

SECTION R.

CHRISTMAS TREES

Chal Landgren and Ed Peachey

Revised March 2019

Excessive weed growth in Christmas trees reduces tree vigor, increases vertebrate pests, and can reduce the quality of the product if plant debris is lodged among branches. However, completely eliminating all vegetation increases runoff, soil erosion, and soil compaction and can diminish tree quality if branches get muddy during harvest. Consequently, vegetation management in Christmas trees requires a balanced approach. Realizing that the goal is to produce quality trees while maintaining long-term site quality and managing—not just controlling—weeds.

Managing weedy vegetation Successful vegetation management in Christmas trees requires a comprehensive approach whereby a combination of weed control practices are used and alternated over several years. Developing these strategies requires knowledge of each weed and control practice. Identify weeds and gather information about the effectiveness of each weed control practice. Consider costs, and select herbicide combinations that can be applied together or in split applications that control the weeds in the crop without damage to trees. Note the action of each herbicide (how the chemical works in the plant), then tank mix and alternate use of these products to reduce the chance of developing resistant species or biotypes. Often a combination of mechanical or herbicidal treatments, and sometimes hand removal or spot treatment with herbicide sprays or wipers, will provide the most effective year-round control.

Being a good neighbor Often, Christmas trees are grown with an assortment of other crops and nearby land uses ranging from apples to zucchini to organic farms to schools. It is important to be mindful of what is growing or happening near the farm. Wine grapes are sensitive to phenoxy herbicides (like 2,4-D and Garlon), especially during bloom and fruit set (March to June). Use the amine formulation, and remember that drift is illegal. Christmas trees have their own sensitivities, especially at bud break when new growth emerges.

Weed shifts Weed infestations are dynamic and change depending on new species introductions and previous cultural and weed control practices. For example, routine cultivation, mowing, or use of the same or similar herbicides will result in weed shifts to species that tolerate these practices. Examples include prostrate weeds that tolerate flailing, deep-rooted or easily spread perennials that tolerate cultivation, and weeds such as common groundsel, field bindweed, and false dandelion, that resist repeated applications of the same or similar herbicides.

Preventing weed shifts Weeds that survive cultivation, mowing or flailing, specific herbicide treatments, or other routine cultural practices must be eliminated before the tolerant species or biotypes become established. Combine a variety of weed control practices or treatments—rotate fields, cultural practices, and herbicides—and spot treat with a hoe or registered herbicide when the weed first appears. Also, clean equipment when moving from an infested field.

Herbicide resistance management Repeated use of glyphosate in perennial crops in western Oregon, including Christmas trees, has selected for a resistant biotype of annual ryegrass. Overreliance on herbicides with a single **site of action** increases the risk of selecting

for resistance in other weed species, and threatens the long-term usefulness of glyphosate for weed control in orchards and other crops. Several alternative, nonselective herbicides, listed below, have different sites of action, and can be applied in rotation with glyphosate to reduce the risk of selecting for weeds that are resistant to glyphosate. Refer to “Section C. Agrichemicals and their Properties” and the subsection “Managing Herbicide-resistant Weeds” in this handbook for more information.

Steps to avoid or manage glyphosate resistance:

1. Use other means to manage weeds, such as cultivation and mowing.
2. Use preemergence herbicides where possible. Consider use of other nonselective herbicides, such as glufosinate with PPO inhibitors for burndown control.
3. To delay development of resistance, use higher glyphosate **rates**, and do not cut the **rate**.
4. If using glyphosate in plantations with resistant weeds, tank mix glyphosate with other herbicides and make the application when the weeds are small.
5. Do not let weeds go to seed.

Ground covers/mulches Some growers manage vegetation such as subclover, grass or weedy vegetation between rows to reduce soil erosion, improve traffic conditions in wet weather, and reduce mud on harvested trees. New grass varieties—including dwarf cultivars such as “Aurora Gold” and “Soil Guard”, which respond well to drought, low soil fertility, or sublethal rates of postemergence herbicides—are being introduced into various horticultural cropping systems. A number of other hard fescue varieties have worked well for Christmas tree growers. Mulches and barriers such as straw and straw bales, and/or course wood debris, can also help hold the soil in place. Consult your local Extension agent or get recent information about living mulches and their management.

Soil-active herbicides Persistent, soil-applied herbicides can be applied to weed-free soil during winter when rain will activate the chemical. Apply lower rates on sandy soils with lower clay, organic matter, or cation exchange capacities.

Postemergence herbicides These are applied to weeds once they emerge, often at a specific weed growth stage, either as a directed spray away from the tree or over the trees in specific situations. For example, clopyralid (e.g., Stinger) may control selected thistles if applied at the proper weed growth stage and may be sprayed over the top of selected tree species. Glyphosate (e.g., Roundup) is typically applied as a directed spray and controls many weeds, but must be applied at the correct stage of weed growth to obtain maximum movement of the product into the roots (see label for details). Avoid applications to green bark, low limbs, or crop foliage. Three postemergence grass herbicides (Segment, Fusilade, and Envoy Plus) can be applied to actively growing grasses in the four- to five-leaf stage for optimum results. More mature grasses can be controlled but often require two applications. All fine fescues resist these products.

Note Herbicides must be applied at the correct rate and time to selectively control weed growth with minimal chance of injury to trees. Obtain more consistent results by reading the herbicide label and other information about the proper application and timing of each herbicide. Good record keeping regarding plant growth stages, rates, surfactants, and weather will also help. Suggested rates listed in this guide are stated as pounds active ingredient per acre (lb ai/a) or pounds acid equivalent per acre (lb ae/a), as well as product amounts per acre. For band applications under tree rows, reduce quantity of herbicide applied proportionately to the area within the row actually sprayed.

Some products are not recommended for first-year seedlings and/or some stock-types, such as container seedlings, that may be more susceptible to damage using soil-active herbicides due to the light-textured potting mix.

Site Preparation Many new Christmas tree growers are so anxious to plant trees that they rush into planting before the site is well prepared or the weeds are under control. Most regret the rush. Prior to tree planting, there are a wide range of chemical and mechanical site preparation options. After planting, options are more limited because the trees require protection. Be aware, too, that even though the site may look clean, many brush species, such as blackberries, can rapidly sprout from living root systems. Again, better to wait a year and clean up your site than to rush into planting.

New Plantings—Foliar Applied without Soil Residual

fluazifop (Fusilade DX)

Rate 0.25 to 0.375 lb ai/a (16 to 24 fl oz/a)

Time Apply to actively growing grasses in early spring, following ample rain, as a directed spray with 0.25% nonionic surfactant.

Remarks Identify grasses and adjust rates depending on susceptibility and stage of weed growth according to label instructions. Results often are erratic on grasses stressed from lack of vigor, drought, high temperature, or low fertility. More mature grasses and quackgrass can be controlled but may require two applications. Annual bluegrass and all fine fescues resist treatment. Inhibits fatty acid production, cell membranes, and new growth.

Caution Do not tank mix with other pesticides or apply within 5 days of other pesticide treatments. Grazing is prohibited.

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

Chemical family Aryloxyphenoxy propionate

sethoxydim (Segment and others)

Rate 0.28 to 0.47 lb ai/a (2.25 to 3.75 pints/a Segment), depending on grass species and height

Time Apply at optimum growth stage of grass weed listed on the label.

Remarks Identify susceptible grasses. Control often is erratic on grasses stunted or stressed from drought, high temperatures, or low fertility. Resistant grasses include annual bluegrass and all fine fescues, whereas quackgrass can be suppressed. Inhibits fatty acid production, cell membranes, and new growth.

Caution Do not tank mix with other pesticides for use on conifer seedlings less than 10 months old or injury may occur.

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

Chemical family Cyclohexanedione

Established Plantings—Winter Applications that Persist in Soil

atrazine (several products)

Rate 2 to 4 lb ai/a (4 to 8 pints/a Atrazine 4L)

Time Apply February through March to dormant trees. Apply atrazine before annual weeds are 1.5 inches tall; use higher rates for quackgrass control.

Remarks Requires more moisture than Velpar to activate. Do not exceed 4 lb ai/a per year.

Caution A restricted-use herbicide.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazinone

dichlobenil (Casoron CS)

Rate 1.96 to 3.92 lb ai/a (1.4 to 4.3 gal/a)

Time Apply midwinter immediately before a cold rain, to reduce volatility and enhance weed suppression.

Remarks Liquid formulation of encapsulated crystals of dichlobenil. Controls most germinating seeds and seedlings of annual and perennial grasses and broadleaf weeds.

Caution Use only around well-established plants; typically wait until 1 year after transplanting. Do not use on light sandy soils. Do not apply with high or gusty wind, high temperatures, low humidity, or temperature inversions. Grazing livestock is prohibited. Inhibits cellulose and cell wall formation.

Site of action Group 20: inhibits cell wall synthesis Site A

Chemical family Nitrile

Dithiopyr (Dimension 2EW)

Rate .35 to .5 lb ai/a (1.5 to 2.0 pints /a)

Time Apply for preemergent control of listed grasses and broadleaf weeds. Directed spray only

Remarks Has post emergent control of crabgrass at up to 5 leaves per plant.

Caution Optimum control when made to soil that is free of weeds and clods. Avoid soil disruption after application

Site of action Group 3: microtubule assembly inhibitor

Chemical family dinitroaniline

flufenacet + metribuzin (Axiom DF)

Douglas-fir and true firs only; Supplemental label Oregon only

Rate 12 to 20 oz/a

Time Apply pre- or very early postemergence to weeds when trees are completely dormant. Trees must be established at least one growing season.

Remarks SLN label OR-150015.

Caution Do not apply more than once per production year or within 11 months of last treatment. Both herbicides may contaminate ground water if soil is permeable or water table is shallow.

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

flumioxazin (SureGuard and others)

Rate 0.25 to 0.38 lb ai/a (8 to 12 oz/a SureGuard). Refer to organic matter, soil types, and rates listed on label for various broadleaf weeds.

Time Pre- or postemergence (weeds up to 2 inches tall). Preferred time is fall, to maximize the potential for rain to activate and set the herbicide. Tank mix with approved herbicides if weeds are large, or if weedy vegetation will keep SureGuard from reaching the soil surface.

Remarks Residual or postemergence weed control can be achieved by adjusting rates or labeled tank-mixes (see label). Use a surfactant to improve postemergence control.

Caution Do not apply over the top of nondormant trees unless injury can be tolerated. Use of adjuvants is not recommended.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Diphenylether

hexazinone (Velpar and others)

Rate 1 to 2 lb ai/a (1.33 to 2.6 lb/a Velpar DF, 4 to 8 pints/a Velpar L), depending on soil texture and tree age.

Time Apply in spring before conifer bud break.

Remarks Requires some moisture to activate in soil but less than required for atrazine. Consult label for specific doses and precautions depending on type of soil and soil organic matter content. If trees are growing actively, apply as a directed spray to reduce chance of injury. Later applications in early April may be more effective than March applications due to greater leaching from spring rains.

Caution A restricted-use herbicide in Washington. Label cautions that this herbicide may contaminate ground water if soil is permeable, or water table is close to the soil surface.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazinone

hexazinone + sulfometuron (Westar DG)

Production discontinued in 2018

Rate 1 to 1.5 lb/a Westar DG, depending on soil texture and tree species; consult label

Time Apply either before or soon after weeds emerge, when weeds are small and actively growing. Apply broadcast only to dormant trees. If trees have broken dormancy, directed applications are required to avoid contact with new growth.

Remarks Recommended for Douglas-fir, Fraser fir, grand fir, noble fir, Nordmann fir, and Turkish fir. For other species, apply first to small areas to determine selectivity.

Caution Hexazinone is a restricted-use herbicide in Washington. Surfactants are not recommended and may cause excessive injury. For maximum safety to grand fir, use large transplant stock and apply at 1 to 1.25 lb/a, or use after trees have been established at least one growing season. In newly transplanted fields, rain or irrigation should have settled soil. Use low rates on soils with low organic matter and coarse structure. Label cautions that this herbicide may contaminate ground water if soil is permeable, or water table is close to the soil surface. Significant carryover potential. Must wait at least one year after

last application before planting most other crops, and then use a field bioassay to determine crop safety.

Site of action (hexazinone) Group 5: photosystem II inhibitor; (sulfometuron) Group 2: acetolactate synthase (ALS) inhibitor

Chemical family (hexazinone) triazinone; (sulfometuron) sulfonylurea

indaziflam (Marengo)

Rate 0.047 to 0.063 lb ai/a (7.5 to 15.5 oz/a Marengo), depending on soil texture

Time Apply prior to weed seed germination, in fall to early spring, to firmed soil that does not have cracks.

Remarks Existing vegetation must be controlled with glyphosate or burndown herbicides such as glufosinate. Controls annual broadleaf and grass weeds and perennial weeds from seed only. Existing perennial/biennial weeds growing from roots will not be controlled. Rainfall or irrigation of .25 inch or more within 3 weeks of application is required for maximum efficacy.

Caution Avoid direct contact with foliage, green bark, or roots of desired species. Clean spray tanks thoroughly after use. Make sure soil is settled around trees and there are no cracks. Surface and groundwater advisories are included on the label because of potential harm to nontarget organisms and potential for runoff and percolation to ground water. A well maintained and level vegetated buffer strip of 25 ft or more will help reduce runoff. Application of indaziflam 48 or more hours before rain is forecasted will reduce runoff potential.

Site of action Group 29: inhibits cellulose biosynthesis

Chemical family Alkylazine

isoxaben (Gallery 75DF, Gallery T&V and others)

Rate 0.495 to 0.998 lb ai/a (0.66 to 1.33 lb/a)

Time Apply to debris-free soil surface in late summer to early fall, in early spring, or immediately after cultivation.

Remarks Identify weeds and adjust rates according to charts on label. Activate with 0.5 inch water or shallow cultivation before weeds begin to emerge. Chemical stability remains adequate when left on soil surface for 21 days.

Caution Do not apply to newly transplanted crops until soil settles.

Site of action Group 21: inhibits cell wall biosynthesis Site B

Chemical family Benzamide

isoxaben + trifluralin (Snapshot 2.5TG and others)

Rate 2.5 to 5 lb ai/a (100 to 200 lb/a)

Time Apply to weed- and debris-free soil.

Remarks Activate within 3 days using 0.5 inch of water or shallow cultivation before weeds begin to emerge. Follow label instructions for repeat treatments.

Site of action (isoxaben) Group 21: inhibits cell wall biosynthesis Site B; (trifluralin) Group 3: microtubule assembly inhibitor

Chemical family (isoxaben) benzamide; (trifluralin) dinitroaniline

oryzalin (several products)

Rate 2 to 4 lb ai/a (2 to 4 quarts/a product)

Time Apply to weed-free soil after transplant, or in spring when 0.5 to 2 inches of rain will activate herbicide.

Remarks Apply over the top of established Christmas trees. Tank mix with glyphosate to control emerged weeds.

Caution Do not apply to Douglas-fir (*Pseudotsuga menziesii*). Do not apply to seedbeds or seedling transplant beds. Apply only to established plants that have been transplanted into their final growing location for a sufficient period of time to allow the soil to be firmly settled around the roots from packing and rainfall or irrigation.

Site of action (oryzalin) Group 3: microtubule assembly inhibitor

Chemical family (oryzalin) dinitroaniline

oryzalin + benefin (XL 2G)

Except Douglas-fir and eastern hemlock

Rate 200 lb/a (2 to 4 months of weed control) to 400 lb/a (4 to 8 months of weed control)

Time Apply to established Christmas trees before target weed species emerge. Established plantings are those that have been transplanted to their final location, and soil has settled with rain or irrigation.

Remarks Controls winter or summer annual grasses and broadleaves. At least 0.5 inch of rain or irrigation is required to activate herbicides. If rain does not fall in 21 days, cultivate to activate. Does not control emerged species. For maximum efficacy, soil should be free of weeds and clod size small. Do not exceed 800 lb/a per season; allow 2 months between applications.

Caution Not for Douglas fir or eastern hemlock; noble fir not listed.

Site of action (both) Group 3: microtubule assembly inhibitor

Chemical family (both) dinitroaniline

oxyfluorfen (Goal 2XL, Galigan 2E, GoalTender and others)

Rate 1 to 2 lb ai/a (4 to 8 pints/a Goal 2XL & Galigan 2E; 2 to 4 pints/a GoalTender)

Time Apply over trees or as directed spray throughout the year, except when buds and new shoot growth are tender and not yet hardened off.

Remarks Controls small emerged broadleaf weeds with brief soil residual. Perennial and emerged annual grasses are not controlled, although fine fescues may be suppressed. Acts as contact, either directly on broadleaf weeds or at soil surface as weeds emerge.

Caution Do not apply in combination with glyphosate, or other products with oil or surfactant additives, until adequately tested.

Site of action Group 14: inhibits protoporphyrinogen oxidase

Chemical family Diphenylether

oxyfluorfen + penoxsulam (Cleantraxx)

Washington only

Rate 3 to 4.5 pints/a Cleantraxx

Time Apply for preemergent and early post emergent control of herbaceous broadleaf weeds and grasses. Can be applied over trees or as directed spray throughout the year, except when buds and new shoot growth are tender and not yet hardened off.

Remarks Perennial and emerged annual grasses are not controlled, although fine fescues may be suppressed. Absorbed either directly on leaves of broadleaved weeds or at soil surface as weeds emerge.

Caution Do not apply in combination with glyphosate, or other products with oil or surfactant additives, until adequately tested.

Site of action oxyfluorfen- Group 14: inhibits protoporphyrinogen oxidase; penoxsulam- Group 2: inhibition of acetolactate synthase

Chemical family (oxyfluorfen) Diphenylether; (penoxsulam) Triazolopyrimidine

pendimethalin (Pendulum 3.3EC and 2G, AquaCap and others)

Rate 2 to 4 lb ai/a (2.4 to 4.8 quarts/a 3.3EC; 100 to 200 lb/a 2G; and 2.1 to 4.2 quarts/a AquaCap) depending on length of control desired)

Time Apply before weed seeds germinate. Tank mix with glyphosate, glufosinate, or labeled burndown herbicides to control existing vegetation.

Remarks Do not apply during bud swell through flushing. Soil should be free from all established weeds. Water within a few days to activate herbicide before weeds emerge. Make sure soil has settled and roots are not exposed to sprays. Inhibits mitosis in roots and shoots.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

prodiamine (Barricade 4FL and others)

Rate 0.65 to 1.5 lb ai/a (21 to 48 oz/a Barricade 4FL)

Time Apply to weed-free site; follow with 0.5-inch rain or irrigation or shallow incorporation.

Remarks Do not apply during bud swell through flushing. Soil should be free from all established weeds. Water within a few days to activate.

Caution Do not exceed maximum rate listed on label in a 12-month period.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

pronamide (Kerb SC)

Rate 1 to 2 lb ai/a (2 to 4 lb/a 50W) and 2 lb ai/a (2.5 to 5 pints/a SC)

Time Make a single application in fall, before freezing weather.

Remarks Not recommended on trees less than 1 year old. Use higher rates for quackgrass and finer soils. Requires soil moisture to activate. Primarily for grass control. Degraded by microorganisms in warmer weather. SLN labels OR-120019 allows for aerial application of Kerb SC. Inhibits cell division or mitosis.

Caution A restricted-use herbicide. Preharvest interval is 1 year.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Benzamide

simazine (several products)

Rate 2 to 4 lb ai/a

Time Fall or spring.

Remarks Simazine must be applied before weeds emerge. One application per year unless to control quackgrass. Avoid applying over actively growing trees.

Caution A restricted-use herbicide. Wait to apply simazine for at least 1 year after transplanting. In Idaho, do not apply simazine to trees less than 3 years old.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazine

Established Plantings—Broadcast or Directed Applications

2,4-D (many products)

Rate 0.95 lb to 3.8 lb ae/a (2 to 8 pints/a), depending on weed species

Time Apply over-the-top as a broadcast treatment when trees are dormant using a low rate, or direct spot sprays toward actively growing weeds before budbreak or after budset during cool weather.

Remarks Read label carefully. Mimics natural plant hormones. May be tank mixed with atrazine. Ester formulations typically have higher volatility; use with caution near sensitive plants.

Caution Do not apply over the tops of pine or true firs (*Abies* spp.)

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

asulam (Asulox and others)

Douglas-fir, grand fir, noble fir, and Scotch pines

Rate 3.34 lb ai/a (1 gal/a)

Time For bracken fern control. Apply after bud break and hardening or firming of new tree growth. Bracken should be in full frond prior to treatment.

Remarks Lower than labeled rate usually is effective and is advised. Inhibits cell division or mitosis.

Caution Do not graze treated areas. Aerial applications prohibited.

Site of action Group 18: inhibits DHP synthase step

Chemical family Carbamate

clethodim (Envoy Plus and others)

Douglas-fir, true firs (*Abies* spp.), and pines

Rate 0.094 to 0.25 lb ai/a (12 to 32 fl oz/a Envoy Plus), depending on grass species

Time Apply postemergence to actively growing annual or perennial grasses as listed on label.

Remarks Consider environmental and plant growth conditions that affect leaf uptake; see label for guidelines.

Caution Do not exceed 64 fl oz/a per season.

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

Chemical family Cyclohexanedione

clopyralid (Stinger, Transline and others)

Rate 0.09 to 0.19 lb ae/a (0.25 to 0.5 pint/a for broadleaf weeds; 0.5 to 0.66 pint/a for difficult-to-control perennials)

Time Apply broadcast over tree tops when broadleaf weeds are growing actively, from emergence to five-leaf stage. For perennials such as Canada thistle, apply after most basal leaves have emerged and before bud stage.

Remarks Apply broadcast, in bands, or over the tops of trees. Avoid using surfactants or crop oils. To avoid needle curling, do not apply during first year after transplanting. Mimics natural plant hormones.

Caution Do not exceed 0.67 pint/a per season or 0.5 pint/a for blue spruce. Do not use on Scots pine. Do not add surfactant or crop oil. Do not apply in the first year of transplanting because some needle curling has been observed on first year transplants.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

flazasulfuron (Mission)

Oregon and Washington only

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

Time Pre- and postemergence. Apply to broadleaf weeds and grasses less than 4 inches tall and prior to tillering of grasses.

Remarks Directed applications preferred, to minimize risk of crop injury. 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. Controls wild carrot and rattail fescue.

Caution Do not apply the first year after planting. 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

fluazifop (Fusilade DX)

Rate 0.125 to 0.375 lb ai/a (8 to 24 fl oz/a) depending on weed species present.

Time Apply to actively growing grasses in early spring following ample rain. Check label for recommended maximum growth stages of weeds. Apply as a directed spray with 1% crop oil concentrate or 0.25% nonionic surfactant.

Remarks Identify grasses and adjust rates depending on susceptibility and stage of weed growth as label instructs. Results often are erratic on grasses stressed from lack of vigor, drought, high temperature, or low fertility. More mature grasses and quackgrass can be controlled but may require two applications. Annual bluegrass and all fine fescues resist treatment. Inhibits fatty acid production, cell membranes, and new growth.

Caution Do not tank mix with other pesticides or apply within 5 days of other pesticide treatments. Grazing is prohibited.

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

Chemical family Aryloxyphenoxy propionate

glufosinate (Finale ES)

Rate Directed spray application: 0.5 to 1.5 lb ai/a (2 to 6 quarts/a); Spot treatment: 2 to 4 fl oz/1 gal of water

Time Apply to actively growing weeds.

Remarks Do not let spray or drift contact living tissue or green, thin, or un-calloused bark, as injury may occur.

Caution Do not broadcast spray over Christmas trees.

Site of action Group 10: inhibits glutamine synthase

Chemical family Phosphinic acid

glyphosate (numerous product names)

Rate Spray: consult labels

Time Select application equipment to prevent crop injury by directing spray toward base of plants or with selective applicators.

Remarks Adjust concentration depending on equipment, or consult label about rate and time of application, especially for perennial weeds. Additional surfactant or mixing ammonium sulfate as label instructs may improve control of slightly stressed weeds. Avoid contact of spray or mist with foliage or green bark of desirable plants. Inhibits production of three amino acids and protein.

Caution Do not exceed 10.6 lb ai/a per year. To avoid weed resistance, rotate herbicides and weed control practices.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate (several products)

Rate Wiper: 33% solution

Time Consult label for best time to apply to specific weeds.

Remarks Avoid contact with desirable vegetation. In severe infestations, reduce equipment ground speed or apply in two directions to ensure contact with wiper.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

sethoxydim (Segment and others)

Rate 0.28 to 0.47 lb ai/a (2.25 to 3.75 pints/a Segment), depending on grass species and height

Time Apply at optimum growth stage listed on the label.

Remarks Identify susceptible grasses. Control often is erratic on grasses stunted or stressed from drought, high temperatures, or low fertility. Resistant grasses include annual bluegrass and all fine fescues; quackgrass can be suppressed. Inhibits fatty acid production, cell membranes, and new growth.

Caution Do not mix or apply with any other pesticide, additive, or fertilizer except as specified on the label.

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

Chemical family Cyclohexanedione

triclopyr (Garlon 3A, Vastlan, and others)

Rate 0.75 to 1.875 lb ae/a (2 to 5 pints/a)

Time Apply in late summer or early fall after trees' terminal growth has hardened off, but before target weeds drop leaves.

Remarks To control woody plants and perennial and broad-leaf weeds. Select application equipment to prevent tree injury by directing spray toward base of plants or with selective applicators.

Caution Triclopyr spray solutions can injure needles and branches.

Site of action Group 4: synthetic auxin

Chemical family Carboxylic acid

Herbicide Effectiveness in Christmas Trees

	2,4-D	Asulam (Asulox)	Atrazine	Atrazine + 2,4-D Isooctyl ester (Shotgun)	Clethodim (Envoy and others)	Clopyralid (Stinger)	Fluazifop (Fusilade DX)	Flufenacet + metribuzin (Axiom DF)	Glufosinate (Finale)	Glyphosate (Round-up and others)	Hexazinone (Velpar L)	Hexazinone + sulfometuron (Westar DG)	Oryzalin (Surflan)	Oryzalin + benefin (XL 2G)	Oryzalin (Surflan) + simazine (Princep)	Oxyfluorfen (Goal)	Pendimethalin (Pendulum)	Prodiamine (Barricade)	pronamide (Kerb)	Sethoxydim (Poast, Vantage)	Simazine (various products)	Triclopyr (Vastlan)
Broadleaf Weeds																						
Bindweed, field	G	P	P	G	NU	G	NU	P	P	F			P	P	P	P	P	P	P	NU	P	F
Clovers	G	P	F	G	NU	E	NU	F	F	G	G	G	P	P	P	G	F		P	NU	P	G
Dandelion	G	P	P	G	NU	G	NU	F	F	G	G	G	P	P	G	G	P		P	NU	P	G
Dandelion, false	G	F	P	G	NU	G	NU	F	F	G	G	G	P	P	G	G	P		P	NU	P	G
Dock, curly	F	F	P	F	NU	P	NU		P	G	F	F	P	P	F	G	F		S	NU	P	
Filaree	F	P	F	G	NU		NU		F	F	G	G		G	F	G	F		R	NU	P	G
St. Johnswort			-	-	NU		NU								G		P			NU		
Groundsel, common			G	G	NU	E	NU		F	E					G		P			NU		
Hawksbeard			-		NU		NU								G	G	P		P	NU		
Knotweed	G		G	G	NU	P	NU		F	F	G	G	F	G	G	F	G	G	F	NU	F	
Lambsquarters	G		E	E	NU	F	NU		G	E	G	G	G	G	G	E	G	G	F	NU	E	
Lettuce, prickly	G		G	G	NU	E	NU		G	G	G	G	P	F	F	G	P		P	NU	G	
Marestail			-		NU		NU		F	G	G	G			P		P			NU		
Mullein			-		NU		NU		F	F							F			NU		
Mustards	G		G	G	NU	F	NU		G	G	G	G	P	P	P	F	G	G	F	NU	G	
Oxeye daisy			P	F	NU	F	NU		P	F							F			NU		
Pigweed			G	E	NU	G	NU		G	E			G	G	G	E	G	G	F	NU	G	
Plantain		P	P	F	NU		NU		F	G			P	P	F	G			P	NU	G	
Queen Anne's lace			P	F	NU		NU		F	G			P	P	F		P	P	P	NU		
Ragwort, tansy		F	-		NU	E	NU		F	G			P	P	F		P		P	NU		
Sowthistle, annual	G		F	G	NU	E	NU		P	G	G	G	P	F	G		P		P	NU	G	
Sowthistle, perennial	G	P	P	G	NU	G	NU		P	G	F	F	P	P	F		P		P	NU		
Spotted catsear	E	P	F	G	NU	G	NU		F	G	F	F			G		P			NU	G	
Thistle, bull	G	P	P	F	NU	E	NU		F	G			F	F		G	P		P	NU	G	
Thistle, Canada	G	P	P	F	NU	E	NU		P	F			P	P		F	P		P	NU	P	G
Willow herb			F	G	NU	F	NU		F	F					F		P			NU		
Vetch	G		F	G	NU	E	NU		F	G							F			NU	F	G
Type	F	F	S,F	S	F	F	F	S	F	F	S	S	S	F	S	F	S	S	S	F	S	F

E = excellent (90 to 100% control); G = good (80 to 90% control); F = fair (70 to 80% control); P = poor (<70% control);
 ? = efficacy unknown; — more research needed; NU = not used for this pest; * = used but not a standalone management tool.
 Note Weed size or stage of growth is an important consideration with most post-emergence herbicides.
 In "Type" row S = soil-active against pre-emerged weeds; F = foliar-active against emerged weeds.

	2,4-D	Asulam (Asulox)	Atrazine	Atrazine + 2,4-D Isooctyl ester (Shotgun)	Clethodim (Envoy and others)	Clopyralid (Stinger)	Fluazifop (Fusilade DX)	Flufenacet + metribuzin (Axiom DF)	Glufosinate (Finale)	Glyphosate (Round-up and others)	Hexazinone (Velpar L)	Hexazinone + sulfometuron (Westar DG)	Oryzalin (Surflan)	Oryzalin + benefin (XL 2G)	Oryzalin (Surflan) + simazine (Princep)	Oxyfluorfen (Goal)	Pendimethalin (Pendulum)	Proflaminate (Barricade)	pronamide (Kerb)	Sethoxydim (Poast, Vantage)	Simazine (various products)	Triclopyr (Vastlan)
Grass Weeds																						
Barnyard-grass	P		P	P	G	NU	G	G	F	G	G	G	G	G	G	P	E	G	F	G	G	P
Bentgrass	P		P	P	F	NU	F	F	P	G			P	P	P		G	G	P	F		P
Bluegrass, annual	P	G	P	P	E	NU	E	E	G	G	G	G	G	G	G	G	E	G	P	E	G	P
Bromegrass	P		P	P	G	NU	G	G	G	G	G	G	G	G	G	G	F		P	G	G	P
Fescues, fine	P		P	P	F	NU	F	G	F	F		F			G		G	G	G	F		P
Fescues, tall	P	P	P	P	F	NU	F	G	F	F	F	G	F	F	G	G	G	G	G	F	P	P
Orchardgrass	P	F	P	P	G	NU	G	G	F	G	F	F	P	P	G		G		G	G	P	P
Quackgrass	P	P	P	P	F	NU	F	G	P	F	G	G	P	P	P		P		G	F	P	P
Ryegrass, annual	P	P	P	P	G	NU	G	G	F	G	G	G	G	G	G	G	G	G	G	G	G	P
Ryegrass, perennial	P	F	P	P	G	NU	G	G	F	G	F	F	P	P	G		G	G	G	G	P	P
Velvetgrass	P		P	P	G	NU	G	G	F	G			P	P	G		G		G	G	P	P
Witch grass	P		P	P	G	NU	G	G	F	G	F	F			G		E	G	G	G		P
Woody Species																						
Alder	F	R	P	F	NU		NU									P	NU	NU	P	NU	P	G
Blackberry, evergreen	G	R	P	F	NU	F	NU				G	P	P	P		P	NU	NU	P	NU	P	G
Blackberry, Himalaya	G	R	P	F	NU	F	NU				G	P	P	P		P	NU	NU	P	NU	P	G
Blackberry, trailing	G	R	P	F	NU	F	NU									P	NU	NU	P	NU	P	G
Cherry	G	R	P	F	NU		NU									P	NU	NU	P	NU	P	P
Cottonwood	F	R	P	F	NU		NU									F	NU	NU	P	NU	P	G
Maple	F	R	P	F	NU		NU									P	NU	NU	P	NU	P	F
Maple, vine	F	R	P	F	NU		NU									P	NU	NU	P	NU	P	G
Oak	F	R	P	F	NU		NU									P	NU	NU	P	NU	P	F
Poison-oak	F	R	P	G	NU	F	NU			F			P	P		P	NU	NU	P	NU	P	G
Salal		R	P		NU		NU									P	NU	NU	P	NU	P	
Scotch broom	P	R	P		NU		NU			F			P	P		P	NU	NU	P	NU	P	F
Willow		R	P		NU		NU									P	NU	NU		NU	P	F
Other Weeds																						
Fern, bracken	P	G	P	P	NU	NU	NU	NU	NU	P	F	F	P	P		P	NU	NU	P	NU	F	P
Horsetail, field	P	P	NU	NU	NU	NU	NU	NU	F	P			P	P		P	NU	NU	P	NU		P
E = excellent (90 to 100% control); G = good (80 to 90% control); F = fair (70 to 80% control); P = poor (<70% control); ? = efficacy unknown; — more research needed; NU = not used for this pest; * = used but not a standalone management tool. Note Weed size or stage of growth is an important consideration with most post-emergence herbicides. In "Type" row S = soil-active against pre-emerged weeds; F = foliar-active against emerged weeds.																						