

SECTION T.

PROFESSIONAL LANDSCAPE MAINTENANCE

Introduction

Ed Peachey

Revised March 2022

This section is primarily a reference for commercial enterprises that manage landscapes or garden areas, often with the use of herbicides. Please refer to other University and Extension guides that cover homeowner uses <https://catalog.extension.oregonstate.edu/em8742>. The herbicides listed in this section are intended for commercial use unless noted otherwise.

Weed management in professionally managed landscapes requires a thorough knowledge of the weeds, weed control practices, application options, plant tolerances, and management strategies. Success with any method depends on planning, properly selecting control methods, and effective timing. When selecting chemicals for weed control, you must understand the subtle differences in application techniques, residual activities, susceptibilities, and timing for control of target species, tolerance of desirable plants, potential for weed shifts, and long-term effects of integrating site objectives and year-round weed management strategies. Often, treatments must be repeated or combined with other practices for maximum control.

Weed shifts Weed infestations are dynamic and change depending on previous cultural and weed control practices. For example, routine use of the same or similar herbicides will result in a shift to weed species that tolerate the treatment. Repeated use of simazine in nurseries was first demonstrated to cause a shift within a natural population of common groundsel. Since then, more than 72 species represented in 40 genera have been reported to tolerate triazine herbicides. Globally, there are currently 413 unique cases of herbicide resistance (species x site of action), found in 222 species.

Preventing weed shifts Weeds that survive repeated use of the same or similar herbicides must be eliminated before the tolerant species or biotypes become established. Spot-treat or hand pull weeds and combine these methods with other weed management practices to minimize the occurrence of resistant biotypes.

Managing weedy vegetation Successful weed control in landscapes requires a comprehensive or year-round approach whereby a combination of weed control practices is employed and alternated over several years. Development of these strategies requires knowledge of each weed and weed control practice. Weeds must be identified and information gathered 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 present in the landscape. Note the action of each herbicide or how the chemical works in the plant. Then tank mix, and alternately use these products to reduce the chance of developing resistant species or biotypes. Often a combination of mechanical, herbicidal, and sometimes hand removal or spot treatment with herbicide sprays or wipers will provide the most effective year-round control.

Soil-active herbicides Persistent, soil-applied herbicides can be applied to weed-free soil during winter when rain will activate the chemical. Some compounds may be applied throughout the year if irrigation is available. Apply lower rates on sandy soils having lower clay or organic matter, or cation exchange capacities. Existing vegetation can be controlled by mixing the soil-active herbicide with a post-emergence contact or translocated herbicide, provided such a mix is not prohibited by either label. Consult labels for listed species and duration of expected control. Avoid disturbing the soil when applying.

Postemergence herbicides In landscape plantings, postemergence weed control requires precision since few options exist. Postemergence treatments either selectively control susceptible weeds or are applied with selective equipment. Frequent scouting aimed at identifying susceptible weeds and the correct stage of weed growth must be combined with appropriate weather conditions and labeled spray additives to maximize control. Consult each label for numerous precautions or information about crop or cultivar tolerances. Always test new products on selected plants before adopting their use throughout your operation.

Caution! Information provided in this handbook is not intended to be a complete guide to herbicide use. Before using any chemical, read the recommendations on the label. Before a chemical can be recommended for a specific use, it must be thoroughly

tested. The recommendation on the manufacturer's label, when followed, can prevent many problems from arising from the wrong use of a chemical.

Note Herbicides must be applied at the correct rate and time to selectively control weed growth with minimal chance for injury to landscape plants. Obtain more consistent results by reading the herbicide label and other information about the proper application and timing of each herbicide. 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). Calibrate your equipment precisely and verify exact application rates, especially to irregular landscape sites.

Established Tree, Shrub, Rose, and Ground Cover Landscapes

Ed Peachey

Revised March 2022

Multiply rate by 0.023 for amount per 1,000 sq ft

geo-textiles

Available at agricultural and garden supply stores

Spun-bonded fabrics (non-woven) lightweight, extruded polypropylene fibers; requires mulch cover due to moderate UV light sensitivity; weed roots and rhizomes can penetrate fabric unless removed before establishment; cheapest option.

Woven fabrics moderate-weight polypropylene fibers woven into a mat; can be used without mulch cover due to UV light stability; weed roots and rhizomes can penetrate fabric although tightness of weave can prevent some weeds; moderate cost.

Laminates highly porous, dense poly film bonded to capillary fibers with a pressed, non-woven bottom layer. Surface is slick and causes rapid wetting and drying to prevent weed establishment except for perennial rhizomes that can penetrate the laminate; most expensive geo-fabric.

Soil-applied

DCPA (Dacthal)

Rate 4.5 to 10.5 lb ai/A (6 to 14 lb/A) depending on soil type and target weeds.

Time Apply to weed-free soil in early spring or late summer for control of susceptible winter weeds for annual weed control.

Remarks Performs erratically west of the Cascades. Sprinkler-irrigate after application to activate herbicide. Inhibits mitosis in roots and shoots.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Phthalic acid

dichlobenil (Casoron 4G)

Rate 4 to 6 lb ai/A (100 to 150 lb/A granular product)

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

Remarks Weigh and distribute uniformly and exactly over precisely measured areas to ensure accurate applications. Oregon results 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. Inhibits cellulose and cell wall formation. Products containing dichlobenil approved for homeowner use.

Caution Some groundcovers may not be tolerant; consult label. Pine species are sensitive to injury from Casoron 4G if applied

within two years after transplanting. Do not use on trees that have been established for less than 6 months. Do not allow granules to stick to foliage or to accumulate at the soil line around the base of the tree.

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

Chemical family Nitrile

dimethenamid-p (Tower 6.0)

Rate 0.98 to 1.5 lb ai/A (21 to 32 oz Tower/A)

Time Apply to established plantings prior to weed emergence.

Remarks Does not control emerged weeds. Wait 2 to 4 weeks after planting for soil to settle before application. Irrigation or rainfall is needed to activate herbicide.

Caution Do not apply to seedbeds. Do not apply to sensitive ornamental plants listed on the label such as purple coneflower or ornamental grasses. Do not apply to newly transplanted ornamentals until plants have been watered and soil has been thoroughly packed and settled around roots. Use the low-labeled rate and repeat applications for extended landscape weed control. Do not apply at bud break.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

dithiopyr (Dimension 2EW, EC or Ultra 40WP and several others)

Rate 0.5 lb ai/A (2 pints/A Dimension 2EW)

Time Apply before weeds emerge around bases of ornamental plants in landscape.

Remarks For best results, prepare a weed-free surface with minimal clods and leaf debris. In the spring when buds are rapidly growing and expanding, over the top application of Dimension 2EW may temporarily injure new growth of desirable plants.

Caution Do not exceed 1.5 fl oz/1,000 sq ft every 3 to 4 months (2 pints/A), or 4.5 fl oz/1,000 sq ft per year (6 pints/A). Do not apply to plant roots or weakened ornamental plants, or when drift potential is moderate to high. Do not use in enclosed structures. Dithiopyr is toxic to fish and highly toxic to oysters, shrimp, and other aquatic organisms.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Pyridine

EPTC (Eptam 7E)

Not for use in roses

Rate 5 to 14.9 lb ai/A (5.75 to 17 pints/A) depending on target species

Time Apply and immediately incorporate 2 to 3 inches deep with a rototiller 2 weeks before transplanting balled or canned stock; or, spray postplant and incorporate with tillage. In spring, apply around established plants after growth and incorporate.

Remarks Use higher rates for perennial weed control and incorporate to a depth of 6 inches with a rototiller. Note sensitive flowers listed on label. Primarily for grass control including quackgrass suppression.

Site of action Group 8: lipid synthesis inhibitor but not an ACCase inhibitor

Chemical family Thiocarbamate

flumioxazin (SureGuard SC 51%, BroadStar G 0.25%, and others)

Rate 8 to 12 oz (0.25 to 0.38 lb ai/A) of SureGuard; 0.375 lb ai/A (150 lb/A BroadStar)

Time Apply to weed-free surface. Flumioxazin should only be applied by commercial licensed applicators. SureGuard application near ornamental plants is limited to directed sprays around well-established woody shrubs and trees. BroadStar may be applied over the top of listed species; foliage of desirable crops must be dry at the time of application. Wet foliage will trap granules on the leaf surface or channel granules to the base of growing plants and burn the foliage

Caution Avoid sensitive crops such as buddleia (butterfly bush) and hydrangea. Do not apply to herbaceous bedding plants or

areas where bedding plants will be planted or transplanted within three months following application.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family N-phenylphthalimide

halosulfuron-methyl (Sedgehammer)

Nutsedge control around established woody ornamentals in landscapes; not for use on roses or ground covers

Rate 0.031 to 0.062 lb ai/A (2/3 to 1 1/3 oz product/A)

Time After nutsedge has reached the 3- to 8-leaf stage of growth.

Remarks Wait 3 months after transplanting ornamentals, before application, and allow soil to settle around plant. A second treatment may be required 6 to 10 weeks later. Do not exceed 0.25 lb ai/A total or four applications per season. Use 0.5% nonionic surfactant concentration for broadcast applications.

Caution Do not apply as an over-the-top spray to desirable flowers, ornamentals, vegetables, shrubs or trees. Avoid contact of this product to leaves of desirable plants since foliar injury, discoloration or death may result. Apply to actively growing nutsedge that is not stressed.

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

Chemical family Sulfonylurea

indaziflam (Marengo and Specticle, granular or sprayable)

Rate 0.031 to 0.062 lb ai/A (2.5 to 5 oz/A Specticle)

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

Remarks Existing vegetation must be controlled with glyphosate or burndown herbicides such as glufosinate or paraquat. 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 0.25 inch or more within 3 weeks of application is required for maximum efficacy.

Caution Read label thoroughly to understand situations that should be avoided. This product has a long residual and may injure grasses 2 to 3 years after application. Avoid direct contact with foliage, green bark, or roots of desired species. Clean spray tanks thoroughly after use. Do not apply around bedding plants. Do not apply around bearing fruit trees, unless beyond the tree drip line. Applications over heavily mulched areas may not control weeds adequately. It is best to apply the product before the mulch is applied. Avoid applications to newly seeded grasses.

Site of action Group 29: inhibits cellulose biosynthesis

Chemical family Alkylazine

isoxaben (Gallery 75 DF)

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

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

Remarks Identify weeds; adjust rates according to charts on label. Activate with 0.5 inch water or shallow cultivation before weeds emerge. Chemical stability remains adequate when left on soil surface for 21 days. Primarily controls broadleaf weeds. Products containing isoxaben also approved for home owner use.

Caution Do not apply to newly transplanted crops until soil settles. See label for 14 sensitive ornamental species for which isoxaben is not recommended, including hydrangea, purple coneflower, and yucca. Use untreated soil to fill around transplants if isoxaben has been applied within 1 year. Many approved species are listed on the label, ornamental roses are not mentioned.

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

Chemical family Benzamide

napropamide (Devrinol DF-XT, 2-XT, or 50DF)

Rate 4 to 6 lb ai/A (200 to 300 lb/A 2G)

Time Apply any time to weed-free soil, then sprinkler irrigate to wet soil 1 to 2 inches deep, or apply during midwinter rains in western Oregon for annual weed control.

Remarks Use higher rates with severe weed populations, or when broadleaf weeds are present. Primarily grass control including crabgrass and annual bluegrass. Inhibits root growth. Supplemental label in Oregon for Devrinol 2-XT includes roses.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Acetamide

oryzalin (Surflan AS and several others)

Rate 2 to 4 lb ai/A (2 to 4 quarts/A) depending on length of control

Time Apply any time to weed-free soil, then sprinkler irrigate with 0.5 inch if no rain falls within 1 week, or cultivate 1 inch deep to activate herbicide for annual weed control.

Remarks Consult label for tolerant ornamental species. Both grass and broadleaf control. Suppresses but will not control mustards, prickly lettuce, horseweed, and mallow. Inhibits mitosis, primarily in roots. Available products containing oryzalin are approved for homeowner use.

Caution **Applications of Surflan AS over the top of plants with newly forming buds may cause injury.** Use is not recommended on slender deutzia, Douglas-fir, 'Techny' arborvitae, eastern hemlock, begonia, or coleus.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

oxadiazon (Ronstar 2G, Ronstar Flo, and others)

Rate 2 to 4 lb ai/A (100 to 200 lb/A) depending on target weed species

Time Apply any time to weed-free soil and irrigate with 0.25 to 0.33 inch water immediately after applying for annual weed control.

Remarks Do not cover with soil or mulch, or incorporate, because weed control will desist. Weeds in the pink family (chickweed, mouseear chickweed, and pearlwort) are resistant. Controls a wide range of broadleaves and some grasses. Apply anytime during the year, prior to weed seed germination. Can be applied to both newly transplanted and established ornamentals. Application can be made to actively growing or dormant ornamentals. Rainfall or overhead irrigation after application will improve weed control activity.

Caution **Applications of RONSTAR G must be made by a professional applicator only.** Do not apply to wet foliage or under conditions in which granules will collect on leaves. For residential properties, do not allow unprotected persons or pets to enter the treated areas until the RONSTAR G Herbicide is watered-in. See label for sensitive ornamentals, including some varieties of rhododendron, spruce, hemlock, azalea, viburnum, and cotoneaster. Avoid contaminating water intended for irrigation. Do not use on plants that will produce fruit within 1 year.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Oxadiazole

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

Rate 2 to 4 lb ai/A (100 to 200 lb/A Pendulum 2G) depending on desired length of weed control

Time Apply at time of planting or before weed seed germinates.

Remarks **Directed or over the top sprays.** Controls most annual grasses and some broadleaves. Soil should be loose and free of all established weeds. Water within a few days to activate herbicide before weeds emerge.

Caution Granules may stain stone, wood, or other porous surfaces. Do not apply to newly transplanted ornamentals until plants have been watered and soils has been thoroughly packed and settled around roots.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

prodiamine (Barricade 65WG or 4L and 63 others)

Rate 0.65 to 1.5 lb ai/A (1 to 2.3 lb/A 65WG) depending on desired length of weed control

Time Apply any time to weed-free soil, and incorporate with 0.5 inch water or rain within 14 days.

Remarks May be applied to newly transplanted and established ornamentals as a broadcast, over-the-top spray or directed-spray. Activate with 0.5 inch of rain or irrigation water, or with shallow incorporation.

Caution Do not exceed 2.3 lb/A in any 12-month period. Labels may have slight differences for approved uses.

Site of action Group 3: microtubule inhibitor

Chemical family Dinitroaniline

pronamide (Kerb SC T&O and 50 W or WP)

Not for use in roses or groundcovers

Rate 1 to 2 lb ai/A (2.5 to 5 pints/A)

Time Apply in fall before soil freezes.

Remarks **Fall applications to woody ornamentals before leaf fall.** Preemergence and postemergence control of susceptible winter annual and perennial grasses and chickweed. Requires soil moisture from rain or irrigation to activate; do not incorporate mechanically. Use lower rates for annual grasses and light-texture soils; higher rates for perennial grasses and heavier soils. Control of established grasses is slow. Degraded by microorganisms in warmer weather. Absorbed primarily through roots.

Caution **A restricted-use pesticide for non-residential use only.**

Site of action Group 3: microtubule assembly inhibitor

Chemical family Benzamide

S-metolachlor (Pennant Magnum)

Rate 1.24 to 2.48 lb ai/A (1.3 to 2.6 pints/A)

Time Apply as direct spray toward base of desired plant, either to established ornamentals or 5 days after transplanting.

Remarks Existing weeds must be removed. Primarily controls grasses, but also some broadleaf weeds, and suppresses nutsedge. 12 month PHI if applying to fruit trees.

Caution Do not apply more than twice per year. Consult label for tolerant ornamentals.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

trifluralin (Trifluralin 10G)

Rate 0.4 lb ai/A

Time Apply before weeds emerge.

Remarks Trifluralin must be activated by a single rain or overhead sprinkler irrigation of at least 0.5 inch. If not activated within 3 days, mechanically incorporate trifluralin with equipment that won't damage. Apply before weed seeds germinate; trifluralin will not control established weeds.

Caution Do not apply to ground covers until they are established and well rooted. Do not apply Trifluralin to newly transplanted ornamentals, ground covers, flowers, and non-bearing fruit and nut crops and non-bearing vineyards until soil or potting media has been settled by packing and irrigation or rainfall and no cracks are present or injury may occur.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

Convenient Soil-applied Premixes for Broad-spectrum Control of Grasses and Broadleaf Weeds

benefin + oryzalin (XL 2G)

Rate 200 lb/A per application

Time Apply before target weeds germinate.

Remarks Precisely calibrate application equipment, preferably at half rates, to enable two perpendicular passes for increased accuracy. Inhibits cell division or mitosis, primarily in roots. At least 2 months between applications; do not exceed 600 lb/A per year.

Caution Sensitive species include Douglas-fir, eastern hemlock, and begonia.

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

Chemical family (both) Dinitroaniline

isoxaben + trifluralin (Snapshot 2.5 TG)

Rate 200 lb/A

Time Apply to soil that is free from weeds and debris. Soil must be settled with water and free of cracks after transplanting.

Remarks Activate within 31 days using 0.5 inch of water or shallow cultivation before weeds begin to emerge. Follow label instructions for repeat treatments.

Caution Do not apply to unrooted liners or cuttings, bedding plants, or new-planted ground covers.

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

Chemical family (isoxaben) benzamide; (trifluralin) dinitroaniline

Postemergence or Foliar Applied

bentazon (Basagran T&O)

Rate 0.5 lbs ai/A (1 pt/A Basagran)

Time Spring to early summer, depending on growth stage of weeds.

Remarks Use handheld pump-up back pack or knapsack sprayers. For control of Canada thistle and suppression of sedges and nutsedge where other options such as clopyralid are not possible. For Canada thistle, apply 2 pints/A when plants are between 8 inches tall and bud stage. Apply a second application 2 weeks later if needed. For nutsedge, apply 1.5 to 2 pints/A when plants are 6-8 inches tall, and make a second application 7 to 10 days later if needed. Always add a crop oil concentrate. Use no more than 2 lb ai/A per year. Irrigate to make sure plants are actively growing before applying bentazon. Not as effective if temperatures drop below 50°F at night and in daytime does not exceed 70°F. Efficacy will be poor on drought stressed weeds.

Caution Apply as a directed spray, away from the crop. May apply over the top of some species if crop oil concentrate is not added and application is tested on a few plants to verify crop safety.

Site of action Group 6: photosystem II inhibitor

Chemical family Benzothiadiazole

clethodim (Envoy Plus and several others)

Rate 0.09 to 0.18 lb ai/A (12 to 32 oz/A)

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

Remarks **For grass control in ornamental plantings.** Controls annual bluegrass. Applications made to grass plants stressed by insufficient moisture, hot or cold temperatures, or to grass plants exceeding recommended growth stages may result in unsatisfactory control.

Caution Do not exceed 68 fl oz/A per season. Test for crop safety before applying to landscape species not listed on the label.

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

Chemical family Cyclohexanedione

clopyralid (CleanSlate)

Conifers, non-leguminous woody species, and ornamental grasses in landscapes

Rate 0.094 to 0.65 lb ae/A (0.25 to 1.5 pints/A depending on weed species present)

Time Apply to actively growing broadleaf weeds. For perennials such as Canada thistle, apply after most basal leaves have emerged and before bud stage.

Remarks Spot and directed applications are permissible; do not make broadcast applications. Surfactants or crop oils are generally not needed

Caution Do not allow sprays of this product to contact exposed suckers and/or roots of susceptible trees or shrubs or injury may occur. Do not apply to turf, except golf courses.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

fenoxaprop ethyl (Acclaim Extra)

Rate 0.015 to 0.173 lb ai/A (3.5 to 39 fl oz/A) depending on weed species and growth stage

Remarks For grass control in many deciduous and evergreen trees, and in shrubs and herbaceous and flowering plants. Adjust rates depending on number of grass tillers (see label). Ensure thorough coverage to actively growing, susceptible grasses. Repeat after grass begins active growth, but do not exceed 120 fl oz/A per season. Inhibits fatty acid production, cell membranes, and new growth.

Caution Salvia and philodendron are not tolerant. Determine crop tolerance before extensive use.

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

Chemical family Aryloxyphenoxy propionate

fluzifop (Fusilade II Turf and Ornamental, Ornamec 170)

Rate 0.25 to 0.375 lb ai/A (16 to 24 fl oz/A Fusilade II; 6 to 9 oz/1,000 sq ft Ornamec)

Time Apply to actively growing grasses, or within 7 days after irrigation, as a broadcast or directed spray with 0.25% nonionic surfactant when susceptible grasses are in the labeled growth stage.

Remarks Identify grasses, and adjust rates depending on susceptibility and stage of weed growth as label instructs. Results often are erratic if grasses are 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.

Caution Do not tank mix with other pesticides. Do not apply within 5 days of other pesticide treatments. Not for use on tulips.

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

Chemical family Aryloxyphenoxy propionate

glufosinate ammonium (Finale)

Spot or directed spray only

Rate 2 to 4 fl oz/gal of water

Time Apply to thoroughly cover actively growing weeds.

Remarks May be used to trim or edge landscape plantings.

Caution Do not apply as an over-the-top broadcast spray in ornamentals or shade trees. Avoid all contact with desirable foliage and green bark. REI 12 hr.

Site of action Group 10: glutamine synthase inhibitor

glyphosate (numerous product names)

Not for ground covers

Rate Spray: 1.5 to 5 lb ai/A or 1 to 2% solution for high-volume sprayers

Time Apply as directed spray toward base of bush, when weeds are actively growing or moving sugars to roots.

Remarks Use lower rates for annual weeds; consult label for higher rates and time of application for perennial weeds. Expedite Application Equipment contains a special formulation using small-droplet technology.

Caution Do not spray green foliage or green (undeveloped) bark. If applications are repeated, do not exceed a total of 10.6 lb ai/A (10.6 quarts/A) per year. Repeated use in Australian orchards for several years has resulted in resistant biotypes. To avoid developing weed resistance, rotate chemicals and weed control practices.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate (several products)

Not for ground covers

Rate Wiper: use 33% solution.

Time Apply 1 gal product to 2 gal water and wipe weeds. Avoid contact with desirable vegetation.

Remarks In severe infestations, reduce equipment ground speed or apply in two directions to ensure contact with wiper. (See remarks above.)

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

halosulfuron-methyl (Sedgehammer)

Nutsedge control around established woody ornamentals in landscapes; not for use on roses or ground covers; directed spray only

Rate 0.031 to 0.062 lb ai/A (0.66 to 1.33 oz/A) to three- to eight-leaf nutsedge

Time Directed spray on established woody ornamentals.

Remarks For control of nutsedge. Use lower rate on light infestations and high rate on heavy infestations. Do not exceed 5.33 oz/A per year. Add a nonionic surfactant at 0.25 to 0.5% v/v. May tank mix with glyphosate. Not recommended on roses or ground covers.

Caution Do not apply over the top of desirable flowers, ornamentals, vegetables, trees, or shrubs. Avoid contact of this product to leaves of desirable plants since foliar injury, discoloration or death may result.

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

Chemical family Sulfonylurea

pelargonic acid (Scythe)

For ornamental trees and shrubs only

Rate Broadcast: use 3 to 10 gal product per 100 gal water depending on species to be controlled. Spot spray: use 5 to 10% solution (6.67 to 13 fl oz/gal) to cover 400 sq ft.

Time For burndown of vegetation with directed and shield sprays, and sucker control. Apply to thoroughly wet foliage, either broadcast to non-crop area or preemergence to ornamental crop; or spot treat and trim around ornamentals, trees, flower beds, paths, and drives.

Remarks Controls small, actively growing weeds and weakens established weeds by removing susceptible vegetation. Disrupts cell membranes, causing leakage and symptoms of leaf burn.

Site of action Group 26: unknown

Chemical family Carboxylic acid

sethoxydim (Segment)

Rate 0.28 to 0.47 lb ai/A (36 to 60 fl oz/A)

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

Remarks Labeled for over the top or directed spray on many landscape ornamentals. 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.

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

Chemical family Cyclohexanedione

Root Growth Control

spunbonded polypropylene + trifluralin (Typar Biobarrier)

Remarks A geo-textile fabric containing permanently attached nodules of time-release herbicide. Prevents root encroachment when placed vertically, horizontally, or surrounding structures such as sidewalks, roads, building foundations, curbs, tennis courts, swimming pools, septic fields, or underground pipes or cables in the soil. Extend edge of fabric 18 inches beyond structure to prevent root growth around edges of protected structure. Maintain at least 4 inches of soil overlay. Physical and mitotic inhibition of roots.

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

Chemical family (trifluralin) dinitroaniline

Bulb, Flower Beds, and Native Wildflowers

Ed Peachey

Revised March 2022

Multiply rate by 0.023 for amount per 1,000 sq ft

Preemergence, Soil-applied Treatments

isoxaben (Gallery 75DF, SC, 2.5DG and several others)

Perennial groundcovers and bulbs

Rate 0.495 lb ai/A (0.66 lb/A Gallery 75DF)

Time **Late winter and early spring.** 2 to 4 weeks after planting, before bulbs and annual weeds emerge. Also may apply after bulbs emerge but before they flower.

Remarks Activate with 0.5 inch water or shallow cultivation before weeds emerge. Chemical stability remains adequate when left on soil surface for 21 days. Primarily for broadleaf control.

Caution Not for commercial production sites. Not recommended on tulips taller than 0.75 inch, or on gladiolus before emergence, or if corms were less than 1 inch in diameter, or on bulbs while they are flowering.

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

Chemical family Benzamide

oryzalin (Surflan AS)

Bulbous iris, daffodil, hyacinth, narcissus, tulip and others

Rate 0.75 lb to 1.5 lb ai/A (0.75 to 1.5 quarts/A) depending on target species and time of year applied.

Time Apply 2 to 4 weeks after planting ornamental bulbs but before annual weeds emerge.

Remarks For fall-planted bulbs, apply in late winter to weed-free soil.

Caution Do not apply to emerged tulips taller than 0.75 inch. Do not apply to gladioli corms prior to emergence or less than one (1) inch in diameter.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

oryzalin + benefin (XL 2G)

Including bulbous iris, daffodil, hyacinth, and tulip

Rate Bulbs: use 75 to 150 lb/A depending on soil texture and time of year. Flowers: use 200 lb/A per application with at least 2 months between applications, not to exceed 600 lb/A per year.

Time Apply before target weeds germinate or immediately after cultivation. For bulbs, apply 2 to 4 weeks after planting but before weeds emerge.

Remarks Consult label for tolerant flowers and bulbs. (Inhibits cell division or mitosis, primarily in roots.)

Caution Do not apply to tulips emerged to 0.75 inch high or more, or to gladiolus before it emerges, or to plants less than 1 inch in diameter. Sensitive species include Douglas-fir, eastern hemlock, and begonia.

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

Chemical family (both) dinitroaniline

oxadiazon (Ronstar 50 WSP)

Gladiolus bulbs only, and a few ground covers

Rate 2 to 4 lb ai/A (4 to 8 lb/A WSP) depending on target weed species.

Time Apply any time to weed-free soil and irrigate with 0.25 to 0.33 inch water immediately after applying for annual weed control.

Remarks Over the top or directed sprays. Apply anytime during the year, prior to weed seed germination. Rainfall or overhead irrigation after application will improve weed control activity.

Caution **Applications of RONSTAR G must be made by a professional applicator only.** Irrigate within 2 hr if applied over the top to wash herbicide from leaves. Weeds in the pink family (chickweed, mouse ear chickweed, and pearlwort) are resistant. Primarily broadleaf control.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Oxadiazole

pendimethalin (Pendulum 2G, AquaCap 3.8ME, or several others)

Rate 2 to 4 lb ai/A (100 to 200 lb/A 2G) depending on desired length of weed control. For wildflowers up to 2.1 quarts/A Pendulum AquaCap

Time Apply before, during, or after planting bulbs. Apply to seeded wildflowers after flower seedlings have emerged but before weed seeds germinate.

Remarks May be applied to control susceptible weeds (primarily grasses) in bulbs (including crocus, daffodil, gladiolus, and tulip) and established wildflowers (including black-eyed Susan, California poppy, coreopsis, and oxeye daisy) listed on the label. Primarily for grass control.

Caution Granules may stain stone, wood, or other porous surfaces.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

prodiamine (Barricade 65WG/4FL and several others)

See label for listed bulbs and wildflowers

Rate 0.65 to 1.5 lb ai/A (1 to 2.3 lb/A 65WG or 21-48 oz/A 4FL) depending on length of control desired, and number of applications per year.

Time In fall or spring before weeds germinate or after weeds are removed.

Remarks Irrigate soon after treatment to wash herbicide onto the soil surface and to activate it within the top layer of soil. Do not exceed 2.3 lb/A.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

S-metolachlor (Pennant Magnum)

Many bulbs and flowers, except daffodil

Rate 1.24 to 2.48 lb ai/A (1.3 to 2.6 pints/A) depending on soil type and organic matter.

Time After transplanting

Remarks Apply when soil has firmed around plant. Irrigate shortly after planting to wash the herbicide from foliage and to activate the herbicide in the soil. Will not control emerged weeds. Existing weeds must be removed. Primarily targets grasses but controls some broadleaves and suppresses nutsedge. Inhibits seedling roots and/or shoots.

Caution Consult label for tolerant and approved species. Do not apply more than twice per year.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

trifluralin (Treflan 10G)

Rate 0.4 lb ai/A (40 lb/A)

Time Apply Trifluralin 10G to the soil surface 2 to 4 weeks after planting, but prior to the emergence of annual weeds. Trifluralin 10G may also be applied following bulb emergence. For fall planted bulbs, apply Trifluralin 10G again in late winter or early spring to weed-free soil surfaces.

Remarks Trifluralin must be activated by a single rain or overhead sprinkler irrigation of at least 0.5 inch. If not activated within 3 days, mechanically incorporate trifluralin with equipment that won't damage bulbs. Apply before weed seeds germinate; trifluralin will not control established weeds.

Caution Do not make preplant applications of Trifluralin 10G to areas where gladioli corms less than one inch in diameter will be planted or injury may occur.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

Postemergence or Foliar-applied Treatments

bentazon (Basagran T&O, Broadloom)

Rate 0.5 lb ai/A (1 pint/A Basagran)

Time Spring to early summer, depending on growth stage of weeds.

Remarks Use handheld pump-up backpack or knapsack sprayers to direct spray around bulbs, bedding plants and flowers. For control of Canada thistle and suppression of sedges and nutsedge where other options such as clopyralid or S-metolachlor are not possible. For Canada thistle, apply 2 pints/A when plants are between 8 inches tall and bud stage. Apply a second application 2 weeks later if needed. For nutsedge, apply 1.5 to 2 pints/A when plants are 6-8 inches tall, and make a second application 7 to 10 days later if needed. Always add a crop oil concentrate. Use no more than 2 lb ai/A per year. Irrigate to make sure plants are

actively growing before applying bentazon. Not as effective if temperatures drop below 50°F at night and in daytime does not exceed 70°F. Efficacy will be poor on drought stressed weeds.

Caution Apply as a directed spray, away from the crop. May apply over the top of some species if crop oil concentrate is not added and application is tested on a few plants to verify crop safety.

Site of action Group 6: photosystem II inhibitor

Chemical family Benzothiadiazole

clethodim (Envoy Plus and several others)

Many bulbs, and flower beds

Rate 0.09 to 0.18 lb ai/A (9 to 32 oz/A) depending on weed species

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

Remarks For grass control in ornamental plantings. Controls annual bluegrass. Applications made to grass plants stressed by insufficient moisture, hot or cold temperatures, or to grass plants exceeding recommended growth stages may result in unsatisfactory control. NIS required at 0.25%.

Caution Do not exceed 68 fl oz/A per season. Test for crop safety before applying to landscape species not listed on the label.

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

Chemical family Cyclohexanedione

fenoxaprop ethyl (Acclaim Extra)

Daylily, iris and others

Rate 13 to 39 fl oz/A

Remarks Adjust rates depending on number of grass tillers (see label). Ensure thorough coverage to actively growing, susceptible grasses. Repeat after grass begins active growth but do not exceed 120 fl oz/A per season. Inhibits fatty acid production, cell membranes, and new growth.

Caution Determine crop tolerance before extensive use.

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

Chemical family Aryloxyphenoxy propionate

fluazifop (Fusilade II)

Alyssum, marigold, petunia, geranium, iris, zinnia, and many others; not for tulips

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

Time Apply to actively growing grasses or within 7 days after irrigation with 0.25% nonionic surfactant when susceptible grasses are in the labeled growth stage.

Remarks Check label for crops that can be injured by over-the-top applications. 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. Do not apply within 5 days of other pesticide treatments.

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

Chemical family Aryloxyphenoxy propionate

sethoxydim (Segment II)

Rate 0.28 to 0.47 lb ai/A (1.5 to 2.5 pints/A)

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, but quackgrass can be suppressed. Inhibits fatty acid production, cell membranes, and new growth. Many species of bedding plants, ground covers and wildflowers are listed as tolerant on the label, but some have been injured in limited testing such as snow-in-summer (*Cerastium tomentosum*). Best to test plant tolerance on a small area if tolerance is in question.

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

Chemical family Cyclohexanedione

General Maintenance around Ornamental Plantings

Ed Peachey

Revised March 2022

diquat (Reglone)

Rate 0.5 lb ai/A

Time Apply any time when weeds are small and actively growing.

Remarks Avoid spray contact with desirable ornamental plants. Acts as a contact; absorbs electrons after photosynthesis and recycles herbicide.

Caution A moderately toxic herbicide; protective gear required for handling and application. Do not ingest or inhale spray mist. Wear protective face shields, respirators, and clothing.

Site of action Group 22: photosystem I electron diversion

Chemical family Bipyridilium

glyphosate (numerous product names)

Rate Spray: use 1.5 to 5 lb ai/A, or 1 to 2% solution for high-volume sprayers.

Time Apply as directed spray toward base of ornamental plant when weeds are actively growing or moving sugars to roots.

Remarks Use lower rates for annual weeds; see label for higher rates and timing for perennial weeds. Expedite Application Equipment contains a special formulation using small-droplet technology.

Caution Do not spray green foliage or green bark. If repeating applications, do not exceed a total of 10.6 lb ai/A (10.6 quarts) per year. Inhibits production of three amino acids and protein synthesis.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate

Rate Wiper: use 33% solution.

Time Apply 1 gal product to 2 gal water and wipe weeds, avoiding contact with desirable vegetation. In severe infestations, reduce equipment ground speed or apply in two directions to ensure contact with wiper. (See remarks above.)

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted