai/a (1 oz/a)

Time Apply to fully leafed-out brush.

Remarks Full spray coverage is required. Use a surfactant.

Caution Apply only to rangeland and non-crop sites.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

triclopyr amine (Garlon 3A) or triclopyr ester (Garlon 4) or triclopyr + 2,4-D LV ester (Crossbow)

Rate Depends on which triclopyr formulation is used

Time Apply when willows are actively growing.

Remarks Foliage must be thoroughly wet.

Caution Garlon products are registered for use on rights-of-way, industrial sites, and forestry (release and site preparation). Crossbow can be used on permanent pastures and rangeland up to 1.5 gal/a. Observe all grazing and harvesting restrictions. Avoid spray drift.

Site of action (all) Group 4: synthetic auxin

Chemical family (triclopyr) pyridine; (2,4-D) phenoxy acetic acid

Willowherb, hairy (*Epilobium hirsutum*)

Remarks Although PNW data are preliminary, aminopyralid, glyphosate, imazamox, imazapyr, and triclopyr gave promising results in initial trials.

Site of action (imazamox, imazapyr) Group 2: acetolactate synthase (ALS) inhibitor; (glyphosate) Group 9: inhibits EPSP synthase; (aminopyralid, triclopyr) Group 4: synthetic auxin

Chemical family (imazamox, imazapyr) imidazolinone; (glyphosate) none generally accepted; (aminopyralid, triclopyr) pyridine

Wiregrass, African or ventenata (*Ventenata dubia*)

imazapic (Plateau, Panoramic)

Rate 5 oz /a Plateau or Panoramic

Time Apply in the fall after African wiregrass has emerged.

Remarks High litter levels may reduce effectiveness, some bare ground should be visible for better control. Labeled for use on pasture, range, Conservation Reserve Program (CRP), and non-cropland.

Caution Many perennial grasses can be injured if applications are made during the spring.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

sulfosulfuron (Outrider)

Rate 0.75 oz/a Outrider

Time Apply in the fall after African wiregrass has emerged (1 inch rain and soil temperature above 45°F).

Remarks Many grasses are sensitive to sulfosulfuron so selection of grasses for any revegetation efforts should consider use of wheatgrasses. Mature Idaho fescue is tolerant and while perennial bromes are injured during the first season, they will persist. Meadow foxtail (*Alopecurus pratensis*) is removed from perennial grass stands so if this species is used for forage, avoid applying sulfosulfuron.

Caution Labeled for use on pasture, range, Conservation Reserve Program (CRP), and non-cropland. Wheat is the only rotational crop for one year after application, see label for details.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

flufenacet + metribuzin (Axiom DF)

Rate 0.27 to 0.31 lb ai/a flufenacet + 0.068 to 0.084 lb ai/a metribuzin (8 to 10 oz/a Axiom) in established timothy hay.

Time Apply before weeds emerge, or no later than the two-leaf stage.

Remarks Do not graze timothy in the fall and cut height cannot be shorter than 3.5 inches. Rain or irrigation after application is needed for sufficient weed control activity.

Caution Harvest at lower than 3.5 inches may cause injury to timothy. Grazing in fall after hay harvest may cause injury to timothy. It is best to harvest at 4 inches to allow energy stored in stems to be used to produce new stems next year.

Site of action (flufenacet) Group 15: inhibits very long chain fatty acid synthesis; (metribuzin) Group 5: photosystem II inhibitor

Chemical family (flufenacet) oxyacetamide; (metribuzin) triazinone

indaziflam (Esplanade 200 SC)

Rate 3.5 to 7 oz/a

Time Apply preemergence.

Remarks Controls many other annual grasses and some broad-leaf weeds.

Caution Keep away from surface water, at least 25 feet, and areas below the mean watermark.

Site of action Group 29: cellulose biosynthesis inhibitor

Chemical family Alkylazine

rimsulfuron (Matrix, Laramie)

Rate 2 to 4 oz /a

Time Apply before or soon after seedlings emerge.

Remarks Controls some other annual grasses, and some annual broadleaf species. Add a nonionic surfactant at 1 quart/100 gal spray to improve activity.

Caution Consult label if there are plans to seed grasses after application.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

Woad, dyer's (*Isatis tinctoria*)

2,4-D LV ester

Rate 1.9 to 2.85 lb ae/a

Time Apply in spring or fall to rosettes, or in early summer when plant is in bud.

Remarks For satisfactory control, it may be necessary to treat infested areas during both the rosette and bud stages of growth.

Caution Avoid drift to sensitive crops.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

aminocyclopyrachlor + chlorsulfuron (Perspective)

Rate 1.8 to 3.2 oz/a aminocyclopyrachlor + 0.7 to 1.3 oz/a chlorsulfuron (4.5 to 8 oz/a of product)

Time Apply to actively growing plants in spring.

Remarks Adjuvants can be used; these include methylated seed oils 0.5 to 1% v/v, nonionic surfactants at 0.25 to 1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.

Caution Even low rates can kill nontarget tree and shrub species, so avoid application within a distance equal to the tree height of the sensitive species. Do not allow spray to drift off target. Can injure several grass species including bromes, as well as basin wildrye.

Site of action (aminocyclopyrachlor) Group 4: Synthetic auxin; (chlorsulfuron) Group 2: ALS inhibitor

Chemical family (aminocyclopyrachlor) Pyrimidine carboxylic acid; (chlorsulfuron) Sulfonylurea

chlorsulfuron (Telar)

Rate 0.75 oz ai/a (1 oz/a Telar)

Time Apply before or after weeds emerge. Results are best on young, actively growing weeds.

Remarks Constantly agitate while mixing and spraying. Add 0.25% v/v nonionic surfactant to spray mixture. Labeled for use on pasture, range, Conservation Reserve Program (CRP), and non-cropland.

Caution Use on non-cropland only. Avoid contact with sensitive crops. Can persist in soil. Do not treat powdery, dry soils or light, sandy soils if rain is not likely soon after treatment. Do not apply to frozen ground.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

imazapic (Plateau)

Rate 0.125 to 0.188 lb ai/a

Time Apply to rosettes or after blossoms open (full bloom) until plants desiccate.

Remarks Add 1 quart/a methylated seed oil to the spray mix.

Caution Before using, note crop rotation restrictions.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

metsulfuron (Escort and others)

Rate Escort: use 0.3 to 0.6 oz ai/a (0.5 to 1 oz/a)

Time Apply to actively growing plants.

Remarks Use a nonionic or silicone surfactant.

Caution Do not let spray drift to sensitive crops. Apply only to pasture, rangeland, and non-crop sites. Application sites differ between products; consult labels.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea