

SECTION U.

TURFGRASS

Alec Kowalewski

Revised March 2020

Influence of Cultural Practices on Weed Encroachment

Poor turf culture is a major reason for weedy lawns. Any effort to control weeds in turf should start with improving cultural practices (mowing, fertilization and irrigation). Properly implemented primary cultural practices will reduce the turfgrass susceptibility to weed encroachment and prevent conditions conducive to weed growth and development.

Mowing

Increasing your mowing height and increasing your mowing frequency will reduce weed occurrence in lawns. Increasing your mowing height provides a number of benefits, such as deeper rooting, which will translate to increased drought tolerance. Increasing the mowing height will also prevent weed seed germination. Weed seeds are constantly entering turfgrass, but establishment will be substantially reduced by increasing mowing height. The increased mowing height reduces the amount of sunlight that reaches weed seeds at the soil surface.

Increasing mowing frequency will also mitigate weed encroachment by increasing turfgrass density. At a minimum turfgrass should be mowed once a week, while putting greens will likely require daily mowing during period of peak growth. More frequent mowing triggers a physiological response within the turfgrass directing more energy and resources into lateral growth rather than vertical growth. Having denser turfgrass will minimize the establishment of annuals grasses, like crabgrass, and annual bluegrass.

Acceptable mowing heights for commonly used turfgrasses are below.

Mowing Height Ranges for Northwest Turfgrasses	
Turfgrass species	Optimum Height Range (inches)
Bentgrass (colonial, bent and highland)	0.5 to 1
Fine fescue (chewings, red and hard fescue)	1.5 to 2.5
Perennial ryegrass	1.5 to 2.5
Kentucky bluegrass	1.5 to 2.5
Tall fescue	2.5.5 to 3.5

Fertilization

The second primary cultural practice is fertilization. Maintaining adequate levels of nitrogen and monitoring soil pH are important for a successful IPM program. Nitrogen is the primary nutrient, and turfgrass will require substantially more nitrogen annually than any other nutrient. Depending on the species 2 to 6 lb N per 1,000 sq ft are recommended annually. Tall fescue, fine fescue and bentgrass will require low amounts of nitrogen (2 lbs N per 1,000 sq ft annually), while Kentucky bluegrass and perennial ryegrass will required high amounts of nitrogen (4 to 6 lbs per 1,000 sq ft annually). A maximum rate of 1 lb N per 1,000 sq ft can be applied

in a single application. Applications should be made in the spring and fall months. The other primary nutrients are phosphorous (P) and potassium (K); therefore, it is advantageous to select a fertilizer with these nutrients as well. Fertilizer applied to established lawns should have high amounts of N, low amounts of P and moderate amounts of K, such 25% N – 3% P – 10% K.

Do not apply fertilizer containing P near water sources in late fall or winter, to limit the risk of runoff. In an effort to protect water quality, it is now a best management practice in the state of Washington for homeowners and publicly owned turfgrass areas to conduct a soil test before they are allowed to purchase a turf fertilizer containing phosphorus. In this circumstance soil testing should be conducted once every three years.

Removal of clippings during mowing significantly increases fertilizer requirements. Tests indicate from 25% to 50% of applied N may be removed with clippings. Removing clippings may deplete nutrients in soil and ultimately lead to loss of turf density and increased weed invasion. It is good to return clippings to the site when possible. It can add back enough nitrogen to back off on one of your fertilizer applications if you have been fertilizing appropriately.

Irrigation

The third primary cultural practices in turfgrass management is irrigation. Lack of irrigation (e.g., prolonged summer drought) causes turf to go dormant and survive via crowns, rhizomes, and stolons; turf density decreases, which allows weeds to compete freely once fall rains come or irrigation begins. Once weeds are established, they often thrive under this drought cycle because many are exceptionally deep rooted. Lawns allowed to go dormant every summer require more intensive efforts to control weeds chemically than lawns that are irrigated enough to ensure optimum turf density.

Irrigation should be applied at a 0.25” depth per application 3 to 6 times per week totally 0.75” to 1.5” per week depending on the turfgrass species and environmental conditions. Kentucky bluegrass, perennial ryegrass and fine fescue will require more irrigation to maintain high quality turfgrass, while tall fescue and bentgrass will require less irrigation. Weeds that are an indication of too little irrigation include false dandelion and summer annuals like crabgrass.

Chemical Control of Broadleaf Weeds in Turf

This section summarizes herbicides and herbicide mixtures for use within turfgrass.

Weed susceptibilities to these materials can be found in the table at the end of this section.

Caution Information in this handbook is not intended to be a complete guide to herbicide use. Before using any chemical, read the container label recommendations. 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 from arising through the wrong use of a chemical.

Weed and Feed Products Granular products containing fertilizer and herbicide (often referred to as weed and feed) are popular within the residential and commercial turfgrass industry. Be sure to read the label closely when selecting a fertilizer/herbicide combination. These products contain a variety of different herbicide activities including pre-emergent and post-emergent. A few examples of available products include: 10-3-10 fertilizer with 0.2% Dimension, 22-0-4 All in One Weed and Feed, 18-0-6 Weed Free Zone Plus, 12-5-5 Premium Weed & Feed, 20-0-0 Ultra Turf Moss-Ex Lawn Granules, and 22-4-10 Fert with TGR Poa Annuua Control.

2,4-D (2,4-D Amine 4)

Rate 2 to 4 pints/a

Time Apply when broadleaf weeds listed on label are actively growing.

Remarks 2,4-D is a foliar- or root-absorbed translocated herbicide available as amine salts and low-volatile esters. Amines are generally safe in a wide range of temperatures. Esters are useful in cool, rainy weather but are more likely to volatilize. 2,4-D is effective on dandelion, false dandelion, and plantains but weak on clover and other hard-to-kill weeds. 2,4-D is best used in mixtures for broad-spectrum weed control.

Caution 2,4-D may injure sensitive grasses such as bentgrass (turf) and roughstalk bluegrass when applied at high rates or during periods of environmental stress. Make sure to follow the regulations in eastern Washington for formulation and application timing allowed. Do not exceed maximum of 6 pints/a per season, excluding spot treatments.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

bromoxynil (Broclean for sod farms, Agrisolutions MOXY 2E, Agristar BROX 2EC, Buctril 4EC Herbicide, Buctril Herbicide, Cleansweep D Herbicide, Maestro 2EC Herbicide, Maestro 4EC Selective Herbicide)

Rate 1 to 2 pints/a. All mixtures with bromoxynil are for non-residential turfgrasses.

Time Must be applied to actively growing weed seedlings (less than four-leaf stage, 2 inches tall, or 1 inch in diameter) for optimal control.

Remarks Broclean is available as an octanoic acid ester formulation of bromoxynil. A selective postemergence herbicide, it controls certain broadleaf weeds in sod production, seedling and established nonresidential turfgrass, noncropland, and industrial sites. Acts on contact with very little persistence. Established turfgrasses tolerant to bromoxynil are bentgrasses, Kentucky bluegrass, fescues, ryegrass, bermudagrass, zoysiagrass, and St. Augustinegrass. It is active on a range of weeds, including annual sowthistle, field pennycress, lambsquarters, nightshades (black, eastern black, cutleaf, hairy, and silverleaf), green and Pennsylvania smartweed, pepperweed, and shepherdspurse. It will suppress Canada thistle only by burning down the top growth. See label for tank-mix recommendations with specific herbicides, and for cautions and additional weeds that those mixtures control.

Caution Leaves may burn if plants are stressed at time of application. Apply to dry foliage when weather is not extreme, to minimize temporary leaf burn. Do not apply with fertilizers if leaf burn is a concern due to environmental conditions. Screens

should not be finer than 50 mesh in nozzle tips and in-line strainers on the sprayer. Do not exceed 2 pints/a.

Site of action Group 6: photosynthesis II inhibitor

Chemical family Nitrile

carfentrazone-ethyl (QuickSilver T&O Herbicide)

Rate For moss control by itself use 6.7 fl oz/a, with a second application at 6.7 fl oz/a two weeks after the first application.

Time Apply when broadleaf weeds listed on label are actively growing. Do not apply when conditions favor spray drift or poor spray coverage. Allow at least 2 weeks between sequential broadcast applications. Do not apply by air or through any type of irrigation system.

Remarks QuickSilver T&O Herbicide is a contact herbicide with little or no residual activity. It provides selective postemergence control of broadleaf weeds and silvery thread moss (*Bryum argenteum*) in turfgrass. It is an aryl triazolinone herbicide that interrupts chlorophyll synthesis and produces metabolic byproducts that disrupt plant cell membranes. This process occurs only in susceptible green plants in the presence of light. Symptoms may appear on foliage in 24 hours or less, in susceptible plants. Complete desiccation and death occur within 7 to 14 days of application. QuickSilver is rainfast within 1 hour after application. Established cool-season grasses generally tolerate applications at labeled rates. Tall fescue may yellow slightly within 3 to 5 days after application under some conditions. Recovery typically is within 4 to 7 days. If such injury cannot be tolerated, apply to a small test area before treating a large area. QuickSilver can be applied to the following species of turfgrass 7 days or more after emergence: creeping bentgrass, tall fescue, perennial ryegrass, and Kentucky bluegrass.

Caution Do not apply to carpetgrass, dichondra, or to lawns or turf with desirable clovers. Avoid spray drift to nontarget, desirable, susceptible plants such as vegetables, flowers, ornamentals, trees, and shrubs. Product can be tank-mixed with other products, but observe all label restrictions regarding turf tolerance of companion products when tank-mixed with QuickSilver T&O. Maintain spray solution at pH 5 to 8. Do not exceed 6.7 fl oz/a (0.1 lb ai/a) per application or 26.8 fl oz/a (0.4 lb ai/a) per season.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Triazinone

clopyralid (Lontrel T&O, Clean Slate)

Rate 0.25 to 1.33 pints/a (0.09 to 0.50 lb ae/a)

Time Apply to broadleaf weeds listed on label only on healthy, well-established turf that has a well-anchored root system.

Remarks A foliar- and root-absorbed, highly translocated herbicide formulated as an amine salt. It is active on legumes, black medic, clover (red, hop, white, and sweet), thistles, knapweeds, and speedwell. Use on nonresidential turf such as athletic and recreational sports fields, cemeteries, golf courses, industrial sites, military bases, noncropland, parks, rights-of-way, schools, and other nonresidential turf roadsides.

Caution A restricted-use herbicide in Washington. For use on golf courses only in Washington and Oregon. Lawn uses are restricted to nonresidential uses only. Lontrel T&O is safe on bentgrass; Kentucky bluegrass; Chewings, creeping, and sheep fescue; tall fescue; and perennial ryegrass. May discolor or stunt turf that is not well established or that is stressed by unfavorable conditions. Do not contaminate irrigation ditches or water for

irrigation or domestic uses. Susceptible trees or shrubs (legumes) will be injured if sprays contact exposed suckers and/or roots. Do not reseed turfgrass for 3 weeks after application. Do not use on golf course putting greens or tees or on residential turf. Do not send clippings to a compost facility. Do not collect grass clippings for mulch or compost. Applicators must tell landowners/property managers not to use grass clippings for composting.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Pyridine

clopyralid + triclopyr (Confront, Quali-Pro 2-D Herbicide)

Rate 1 to 2 pints/a (0.09 to 0.19 lb ae/a clopyralid; 0.28 to 0.56 lb ae/a triclopyr)

Time Apply to actively growing broadleaf weeds listed on label.

Remarks A foliar- and root-absorbed, highly translocated herbicide formulated as an amine salt. It is active on legumes, docks, knotweed, and dandelions, among others.

Caution A restricted-use herbicide in Oregon and Washington. For use on golf courses only in Washington and Oregon. Clopyralid + triclopyr mixtures appear safe on tall fescue, Kentucky bluegrass, and perennial ryegrass but may injure bentgrasses, roughstalk bluegrass, and annual bluegrass. Do not use on residential turf. Do not send clippings to a compost facility or use for mulch or compost. Applicators must tell landowners/property managers not to use grass clippings for composting. Do not exceed 4 pints/a Confront per year.

Site of action (both) Group 4: synthetic auxin

Chemical family (both) Pyridine

dicamba (Banvel Herbicide, Clarity Herbicide, Clash Selective Herbicide, Alligare Cruise Control, Alligare Dicamba 4, Detonate Herbicide, Diablo, Dicamba DMA Salt, Dicamba MAX 4, Dicamba, Dicash DGA-4 Herbicide, DuPont BL1 Herbicide, DuPont Dicamba XP Herbicide, DuPont Fexapan, Topeka, Riverdale Vanquish, Vision, Rifle Herbicide, Agrisolutions Sterling Blue Herbicide, Xtendimax with Vaporgrip Technology)

Rate 0.25 to 2 pints/a (0.125 to 1 lb ae/a)

Time Apply to actively growing broadleaf weeds listed on label.

Remarks Dicamba is a foliar- and root-absorbed translocated herbicide available in dimethylamine and sodium salt formulations. It is active on a wide range of weeds, including clovers, chickweeds, and yarrow. It is weak on Oxalis species (wood-sorrel), violets, plantains, and pineapple weed, among others. Dicamba is widely used in mixtures to broaden the spectrum of weed control.

Caution Dicamba persists in soil longer than other common broadleaf herbicides and can move with the wetting front of soil water. Used repeatedly at high rates, it can injure nontarget trees and shrubs via root uptake. As formulated in mixtures, dicamba is generally safe when applied at label rates. Wait 30 days between applications. Do not exceed 4 pints/a per growing season.

Site of action Group 4: synthetic auxin

Chemical family Benzoic acid

dichlorprop (2,4-DP or many other products)

Rate Use a maximum of 0.75 lb ae/a per broadcast application; maximum of 2 lb ae/a for spot treatments.

Time Apply to actively growing broadleaf weeds listed on label.

Remarks 2,4-DP is a foliar- or root-absorbed translocated herbicide available in many mixtures with many other ingredients, in ester and potassium salt formulations. Weed control spectrum is limited when used alone. In mixtures, it generally is more active than MCPP, which it replaces.

Caution Tolerance of grasses to 2,4-DP appears to be similar to tolerance of 2,4-D. Aerial applications are prohibited. Broadcast applications are limited to 0.75 lb ae/a total in no more than two applications per year at least 30 days apart. Spot treatments are limited to 2 lb ae/a total in no more than two applications per year at least 30 days apart. Mixers and loaders supporting hand-gun applications must wear respirators. Do not apply within 25 ft of water. Reentry interval is 48 hours.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

dithiopyr (Armortech CGC 2L, Dimension 2EW Specialty Herbicide, Dimension EC Specialty Herbicide, Dimension Ultra 40WP Specialty Herbicide, Dimension 270-G Turf & Landscape Ornamental, Dithiopyr 2L Specialty Herbicide, Quali-Pro Dithiopyr 40 WSB Specialty Herbicide, many fertilizer products with dithiopyr on granules.)

Rate Use 0.19 to 0.38 lb ae/a.

Time Apply preemergence when soil is about 50°F (approximately when forsythia blooms). Apply postemergence to crabgrass and annual bluegrass when they are very small (below the first tiller stage).

Remarks Dithiopyr is available in EC, 40WSB, and 40WSP formulations, as granules, and on fertilizers. It gives preemergence control of crabgrasses, foxtails, barnyardgrass, and a number of broadleaf weeds, including purslane, Oxalis species, and spurge. It also gives preemergence control of annual bluegrass (*Poa annua*). It gives postemergence control of crabgrass up to the first tiller growth stage. Dithiopyr appears to be safe on mature creeping bentgrass, Kentucky bluegrass, perennial ryegrass, tall fescue, and some fine fescues.

Caution Do not use on seedling turf; injury will be severe. Do not apply to turf under environmental stress. Do not apply more than 0.5 lb ai/a per application or more than 1.5 lb ai/a per year in split or sequential applications.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Pyridine

florasulam (Defendor Specialty Herbicide)

Rate Use 4 fl oz/a (0.25 pints/a; 0.09 fl oz/1,000 sq ft; 2.7 ml/1,000 sq/ft)

Time Apply to small actively growing broadleaf weeds as listed on label.

Remarks When Defendor is applied in early spring, it will prevent dandelions from blooming. It is a systemic herbicide that is absorbed via the leaves, shoots and roots of susceptible broadleaf weeds. It works as an ALS inhibitor, preventing enzyme synthesis and cell division. When applied early in the season, growth of

susceptible weeds will be stunted immediately and effective control will be seen in 2 to 4 weeks. It is safe on most cool-season and warm-season grasses when they are established.

Caution Do not apply to golf course greens. When applying in tank mix combinations, follow label use directions, precautions and limitations. Do not allow Defendor to sit in tank overnight or for prolonged periods without agitation before use. Do not apply directly to desirable plants such as flowers, trees, or ornamental shrubs as serious damage may occur. Do not allow sprays of Defendor to come into contact with exposed suckers or roots of shallow rooted trees or shrubs or damage will occur. To minimize damage to turfgrass, do not apply additional applications within 4 weeks of a previous application. Do not use treated clippings for mulch around edible plants. Do not apply more than 12 fl oz (0.75 pints; 0.039 lb ai florasulam) /a per annual growing season. Do not apply this product through any type of irrigation system.

Site of action Group 2: acetolactate synthase inhibitor

Chemical family Triazolopyrimidine sulfonanilide

fluroxypyr (Comet Selective Herbicide, Vista XRT, Vista XRT Specialty Herbicide)

Rate Use 0.33 to 1.33 pints/a Vista XRT (0.12 to 0.47 lb ae/a); 0.67 to 2.67 pints/a Comet (0.125 to 0.5 lb ae/a)

Time Apply to actively growing broadleaf weeds as listed on label.

Remarks Supplemental label (Vista XRT). Fluroxypyr is a non-volatile ester for postemergence control of annual and perennial broadleaf weeds and woody brush in established turf, including residential lawn, golf courses, sports fields, sod farms, around commercial buildings, and other commercial turf areas. Mow newly seeded turf two or three times before application. Control may be less if applied to wet foliage. Product is rainfast within 1 hour after application. Can be tank-mixed with other postemergence broadleaf herbicides for additional control of white clover, black medic, dandelion, plantain, Oxalis species, and others.

Caution Do not use on golf course putting greens or tees. Do not let spray contact exposed suckers or exposed roots of shallow-rooted trees and shrubs, or injury may occur. To minimize grass injury potential, do not reapply within 4 weeks. Avoid spraying when humidity is low and/or temperatures are high to avoid evaporation and spray drift. Do not tank-mix with a product containing boron; do not mix in equipment previously used to apply a product containing boron unless the tank and spray equipment have been adequately cleaned. Undiluted Spotlight and 2,4-D amine concentrates are not compatible, and cannot be mixed together in the same supply tank when using injection equipment; however, combinations of Spotlight and 2,4-D ester are compatible for this purpose.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

indaziflam (Spect(i)cle 20WSP, Spect(i)cle FLO, Spect(i)cle G, Spect(i)cle Total, Esplanade 200 SC)

Warm season grasses only

Rate Specticle 20WSP: 2.5 to 5 oz/a; Do not exceed 7.1 oz/a per year; Specticle Flo: For single applications: 5 fl oz /a; for multiple applications: 3 to 4.5 fl oz /a., second application 90 days later... Esplanade should be applied at 5 fl oz/a per application

to warm-season turf, repeated applications can be made but the annual rates cannot exceed 10 fl oz/a annually.

Time Apply as a preemergence herbicide to warm season grasses only.

Remarks Indaziflam is a preemergence herbicide that provides outstanding residual control (3 to 8 months) of goosegrass, crabgrasses and *Poa annua*, as well as many broadleaf weeds and annual sedges. It is a non-staining, low-odor formulation. Its primary site of action is the newly developing root of a germinated weed seedling. Necrosis or yellowing may be observed if the herbicide is applied to herbaceous tissue such as leaves and green stems of adjacent ornamental or sensitive turf types. Specticle carries a caution label and delivers the lowest amount of active ingredient than any other currently used preemergence herbicide in turf. Specticle applied prior to *Poa annua* germination will supply exceptional preemergence control while offering the flexibility of making later applications. Turf managers can receive an added benefit from an application of Specticle by being able to make applications up to 2 months after peak germination.

Caution Cool-season grasses like creeping and colonial bentgrass, annual bluegrass, roughstalk bluegrass, tall fescue, fine fescue, perennial ryegrass, annual ryegrass and Kentucky bluegrass are not tolerant to indaziflam. Esplanade is labeled for use on warm-season grasses. Indaziflam requires rainfall or irrigation after application to activate the herbicide and provide maximum control. If insufficient soil moisture is present, this might allow weeds to emerge from deeper soil layers where sufficient soil moisture for the germination of the weed seeds is available. If making more than one application per year, allow a minimum of three months between applications.

Site of action Group 29: Inhibition of cellulose biosynthesis

Chemical family Alkylazine

isoxaben (Gallery 75 Dry Flowable, Gallery SC Specialty Herbicide, Quali-Pro Isoxaben 75 WG Herbicide)

Rate 1.33 lb/a or 0.5 oz or 14 g/1,000 sq ft

Time Apply before weed seed germinates.

Remarks A preemergence herbicide that controls susceptible broadleaf weeds as they germinate. It is root-absorbed and has limited herbicidal activity once weeds emerge. Available as a dry flowable material. Controls chickweeds, clovers, Oxalis species, pineappleweed, narrowleaf plantain, spurge, and many other weeds.

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

Chemical family Benzamide

MCPA (Dagger 5.2LB MCPA Ester Herbicide, MCPA-4 Amine, Nufarm Rhomene MCPA Broadleaf Herbicide, NuFarm Rhonox MCPA Ester Herbicide, Riverdale MCPA L.V.4 Ester, Sword Selective Herbicide, Wildcard Herbicide)

Rate 0.25 to 4 pints/a

Time Apply to actively growing broadleaf weeds listed on label.

Remarks A foliar- or root-absorbed translocated herbicide available in amine and sodium salts and in ester formulations. Its activity and spectrum of weed control are very similar to 2,4-D.

Caution MCPA may injure sensitive grasses such as bentgrass (turf) and roughstalk bluegrass if applied at high rates or during periods of environmental stress.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

MCPP (Mecoprop, Gordons Prof T/O Mecomec 4 Turf Herbicide, Riverdale MCPA p-4 Amine, and many other products)

Rate Broadcast applications: 0.75 lb ae/a; Spot treatments: 1.2 lb/a to areas no larger than 1,000 sq ft; 1.45 oz/1,000 sq ft or 64 oz/a

Time Apply to actively growing broadleaf weeds on label.

Remarks A foliar-absorbed translocated herbicide available in amine and potassium salt (mixes) formulations. It is effective on chickweeds when used alone but is weak on other broadleaf weeds. It is best used in mixtures with 2,4-D and dicamba, where it broadens the spectrum of weed control and reduces injury to sensitive grasses. MCPP is safer on bentgrass lawns and greens than any other phenoxy compound. Limit broadcast applications to 0.75 lb ae/a total in no more than two applications per year, at least 30 days apart. Limit spot treatments to 1.2 lb ae/a total in no more than two applications per year, at least 30 days apart. Do not apply by air or within 25 ft of water. Reentry interval is 48 hr.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

mesotrione (Tenacity)

Rate Use 4 to 8 fl oz/a in 30 gal water for both pre-emergence and early post-emergence control. , use 5 to 8 fl oz/a of Tenacity in 30 gal of water/a. For bentgrass control use 5 fl oz/a in 30 gal of water. Do not apply more than 16 oz/a year. For spot treatment mix 1 teaspoon of Tenacity in 2 gallons of water with 3 teaspoons of nonionic surfactant, apply at a rate of 1 gallon per 1,000 sq ft.

Time Apply prior to seeding or following seedling emergence. When applying after seeding wait until the newly germinated turf has been mowed two times or four weeks after emergence (whichever is longer) before making a post-emergence application

Remarks Tenacity is a systemic preemergence and early post-emergence herbicide for the selective contact and residual control of weeds in turfgrass [golf courses (not putting greens), sod farms, athletic fields, parks, residential and commercial properties, cemeteries, airports, and lawns]. Applied pre-emergence, weeds absorb Tenacity during emergence from soil. A repeat application is required after 2 to 3 weeks for improved post-emergence weed control. Add a nonionic surfactant in post-emergence applications. Dry conditions after application may reduce the preemergence activity. If rain (0.15 inches) has not fallen within 10 days after a preemergence application, activate with 0.15 inches of irrigation.

Caution: Tenacity may temporarily whiten turfgrass foliage. Do not apply to newly germinated turfgrass until it has been mowed two times, or approximately 4 weeks after emergence. Do not use on golf greens. Do not exceed 5 fl oz/a per application to perennial ryegrass or fine fescues, or mixed stands that contain greater than 50% perennial ryegrass and/or fine fescue. Tenacity may reduce density of fine fescue seedlings. Withhold traffic on treated areas until spray has dried, and irrigate lightly to move

product from turf foliage before resuming normal irrigation to prevent movement onto sensitive species such as bentgrass. Do not plant any crop other than turfgrass species for 18 months after the last application of Tenacity because injury may occur.

Site of action Group 27: inhibits 4-hydroxyphenylpyruvate-dioxygenase (4-HPPD)

Chemical family Triketone

metsulfuron-methyl (Alligare MSM, DuPont Escort XP Herbicide, Manor Selective Herbicide, Mansion Turf Herbicide, MSM 60DF, Metcel VMF Herbicide, Metsulfuron 60 EG, Patriot Selective Herbicide, Rometsol Herbicide)

Rate Use 0.25 to 0.5 oz Manor/a. Do not apply more than 0.5 oz/a within 9 month period.

Time Apply to actively growing weeds listed on the label.

Remarks For use on golf courses, lawns, noncrop nonagricultural areas, recreation areas, sod farms, and ornamental turf. Safe for use on Kentucky bluegrass and fine fescues. Do not apply to turf less than 1 year old, or to turfgrass stressed by drought, insects, disease, cold, temperatures above 85°F on cool-season grasses, or poor fertility; injury may result. Adding nonionic surfactant of at least 80% ai at 0.25% v/v (1 quart/100 gal) provides best performance but may temporarily increase turf chlorosis. Use spray volumes of 20 to 80 gal/a and pressures of 25 to 35 psi. Use large droplet size to minimize spray drift Mansion can control annual sowthistle, Canada thistle, common chickweed, common groundsel, yarrow, curly dock, dandelion, henbit, lambsquarters, plantain, prostrate knotweed, prostrate spurge, wild carrot, wild garlic, and woodsorrel (Oxalis).

Caution When overseeding, wait 2 months after application. Do not apply to any body of water, including streams, irrigation water, or wells. Do not apply where water may run off onto agricultural land; crop injury may result.

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

Chemical family Sulfonylurea

penoxsulam (Sapphire, Sapphire Specialty Herbicide,)

Rate 0.25 to 0.5 pints/a (0.01 to 0.02 lb ai/a)

Time Apply to actively growing weeds.

Remarks For use on bentgrasses, Tall fescue and perennial ryegrasses on golf courses, lawns, general turf, school outdoor areas, and sod farms. Under heat stress conditions use only 0.25 pints (0.01 lb ai)/a on perennial ryegrass and tall fescues. Enhances control of white clover, dandelion, sedge weeds, ground ivy, chickweed, oxalis, bittercress, pigweed, kyllinga, sagebrush, broadleaf plantain, and English lawn daisy.

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

Chemical family Sulfonylaminocarbonyltriazolinone

quinclorac (Quali-Pro Quinclorac 75DF, Drive XLR8 Herbicide, Eject 75DF, Halts Pots Crabgrass Control Turf Herbicide, NuFarm Quinclorac SPC 75 DF Herbicide)

Rate Use 0.367 oz/1,000 sq ft or 0.75 lb ai/a. On creeping bentgrass use 0.123 to 0.245 oz/1,000 sq ft or 0.25 lb ai to 0.50 lb ai/a in 2 to 3 applications. See label for timing of applications.

Time Apply postemergence to actively growing weeds listed on label. Apply preemergence before weed seeds germinate

Remarks A selective herbicide with both preemergence and postemergence activity that kills tough broadleaf weeds and grasses such as clover; dandelion; English daisy; foxtail; common, slender, and thymeleaf speedwell; and crabgrass. Drive herbicide enters susceptible weeds through foliage and roots. It is translocated throughout the plant and accumulates in the meristematic regions, where it disrupts plant growth. It offers residual control of annual and perennial weeds through germinating seed uptake. Residual control is 60 to 90 days, depending on application rates, soil type, weed species, and moisture availability. After applying Drive, plants exhibit leaf and stem twisting and chlorosis. Grasses exhibit stunting, chlorosis, and a gradual reddening, followed by necrosis. Use methylated seed oil or crop oil concentrate additives for greater efficacy; see label for rates.

Caution Do not mow 2 days before or after applying Drive 75DF, to maximize weed control. Mulch clippings on site the first three mowings after applying. Do not irrigate for 24 hours after applying; however, irrigation 2 to 7 days after application is recommended. Drive XLR8 is a liquid formulation that is rainfast in approximately 30 minutes. The liquid formulation can also be mixed with other postemergence broadleaf herbicides to increase the spectrum of control. Do not apply within 4 weeks after perennial ryegrass or Kentucky bluegrass seedlings emerge. Applications before or after seeding a turf area will not significantly interfere with germination and growth of Kentucky bluegrass, annual bluegrass, buffalograss, tall fescue, or annual and perennial ryegrass. Must be applied before seedlings emerge. Fine fescues and creeping bentgrasses are only moderately tolerant. Colonial bentgrass is highly susceptible to damage from Drive. Do not apply to golf course collars or greens. Do not allow drift to desirable plants, especially those in the Solanaceae family such as tomatoes, eggplants, and bell peppers. Do not use clippings as mulch or compost around flowers, ornamentals, or trees, or in vegetable gardens.

Site of action Group 4: synthetic auxin

Chemical family Quinoline carboxylic acid

sulfentrazone (Dismiss Turf Herbicide)

Rate Dismiss Turf Herbicide will control or suppress sedges when applied at a rate of 4 to 12 fl oz/a. Apply the highest rate consistent with the rate needed for turfgrass safety (See Table 1 on label). Rates lower than 12 fl oz/a will generally control sedges for at least 60 days. For optimum control of purple nutsedge an initial application of 4 to 8 oz/a followed by a second application is suggested.

Time First application of this product can be made following the second mowing providing the turfgrass has developed into a uniform stand with a good root system. Creeping bentgrass, Kentucky bluegrass, rough bluegrass, fine fescue, tall fescue and perennial ryegrasses are tolerant to this herbicide.

Remarks This herbicide is a selective postemergence herbicide that controls broadleaf weeds and sedges in established turf area including, but not limited to, residential and institutional lawns, athletic fields, commercial sod farms, golf course fairways and golf course roughs. Good coverage is needed for optimum control of sedges.

Caution Use of surfactants is not recommended, the result may include temporary discoloration of some turf types. High temperatures and high relative humidity may increase the risk of temporary discoloration. Do not apply Dismiss Turf Herbicide on turfgrass that is weakened by weather, mechanical, chemical disease or other related stress. Temporary turfgrass discoloration

has been observed when Primo has been either tankmixed or applied within 7 days of a Dismiss Turf Herbicide application. Do not apply to sod within 3 months of harvest or 3 months of establishment.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Triazinone

sulfosulfuron (Certainty Turf Herbicide)

Rate 1.25 oz/a. To control tall fescue, use another application of the same rate, 3 to 4 weeks after the first application. Do not exceed a total of 2.66 oz/a product per year.

Time Apply postemergence when target weeds are actively growing and not disturbed by mowing for at least 2 days after application. Warm, moist conditions following application will accelerate herbicidal activity. Cold, dry conditions will delay herbicidal activity. Weeds stressed by drought are less susceptible to this product.

Remarks This is a postemergence, systemic herbicide with limited soil residual activity. It provides postemergence control of many annual and perennial sedges, grass and broadleaf weeds on highly managed turf, sod farms and native grass sites. This product is for use on the warm season turfgrasses listed here: bermudagrass (hybrid or common), bahiagrass, buffalograss, centipedegrass, kikuyugrass, St. Augustinegrass, seashore paspalum and zoysiagrass.

Use of this product may affect the growth pattern or delay green-up of the desirable turf. This product is absorbed by the roots and foliage of the plants, and rapidly inhibits the growth of susceptible weeds. Susceptible weed growth stops within 24 hours of treatment even though visual symptoms are slow to develop. Susceptible weeds usually show yellowing or browning within 2 to 3 weeks. For St. Augustinegrass and seashore paspalum, test this product on a small area prior to wide-scale use to determine if this product is suitable for your management and cultural practices.

Caution It is no longer recommended for use on cool season turfgrasses. Do not apply directly to or within 4 ft of golf course putting greens. Avoid contacting roots or foliage of susceptible non target vegetation, as injury may occur. Susceptible plants may be injured if seeded or transplanted into treated areas unless otherwise directed on the label. Product may result in temporary chlorosis and discoloration and may affect the growth pattern of desirable turf.

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

Chemical family sulfonylurea

topramezone (Pylex Herbicide)

Rate Broadcast applications for perennial broadleaf weeds: Option A) 3 applications at 1.0 to 1.33 fl oz/a or 0.023 to 0.030 fl oz/1,000 sq ft applied on a 3 to 4 week interval. Option B) 2 applications at 1.5 fl oz/a or 0.034 fl oz/1,000 sq ft applied on a 3 to 4 week interval. Broadcast applications for grassy weeds: 1.0 to 1.5 fl oz/a or 0.023 to 0.034 fl oz/1,000 sq ft. Do not apply more than 2 fl oz/a per application or 4 fl oz/a per year.

Time A single application should be made when weeds are actively growing; it should be applied with a crop oil concentrate (COC) at 0.5% v/v. Weeds should not be under stress from lack of water, excessive water, low fertility, mowing shock, excessive hot or cold temperatures, or injury from other herbicide applications. Pylex can be used for weed control during turfgrass

establishment when establishing from seed. Once grass has been seeded, no applications should be made for 28 days after seeding.

Remarks Pylex can be used for control of broadleaf weeds in Kentucky bluegrass, tall fescue, fine fescue, and perennial ryegrass. It has shown variable tolerance on bentgrass (moderate to severe injury) and annual bluegrass (minimal to moderate injury) at labeled use rates (see grassy weed control for grasses controlled).

Caution Maintain a 5-ft buffer between treated areas and bentgrass greens. Do not make applications to drought-stressed turfgrass and/or drought-stressed weeds. Do not apply to exposed feeder roots of trees or ornamentals, or within the dripline of trees and other ornamental species. Do not use grass clippings as mulch around flowers, ornamentals, trees, or in vegetable gardens. Do not apply an organophosphate or carbamate insecticide within 7 days of applying Pylex, because turfgrass injury may result. To reduce movement into sensitive species, such as bentgrass, avoid foot and vehicle traffic until spray has dried.

Site of action Group 27: HPPD inhibitor

Chemical family Phenyl pyrazole ketone

triclopyr (Turflon Ester Specialty Herbicide, Turflon Ester Ultra, Alligare Boulder 6.3)

Rate Broadcast applications: 0.33 to 0.75 fl oz/1,000 sq ft; Spot treatment: 0.375 to 0.75 fl oz/1,000 sq ft. No more than 1.5 fl oz/1,000 sq ft per application when spot treating.

Time Apply to actively growing weeds listed on label.

Remarks A foliar- and root-absorbed translocated herbicide available by itself in ester formulation, and in mixtures with 2,4-D or clopyralid. Effective against violets, ground ivy, and oxalis in Kentucky bluegrass, perennial ryegrass, and tall fescue. Triclopyr generally is less effective by itself than in mixtures. It can be tank-mixed with commonly used three-way herbicide mixtures to increase the weed control spectrum.

Caution To minimize turf injury, do not treat if turf is under heat or drought stress. Repeat applications at least 4 weeks apart. Mixtures with triclopyr in ester form have injured fine fescue turf after early spring applications in western Oregon. Do not apply to exposed roots of shallow-rooted trees and shrubs. Injury to Deodara cedar is associated with mixtures containing triclopyr in ester form when applied around bud break. Triclopyr may injure bentgrass (turf) and roughstalk bluegrass. Keep out of lakes, streams, and ponds. Toxic to fish.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

Herbicide Mixtures for Weeds in Turf

Mixing two or more herbicides can dramatically increase the spectrum of weed control. Most mixtures have a wide safety margin on desirable grasses and some are specially formulated for sensitive grasses such as bentgrass. Mixtures generally are available in amine salt and low-volatile ester formulations. Ester formulations are the materials of choice in early spring, late fall, and during rainy weather. Amine salt formulations generally are safer than esters around nontarget plants and during period of warm weather.

Mixtures without Triclopyr

2,4-D + fluroxypyr + halauxifen-methyl (GameOn)

Rate 3 to 4 pints per acre. Do not reapply within 3 weeks of a previous application. Do not exceed 8 pints per acre annually.

Time Best weed control results are obtained when applied to small, actively growing weeds. Extreme growing conditions such as drought or near freezing temperatures prior to, at, or following time of application may reduce weed control.

Remarks GameOn provides postemergence control of annual and perennial broadleaf weeds in established turfgrass and ornamental grasses in: golf courses (including fairways, aprons and roughs, tee boxes), industrial sites, cemeteries, commercial sod farms, and unimproved turfgrass areas. Not for use in residential turf. For optimum results, do not mow turfgrass for 72 hours after application.

Caution Do not treat to bentgrass or bermudagrass with GameOn when the mowing height is less than 1/2 inch. GameOn may discolor and/or stunt turfgrass that is not well established or is stressed or weakened. Apply to newly established turfgrass that has tillered or been mowed twice. A minimum spray volume of 10 gallons or more per acre. Do not use on injury-sensitive warm-season turfgrass such as St. Augustinegrass, centipedegrass or bermudagrass.

Site of action (all) Group 4: synthetic auxin.

Chemical family (2,4-D) phenoxy acetic acid; (fluroxypyr) pyridine; (halauxifen methyl) pyridine

2,4-D + fluroxypyr + dicamba (Escalade 2 Herbicide)

Rates 2 to 3 pints in 20 to 240 gal water/a or 0.73 to 1.1 fl oz in 0.5 to 5.5 gal of water/1,000 sq ft. On bentgrass cut at fairway height: apply a maximum of 2 pints/a, or 0.73 fl oz/1,000 sq ft. If grass is under stress: use 1 to 1.5 pints/a or 0.36 to 0.55 fl oz/1,000 sq ft. To limit damage, wait four weeks to make a second application.

Time Apply to actively growing broadleaf weeds listed on label.

Remarks Escalade is formulated to control weeds growing in Kentucky bluegrass, fescue, perennial ryegrass and bentgrass turf (excluding golf greens and tees). Used to control black medic, chickweed, clover, cocklebur, dandelion, knotweed, Oxalis species, plantain, thistle, and many other species of broadleaf weeds listed on the label. For turf, do not exceed two broadcast applications per year.

Caution Do not apply to golf greens and tees, centipedegrass, St. Augustinegrass, dichondra, legumes, and lawns with desirable clovers. Avoid contact with exposed feeder roots of ornamental trees and shrubs. Avoid applying during excessively dry or hot periods, unless irrigating. Do not apply to new grass seedlings until after second mowing. Wait 3 to 4 weeks to apply to newly sodded, sprigged, or plugged areas. Do not irrigate turfgrass

within 24 hours after application. Delay mowing 1 to 2 days before and after applying. Do not apply when air temperature exceeds 90°F. Do not allow people (other than applicator) or pets on treatment area during application. Do not enter treatment area until spray has dried. Do not reseed for 3 to 4 weeks after applying. Product can be mixed with some liquid fertilizers or liquid iron materials; however, test for compatibility before mixing in application equipment, due to product variability.

Site of action (all) Group 4: synthetic auxin

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

2,4-D + mecoprop-p + dicamba (Trimec Classic, Triplet SF)

Rate The maximum Trimec Classic and Triplet application rate is 4.0 pints of product per acre. The maximum annual rate is 8.0 pints per acre for Trimec Classic and 10 pints per acre for Triplet. The maximum number of applications is limited to 2 per year with a minimum of 30 days between applications for both products.

Time Maximum control of weeds in cool-season and warm-season turfgrasses will be obtained from spring or early fall applications when weeds are actively growing.

Remarks Trimec Classic is intended to be applied by lawn care operators and landscape personnel for use in ornamental lawns, turf established in institutional, ornamental, residential/domestic sites and sod farms. Triplet is a selective broadleaf weed control for use on sod farms, highways, rights-of-way, ornamental turf, parks, cemeteries, athletic fields, and golf courses. Caution: Do not apply when air temperatures exceed 90°F. Do not apply to newly seeded turf until after the second or third mowing. Wait 3 to 4 weeks after application before seeding new turfgrass.

Site of action (all) Group 4: synthetic auxin

Chemical family (2,4-D and mecoprop-p) phenoxy acetic acid; (dicamba) benzoic acid, 4-D + mecoprop-p +

dicamba + pyraflufen (4-Speed Selective Herbicide)

Rate 0.67 to 1.5 fl oz/1,000 sq ft in 0.1 to 5 gal water/1,000 sq ft or 1.8 to 4 pints/a in 3 to 200 gal water/a. See chart on label for rates for specific weeds.

Time Apply this product to young, actively growing weeds as a postemergence broadcast or spot spray. Follow-up applications may be required for dense infestations and hard to control species. Use this product on residential, industrial and institutional lawns, parks, cemeteries, athletic fields, golf courses, sod farms and similar turf areas. Do not apply to newly seeded grasses until well established unless discoloration or damage can be tolerated.

Remarks Fast-acting formulation is designed to show weed injury symptoms within 24 to 48 hours of application. Do not apply for at least 3 to 4 weeks after sodding, sprigging or plugging. Reseed no more than 2 weeks after application of the product. In areas that are slit seeded, to assure seed soil contact, reseeding interval may be reduced to 7 days.

Caution Do not apply more than 2 applications per year. Applications must be a minimum of 21 days apart. Turf should not be mowed for 1 to 2 days before or after application to maximize leaf surface of the target plant and aid in translocation. When air temperature exceeds 90°F, temporary turf injury may result from broadcast applications. Avoid applying during excessively dry or hot periods unless irrigation is used. For optimum results, do not apply if rainfall is expected within 4 hours; delay irrigation cycle for 24 hours.

Site of action (2,4-D, mecoprop-p and dicamba) Group 4: synthetic auxin; (pyraflufen) Group 14: protoporphyrinogen oxidase inhibitor

Chemical family (2,4-D and mecoprop-p) phenoxy acetic acid; (dicamba) benzoic acid; (pyraflufen) Phenylpyrazole

2, 4-D + mecoprop-p + dicamba + sulfentrazone (Gordons Proform Surge Broadleaf Herbicide/Turf)

Rate Broadcast treatments: 3.25 to 4 pints/a in 10 to 200 gal water/a or 1.2 to 1.5 fl oz/1,000 sq ft in 0.23 to 5 gal water/1,000 sq ft. Spot Treatments: 1.2 to 1.5 fl oz/1,000 sq ft in 1 gal water/1,000 sq ft. See Table 2 on label for rates to use on hard-to-control weeds.

Time Excellent post-emergence broadleaf weed activity in turfgrass, with improved cool-weather performance. Remarks This product is for use on residential/domestic sites, ornamental sites, institutional sites, noncropland sites and agricultural sites. Grass species that are tolerant are: Kentucky bluegrass, perennial ryegrass, bentgrass, fescues, bermudagrass, Zoysiagrass, bahiagrass and buffalograss. Caution Do not apply to carpetgrass, dichondra, St. Augustinegrass, greens, tees and collars of golf courses, lawns with desirable clovers or legumes or to ornamentals (flowers, groundcovers, landscape beds and shrubs). Turfgrass tolerance to this product may vary and temporary turfgrass yellowing may occur on some varieties of hybrid bermudagrass. To avoid turfgrass injury, apply to turfgrasses that are reasonably free from stress caused by diseases, insects, excess heat or cold, drought, shaded areas, low soil pH, nematodes, improper mowing, or improper applications of fertilizer and pesticides. Do not broadcast this product when temperatures are above 90°F. Delay application of this product to grass seedlings until after the second or third mowing, or 28 days after emergence. For newly sodded, sprigged or plugged grasses, application should be delayed until 3 to 4 weeks after the sodding, sprigging or plugging operations.. Do not irrigate for 24 hr. Delay mowing 2 days before and 2 days after application of this product. Clippings from the first three mowings should be left on the treated area. Do not use these clippings as mulch or compost around flowers, ornamentals or trees, or in vegetable gardens. Do not use near exposed root systems or adventitious shoots within the drop line of desirable trees and shrubs, since injury may result.

Site of action (2,4-D, mecoprop-p and dicamba) Group 4: synthetic auxin; (sulfentrazone) Group 14: protoporphyrinogen oxidase inhibitor

Chemical family (2,4-D and mecoprop-p) phenoxy acetic acid; (dicamba) benzoic acid; (sulfentrazone) triazinone.

2, 4-D + quinclorac + dicamba (Quincept Herbicide, Lesco Momentum Q)

Rate 7 to 8 pints/a in 20 to 300 gal water/a; Spot Treatments: 2.6 to 2.9 fl oz/1,000 sq ft in 0.5 to 6.9 gal water/1,000 sq ft. Maximum of two applications per year.

Time Apply to actively growing grassy and broadleaf weeds listed on label.

Remarks Provides broad-spectrum control of grassy and broadleaf weeds in residential and nonresidential turfgrasses. Sites include but are not limited to: grounds or lawns around residential and commercial establishments, multifamily dwellings, military and other institutions, parks, airports, roadsides, schools, picnic grounds, athletic fields, houses of worship, cemeteries, golf courses, and sod farms. Controls newly germinated one- to two-leaf crabgrass, to one-tiller crabgrass when crabgrass has

matured to five tillers or greater. Quinclorac contributes grassy weed control and is absorbed by foliage and roots and translocated throughout the plant. Susceptible grasses demonstrate stunting, chlorosis, and gradual reddening followed by necrosis and death. Yellowing that may occur on some grasses may be reduced by adding chelated iron or sprayable solution nitrogen. Apply to fine fescue only when it is part of a blend.

Caution Do not apply to newly seeded grass until after the third mowing or 4 weeks after emergence. Do not mow for 2 days before or after applying. Do not apply by air or through any type of irrigation system. Application to established creeping bentgrass must be in two to three split applications. Do not exceed 1.5 lb ai/a quinclorac per year. Do not use on golf course greens, tees, or collars. Do not use on lawns with desirable clovers or legumes.

Site of action (all) Group 4: synthetic auxin;

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

2, 4-D + quinclorac + dicamba + sulfentrazone (Gordons Proform Q4 Plus Turf)

Rate Weeds easily controlled: Use 7 to 8 pints/a or 2.6 to 3 fl oz/1,000 sq ft; Hard-to-control weeds: 9 pints/a or 3.3 fl oz/1,000 sq ft (see Table 1 on label). Use 50 to 220 gal/a (1.2 to 5.0 gal/1,000 sq ft) with spray pressures adjusted to between 20 and 40 psi. Use higher spray volumes for dense weed populations (up to 200 gal/a or 5 gal/1,000 sq ft). Sequential applications as either broadcast or spot treatments should be made 14 to 21 days after the initial application.

Time Postemergence control of grassy weeds and nutsedge if applied at the 1- to 3-leaf stage on residential/domestic sites, ornamental sites, institutional sites, noncropland sites and agricultural sites. Apply this product to weeds that are young and actively growing for best results. (See Tables 1 & 2 on label).

Remarks Provides post-emergence control and suppression of certain grassy weeds and yellow nutsedge in Kentucky bluegrass, perennial ryegrass, fescues, annual bluegrass, rough bluegrass and annual ryegrass turfgrasses.

Caution Do not apply to bahiagrass, carpetgrass, centipede-grass, dichondra, St. Augustinegrass, greens, tees and collars of golf courses, lawns with desirable clovers or legumes or to ornamentals (flowers, groundcovers, landscape beds and shrubs). Turfgrass tolerance to this product may vary and temporary turfgrass yellowing may occur on the fine fescues. To avoid turfgrass injury, apply to turfgrasses that are reasonably free of biotic or abiotic stress. Do not broadcast this product when temperatures are above 90°F. Delay application of this product to grass seedlings until after the second or third mowing, or 28 days after emergence. For newly sodded, sprigged or plugged grasses, application should be delayed until 3 to 4 weeks after the sodding, sprigging or plugging operations. Do not apply this product immediately before rainfall or irrigation. Do not irrigate for 24 hr after application. Delay mowing 2 days before and 2 days after application of this product. Clippings from the first three mowings should be left on the treated area. Do not use these clippings as mulch or compost around flowers, ornamentals trees or in vegetable gardens.

Site of action (2,4-D, Quinclorac and dicamba) Group 4: synthetic auxin; (sulfentrazone) Group 14: protoporphyrinogen oxidase inhibitor

Chemical family (2,4-D) phenoxy acetic acid; (quinclorac) quinoline carboxylic acid; (dicamba) benzoic acid; (sulfentrazone) triazinone.

carfentrazone-ethyl + MCPA + MCPP + dicamba (Gordon's Proform Power Zone)

Rate 1.3 to 1.8 fl oz/1,000 sq ft

Time Apply to actively growing broadleaf weeds.

Remarks Power Zone is an emulsifiable concentrate. Power Zone is a selective postemergence herbicide with superior cool-weather performance on established cool- and warm-season grasses for common and troublesome weeds in turfgrass such as spurge, pennywort, dandelion, and white clover. Evidence of injury can be seen within hours of application, and plants can die in 7 to 14 days. Safe on Kentucky bluegrass, annual bluegrass, annual ryegrass, perennial ryegrass, tall fescue, red or fine leaf fescue, and mixtures of cool-season species in noncropland (Kentucky bluegrass, tall fescue, smooth brome grass, and orchardgrass). Uses include institutional, ornamental, and residential sites, sod production, and noncropland (rights-of-way, roadsides, medians, airports, and military installations). Spray solution must be above pH 5 and below pH 8.

Caution Tolerance to Power Zone may vary; certain F1 hybrids of bermudagrass may yellow temporarily. Environmental conditions and certain spray tank additives (e.g., adjuvants, wetting agents, surfactants), liquid fertilizers, and tank-mixtures containing other emulsifiable concentrates may reduce selectivity on turfgrass. Do not apply to bentgrass greens, carpetgrass, dichondra, legumes, or lawns with desirable clovers. Do not apply to new grass seedlings until after the second mowing. Wait 3 to 4 weeks to apply to newly sodded, sprigged, or plugged areas. Do not irrigate turfgrass within 24 hr after applying. Delay mowing 1 to 2 days before and after applying this product. Treated areas may be reseeded 2 weeks after application. Do not apply when air temperature exceeds 90°F. Do not apply to any body of water, wetlands, irrigation ditch banks, or shorelines.

Site of action (carfentrazone-ethyl) Group 14: protoporphyrinogen oxidase inhibitor; (MCPA, MCPP, and dicamba) Group 4: synthetic auxin

Chemical family (carfentrazone-ethyl) triazinone; (MCPA and MCPP) phenoxy acetic acid; (dicamba) benzoic acid

carfentrazone-ethyl + 2,4-D + MCPP + dicamba (Gordon's Proform SpeedZone Broadleaf Herbicide/ Turf)

Rate 3.0 to 5.0 pints/a or 1.1 to 1.8 fl oz/1,000 sq ft

Time Apply to actively growing broadleaf weeds.

Remarks Speed Zone is an emulsifiable concentrate. Speed Zone is a selective postemergence herbicide with superior cool-weather performance on established cool- and warm-season grasses for common and troublesome weeds in turfgrass such as spurge, pennywort, dandelion, and white clover. Evidence of injury can be seen within hours of application, and plants can die in 7 to 14 days. Safe to apply on Kentucky bluegrass, annual bluegrass, perennial ryegrass, tall fescue, red or fineleaf fescue, creeping and colonial bentgrass (excluding golf greens), and mixtures of cool-season species in noncropland (Kentucky bluegrass, tall fescue, smooth brome grass, and orchardgrass). Uses include institutional, ornamental, and residential sites, sod production, and noncropland (rights-of-way, roadsides, medians, airports,

and military installations). Spray solution must be above pH 5 and below pH 8.

Caution Do not apply to bentgrass greens, carpetgrass, dichondra, legumes, and lawns with desirable clovers. Do not apply to new grass seedlings until after the second mowing. Delay applying for 3 to 4 weeks on newly sodded, sprigged, or plugged areas. Do not irrigate turfgrass within 24 hr of application. Delay mowing 1 to 2 days before and after application. Treated areas may be reseeded 2 weeks after application. Do not apply when air temperature exceeds 90°F. Do not apply to any body of water, wetlands, irrigation ditch banks, or shorelines.

Site of action (carfentrazone-ethyl) Group 14: protoporphyrinogen oxidase inhibitor; (2,4-D, MCPP, and dicamba) Group 4: synthetic auxin

Chemical family (carfentrazone-ethyl) triazinone; (2,4-D and MCPP) phenoxy acetic acid; (dicamba) benzoic acid

dicamba + quinclorac + MCPP (Onetime Herbicide)

Rate Broadcast applications: 64 fl oz/a or 1.45 fl oz/1,000 sq ft with 1.5 pints/a or 0.55 fl oz/1,000 sq ft of methylated seed oil. Spot treatments: use 1.45 fl oz/1,000 sq ft with 0.55 fl oz/1,000 sq ft of methylated seed oil. See Tables 2, 3 and 4 on label for rates for specific weeds.

Time One Time Herbicide may be applied postemergence to residential and nonresidential turfgrasses, such as: airports, parks, multifamily dwellings, military institutions, roadsides, schools, athletic fields, churches, cemeteries and golf courses. Apply to actively growing weeds as postemergence broadcast or spot sprays using the turf species, rate, and growth stages indicated on label.

Remarks One Time Herbicide is an auxin agonist and is absorbed by foliage and roots and translocated throughout the plant. The control symptoms exhibited by broadleaf weeds include leaf and stem curl or twisting, and chlorosis. Susceptible grasses demonstrate stunting, chlorosis and gradual reddening followed by necrosis and death. Annual bluegrass, Kentucky bluegrass, buffalograss, tall fescue, annual and perennial ryegrass and zoysiagrass are highly tolerant when they are established. Creeping bentgrass, hybrid bermudagrass, rough bluegrass, fine fescues and seashore paspalum are only moderately tolerant to this herbicide when the grasses are established. Grasses controlled include: barnyardgrass, large and smooth crabgrass, giant, green and yellow foxtail, kikuyugrass, signalgrass and torpedo-grass. Weeds controlled include: bedstraw, creeping buttercup, chicory, chickweed, clover, dandelion, dock, English daisy, ground ivy, healall, henbit, horseweed, knotweed, lambsquarters, mallow morningglory, pennycress, pepperweed, pigweed, buckhorn and broadleaf plantain, puncturevine, sheep red, shepherd's purse, sowthistle, wild strawberry, speedwell, spurge, bull and Canada thistle, wild violet, wild carrot, wild garlic, wild onion, wood sorrel and yarrow.

Caution Do not use on golf course greens and collars. Do not apply more than 2 applications per year. Do not make repeat applications in less than 30-day intervals. Do not apply to turfgrass grown for sod. Do not make applications of Onetime to drought-stressed turfgrass and/or drought-stressed weeds. Do not apply to fine fescue unless it is part of a seed mix. Do not use clippings as mulch or compost around flowers, ornamentals, trees, or in vegetable gardens.

Site of action (mecoprop-p, dicamba and quinclorac) Group 4: synthetic auxin;

Chemical family (quinclorac) quinoline carboxylic acid; (dicamba) benzoic acid; (MCPP) phenoxy acetic acid

MCPA + fluroxypyr + dicamba (Triple Shot)

Rate 2 to 3 pints in 20 to 240 gal water/a or 0.73 to 1.1 fl oz/1,000 sq ft in 0.5 to 5.5 gal water

Time Apply to actively growing broadleaf weeds listed on label.

Remarks This product is for selective broadleaf weed control in ornamental lawns, parks, cemeteries, athletic fields, golf courses (excluding any bentgrass tees) and sod farms.

Caution Do not use on Dichondra, or on lawns with desirable clovers. Avoid fine mists. Use lawn-type sprayer with coarse spray so wind drift is less likely. Avoid contact with exposed feeder roots of ornamentals and trees. Best control is from spring or early fall applications, when weeds are actively growing. Use higher rate on label for hard-to-control weeds. Do not apply to newly seeded grasses until well established. Avoid broadcast applications when air exceeds 90°F. Spot treatments at temperatures over 90°F may injure turf. Do not mow turfgrass 1 to 2 days before or after application. Wait 3 or 4 weeks after application to reseed.

Site of action (all) Group 4: synthetic auxin;

Chemical family (MCPA) phenoxy acetic acid; (fluroxypyr) pyridine; (dicamba) benzoic acid

sulfentrazone + quinclorac (Solitaire Herbicide, Solitaire WSL)

Rate 0.75 to 1.5 lb ai/a or 4 to 7.9 fl oz/1,000 sq ft

Time This selective postemergence herbicide controls annual grasses, broadleaf weeds and sedges in established turf areas including, but not limited to, residential, commercial and institutional lawns, athletic fields, commercial sod farms, golf course fairways and golf course roughs.

Remarks Postemergence efficacy is improved when adequate soil moisture is present at application. Best weed control results will be obtained when no rainfall or irrigation occurs within 24 hours after application. If not rainfall occurs within 7 days after application in the amount of 0.5 inches, then irrigation of at least 0.5 inches is recommended. Solitaire is absorbed by shoots, roots and foliage.

Caution Do not apply this product through any type of irrigation system. Do not use on soils classified as sand which have less than 1% organic matter. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark.

Site of action (sulfentrazone) Group 14: protoporphyrinogen oxidase inhibitor; (quinclorac) Group 4: synthetic auxin

Chemical family (sulfentrazone) triazinone;(quinclorac) quinoline carboxylic acid;

2, 4-D + 2, 4-DP (many products) or 2, 4-D + MCPP + dicamba or 2,4-D + MCPP-P + dicamba (TruPower 3, Strike 3) or 2, 4-D + 2, 4-DP + dicamba or MCPA + MCPP + dicamba or 2, 4-D + 2, 4-DP + MCPP (Spoiler)

Rate 3 to 4 pints/a. Do not apply more than 9 pints/a per application or 18 pints/a per season, excluding spot treatments. Applications must be 30 days apart.

Time Apply to actively growing broadleaf weeds listed on label.

Remarks These mixtures are available in amine salt and ester formulations. They generally are effective on a broad range of weeds, and are safe on most grasses due to relatively low component rates. As a group, these will not control Oxalis species, violets, lawn ivy, or spurge. Retreatment generally is necessary on difficult weeds such as yarrow, lawn daisy, and clovers.

Site of action (all) Group 4: synthetic auxin

Chemical family (2,4-D, 2,4-DP, MCPP, and MCPA) phenoxy acetic acid; (dicamba) benzoic acid

Mixtures with Triclopyr

2,4-D + triclopyr (Turflon D Low Volatile Weed Killer, Chaser Turf Herbicide, Chaser 2 Amine) or clopyralid + triclopyr (Confront Specialty Herbicide)

For use on golf courses only

Rate 1 to 2 quarts or 0.5 to 1.0 lb ae of Turflon D or Chaser in 20 to 200 gal water/a. Sod farms: 2 quarts/a up to 2 times per year with 21 days between applications. Spot treatments: 1 to 2 fl oz/3 gal water. Only 1 to 2 pints/a of Confront is allowed, with 2 quarts/a per year at the maximum allowable.

Time Apply to actively growing broadleaf weeds listed on label.

Remarks The 2,4-D + triclopyr mixture is available in amine salt and ester formulations; the clopyralid + triclopyr mixture is available only as an amine salt. Both mixtures control a wide range of common weeds and are active on Oxalis species, lawn violets, lawn ivy, and spurge. Confront is weak on mouseear chickweed. Confront is for use on nonresidential turf such as athletic and recreational sports fields, cemeteries, golf courses, industrial sites, military bases, noncropland, parks, rights-of-way, schools, and other nonresidential turf roadsides.

Caution Confront is a restricted-use herbicide in Washington and Oregon. Confront is for use on golf courses only. Mixtures with triclopyr ester may injure fine fescues and other sensitive grasses particularly in early spring. Damage to Deodara cedar has been associated with mixtures containing triclopyr ester applied in spring around bud break. Use Confront only on tall fescue, bluegrass (turf), or perennial ryegrass unless injury to other species can be tolerated. Do not use Confront on residential turf. Do not send clippings to a compost facility. Do not collect grass clippings for mulch or compost. Applicators must tell landowners and managers not to use grass clippings for composting.

Site of action (all) Group 4: synthetic auxin

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

2, 4-D + triclopyr + fluroxypyr (Lesco Momentum FX 2 Herbicide)

Rate 3 to 4 pints/a or 1.1 to 1.5 fl oz/1,000 sq ft on closely mowed fairways: a maximum of 2 pints/a or 0.74 fl oz/1,000 sq ft. Under stress conditions: 1 to 1.5 pints/a or 0.36 to 0.55 fl oz/1,000 sq ft.

Time This product is a broad-spectrum herbicide for control of actively growing annual and perennial broadleaf weeds. It is for use on established residential, industrial and institutional lawns, as well as parks, cemeteries, athletic fields, roadsides, golf courses and sod farms.

Remarks Intended for use by professional turfgrass maintenance personnel, landscaping or commercial applicators only.

Caution Do not use on golf greens or tees. Only 2 applications per year are allowed. Do not enter treated area until the herbicide has dried. Do not treat warm season grasses if they are being mowed at less than 0.5 inch. Turf should not be mowed 1 to 2 days before and after application. Do not reseed before 3 to 4 weeks after application of this product.

Site of action (all) Group 4: synthetic auxin

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

2,4-D + triclopyr + dicamba + pyraflufen (4-Speed XT Selective Herbicide)

Rate 0.67 to 1.5 fl oz/1,000 sq ft in 0.1 to 5 gal water/1,000 sq ft or 1.8 to 4 pints/a in 3 to 200 gal water/a

Time Postemergence product designed to show weed injury within 24 to 48 hours of application. Apply to young, actively growing weeds on residential, industrial and institutional lawns, parks, cemeteries, athletic fields, golf courses, sod farms and similar turfgrass areas.

Remarks For use by turf maintenance personnel, landscape or commercial applicators only. Provides maximum weed control for hard-to-kill weeds like wild violet, wild geranium, spurge and oxalis.

Caution Do not apply more than 2 broadcast applications per year with a minimum interval of 21 days between applications. Do not apply at wind speeds greater than 15 mph. Do not apply to newly sodded, sprigged or plugged grasses for at least 3 to 4 weeks after planting. For best results, turf should not be mowed for 1 to 2 days before or after application to maximize leaf surface of the target plant and help with translocation. Do not apply if rainfall is expected within 4 hr; delay irrigation cycle for 24 hr.

Site of action (2,4-D, triclopyr and dicamba) Group 4: synthetic auxin; (pyraflufen) Group 14: protoporphyrinogen oxidase inhibitor

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

2, 4-D + triclopyr BEE + dicamba + sulfentrazone (Gordons Proform T Zone Broadleaf Herbicide)

Rate For cool season turfgrasses: 3.25 to 4 pints/a or 1.2 to 1.5 fl oz/1,000 sq ft

Time Excellent postemergence activity for tough weeds in turfgrass, such as wild violet, ground ivy, oxalis and wild blackberry. It exhibits improved cool-weather performance. This product is for use on residential/domestic, ornamental, institutional, non-cropland and agricultural sites. Delay application of this product to grass seedlings until after the second or third mowing, or 28 days after emergence. For newly sodded, sprigged or plugged grasses, application should be delayed until 3 to 4 weeks after the sodding, sprigging or plugging operations.

Remarks The sulfentrazone combinations provide rapid and effective weed control for common and troublesome (tough) weed species in turfgrass, including dandelion, spurge, white clover and dollarweed (pennywort). Grass species that are tolerant are: Kentucky bluegrass, annual bluegrass, annual ryegrass, tall fescue, red or fine leaf fescues, perennial ryegrass. This product can also be applied to dormant bermudagrass, Zoysiagrass and bahiagrass.

Caution Do not apply to bentgrass, carpetgrass, legumes, dichondra, St. Augustinegrass, greens, tees and collars of golf

courses, lawns with desirable clovers or legumes, or to ornamentals (flowers, groundcovers, landscape beds and shrubs). Turfgrass tolerance to this product may vary and temporary turfgrass yellowing may occur on some varieties of hybrid bermudagrass. To avoid turfgrass injury, apply to turfgrasses that are reasonably free of biotic or abiotic stress. Do not broadcast this product when temperatures are above 85°F. Delay mowing 2 days before and 2 days after application of this product. Do not apply this product to warm-season turfgrass during spring green-up or in the fall during the transition period between active growth and dormancy.

Site of action (2,4-D, triclopyr and dicamba) Group 4: synthetic auxin; (sulfentrazone) Group 14: protoporphyrinogen oxidase inhibitor

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

Lawn Moss

carfentrazone-ethyl (QuickSilver T&O Herbicide)

Rate Category 1: stand-alone product for weeds: Use 1 to 2.1 fl oz/a or 0.023 to 0.048 fl oz/1,000 sq ft. Category 2: Stand-alone product for silvery thread moss: 6.7 fl oz/a or 0.154 fl oz/1,000 sq ft, with a second application after 2 weeks, at the same rate.

Time During daylight, apply to moss in turfgrasses listed on label.

Remarks QuickSilver T&O Herbicide is a contact herbicide with little or no residual activity. It provides selective postemergence control of broadleaf weeds and silvery thread moss (*Bryum argenteum*) in turfgrass. It is an aryl triazolinone herbicide that interrupts chlorophyll synthesis, and produces metabolic byproducts that disrupt plant cell membranes. This process occurs only in susceptible green plants in the presence of light. Symptoms may appear on foliage in 24 hours or less in susceptible plants. Complete desiccation and death occur 7 to 14 days after application. QuickSilver is rainfast within 1 hour after application. Established cool-season grasses generally tolerate applications at labeled rates. Tall fescue may yellow slightly within 3 to 5 days after application under some conditions. Recovery typically is within 4 to 7 days. If such injury cannot be tolerated, apply to a small test area before treating a large area. QuickSilver produces herbicidal symptoms only in the weed parts it contacts directly. For best results, select a spray volume and nozzle system that ensure thorough, uniform coverage, and minimize fine spray droplets. Spray droplets larger than 400 microns may reduce coverage and reduce weed control. Apply in spray volumes of 20 to 175 gal/a (0.5 to 4 gal/1,000 sq ft). Use higher spray volumes on dense weed populations, turfgrass canopies, or where uniform coverage is difficult to obtain. QuickSilver can be applied at 7 days or more after emergence to creeping bentgrass, tall fescue, perennial ryegrass, and Kentucky bluegrass.

Caution Do not apply to carpetgrass or dichondra or to lawns or turf with desirable clovers. Avoid spray drift to nontarget, desirable, susceptible plants such as vegetables, flowers, ornamentals, trees, and shrubs. Do not apply when conditions favor spray drift or poor spray coverage. Do not exceed 6.7 fl oz/a (0.1 lb ai/a) per application or 0.4 lb ai/a per season. Allow at least 2 weeks between sequential broadcast applications. Do not apply by air or through any type of irrigation system. Quicksilver can be tank-mixed with other products, but observe all label restrictions on turf tolerance of companion products. Maintain spray solution between pH 5 and pH 8.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Triazinone

ferrous sulfate (Moss Max)

Rate 4 lb product/1,000 sq ft for normal moss invasion; For heavy moss: use 8 lb product/1,000 sq ft according to Moss Max label.

Time Apply to moss in early spring and fall when grass is actively growing so that grass will continue to grow and fill in the bare areas after the moss dies.

Remarks Iron compounds act as contact herbicides, and are available in granular and liquid formulations. Treatments are effective whenever moss is actively growing.

Caution Iron stains concrete and painted surfaces. Keep sprays away from these surfaces. Turf may be temporarily discolored (blackened) at high application rates.

potassium salts of fatty acids (Brandt Moss-Aside)

Rate Product is a ready-to-use formulation that is 3% potassium salts of fatty acids

Time Apply to moss in early spring and fall when grass is actively growing and will fill in the bare areas after moss dies.

Remarks Potassium salts of fatty acids act as contact herbicides and are available as liquid concentrates. Treatments are effective whenever moss is actively growing.

Caution May temporarily discolor treated grasses. Product is safe on concrete and other surfaces.

Annual Bluegrass Weed Control in Turf

Selective control of annual bluegrass in turf is a big challenge in the Pacific Northwest. There are no tried-and-true procedures. Every breakthrough reported in another region of the United States is less effective in the PNW than in climates with greater environmental stress. Current strategies involve selective preemergence herbicides, selective pre- and early postemergence herbicides, and selectively suppressing growth with turfgrass growth regulators.

Selective preemergence herbicides prevent annual bluegrass seed from germinating. In general, while most available preemergence herbicides are effective in killing germinating seedlings, they have not provided effective annual bluegrass control. Part of the problem is that there are annual and perennial types of annual bluegrass in irrigated turf. In addition, annual bluegrass can produce seed any time of the year, but seeds most heavily in spring, with a second, less heavy flush of seeds in fall. Finally, annual bluegrass seed can germinate nearly any time of year. These factors make it difficult to target applications. Repeated treatments of preemergence herbicides to maintain herbicide activity year-round may stunt root growth of desirable grasses and predispose them to diseases or reduced stress tolerance.

Selective preemergence and early postemergence control is viable with ethofumesate applied to pure seedling stands of perennial ryegrass. Ethofumesate is active on young annual bluegrass up to about the four-leaf stage. In mature perennial ryegrass, Kentucky bluegrass, or tall fescue, annual bluegrass can be controlled with three applications of ethofumesate in fall. Start in mid-October and reapply at 3- to 4-week intervals. Activity generally is not apparent after the first application, but yellowing begins between the second and third applications. In western Oregon, the death of the treated annual bluegrass may not be apparent until March, depending on the year. Kentucky bluegrass and tall fescue may be slightly injured or discolored. Some tests achieved 90% to 100% control after one series of treatments. Annual bluegrass may invade from seed once the herbicide dissipates.

Selectively suppressing annual bluegrass growth has been successful in many parts of the country. The object is to retard annual bluegrass more than desirable grasses so the balance of competition shifts in favor of the planted grasses. This strategy seems to work best in areas with cold winters and hot, humid summers. Annual strains of annual bluegrass are more sensitive than perennial strains. Reducing annual bluegrass to acceptable levels may take several years, and may require ongoing spring and fall treatments.

Annual Bluegrass

SELECTIVE PREEMERGENCE

See preemergence herbicides listed for annual grasses.

SELECTIVE PREEMERGENCE AND EARLY POSTEMERGENCE

ethofumesate (Poa Constrictor Herbicide, Prograss Herbicide, Prograss SC Herbicide, Thrasher)

Rate After seeding and before weeds emerge: use 0.20 to 3 pints/a. Postemergence Applications: use 2.25 to 3 pints/a no later than the 4-leaf stage of the weed. Harder-to-control weeds must be treated by the 2-leaf stage of the plant. For established grasses: Use 2.25 to 3 pints/a both pre- and postemergence for perennial ryegrass and tall fescue.

Time Apply to grasses listed as tolerant on label, when annual bluegrass is at less than the 4-leaf stage.

Remarks Available only as an emulsifiable concentrate. It gives effective preemergence and early postemergence control of annual bluegrass in new seedings of perennial ryegrass.

Caution Inhibits germination of most desirable cool-season grasses, other than perennial ryegrass. Highly toxic to seedling fine fescues. Surface organic matter decreases the effectiveness of ethofumesate, so remove thatch and other debris before applying.

Site of action Group 16: unknown

Chemical family Benzofuran

SELECTIVE POSTEMERGENCE

amicarbazone (Xonerate Herbicide)

Oregon only

Rate 1 to 10 oz/a Xonerate

Time Apply for selective postemergence and some preemergence control of certain weeds in established turfgrasses.

Remarks Xonerate is a 70% WDG formulation. Controls annual bluegrass in established creeping bentgrass, Kentucky bluegrass, fine fescues, tall fescues, and perennial ryegrass.

Caution Do not apply to grasses under environmental stress or at temperatures of 85°F for most cool-season grasses and not above 80°F air temperatures for creeping bentgrass tees or roughs. Do not apply if soil pH is above 7.4. Do not mix or fill within 50 feet of any wells, ponds, ditches, streams, or lakes. Do not apply more than 10.25 oz/a in one application or per year. Do not apply to sites where annual bluegrass is maintained as a desirable turfgrass. Xonerate does not control perennial broad-leaf weeds in turfgrasses. Apply with labeled tank-mix partners in a minimum of 20 gal/a of spray volume using broadcast boom equipment. Read label carefully for additional precautions about application timing and intervals. Overlap of application can cause turf damage.

Site of action Group 5: Inhibition of photosynthesis at photosystem II

Chemical family Carboxamide

bispyribac-sodium (Velocity SG Herbicide)

Rate 6 oz/a or 30 gal ai/a (0.066 lb ai/a). For conversion to creeping bentgrass or perennial ryegrass: Make 4 applications at 6 oz/a on a 14- to 21-day interval.

Time Apply when grass is actively growing, but before weeds form seed heads.

Remarks Velocity may mildly discolor creeping bentgrass and perennial ryegrass. Discoloration begins 3 to 10 days after application. Vigorously growing grasses should outgrow symptoms within 3 to 14 days. If temporary turf chlorosis is a concern, avoid treating small patches of turf that are surrounded by untreated areas of turf. Velocity performs best under sunny conditions when daytime temperatures are 65 to 80°F during and after application.

Caution Do not apply Velocity to turfgrass with symptoms of heat stress or if significant heat stress is expected. Velocity may increase the susceptibility of creeping bentgrass to Pythium blight when conditions are favorable for infection. Do not apply to creeping bentgrass or perennial ryegrass mowed to less than 0.375 inch. Do not apply to golf greens and roughs. Velocity may not be effective against all biotypes of annual bluegrass.

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

Chemical family Pyrimidinylthiobenzoate

ethofumesate (Poa Constrictor Herbicide, Prograss Herbicide, Prograss SC Herbicide, Thrasher)

Rate New seedings applied preemergence of weeds: use 0.2 to 3 pints/a. Postemergence applications: use 2.25 to 3 pints/a no later than the 4-leaf stage of the weed. Harder-to-control weeds must be treated by the 2-leaf stage of the plant. For established grasses: use 2.25 to 3 pints/a both pre- and postemergence for perennial ryegrass and tall fescue.

Time Apply to grasses listed as tolerant on label, before annual bluegrass reaches the 4-leaf stage.

Remarks Effective only in a series of three or more treatments; single treatments are not effective. Some perennial strains of annual bluegrass may not be affected.

Caution Kills fine fescues and roughstalk bluegrass and causes unsightly injury to most bentgrasses. Assess components of the turf carefully before beginning treatment.

Site of action Group 16: unknown

Chemical family Benzofuran

SELECTIVE GROWTH SUPPRESSION

paclobutrazol (Turf Enhancer 2SC, Trimmit PGR)

Rate Use 0.25 to 0.50 lb ai/a. If annual bluegrass is a significant portion of the population, it would be a good idea to reduce the application rate by 50%. Two additional sequential applications 8 weeks apart are allowed (for a total of 3 applications) per year.

Remarks Available in liquid (2SC) and granular formulations (mixed with fertilizer). Selectively suppresses annual bluegrass growth, allowing tolerant grasses to dominate turf. Long-term success requires annual re-treatment. Tends to be more effective in turf mainly with annual *Poa annua* biotypes. Paclobutrazol is

labeled for use on bentgrass, Kentucky bluegrass, and perennial ryegrass.

Caution Not recommended for turf with more than 70% annual bluegrass. Do not use during periods of extreme environmental stress (e.g., heat, cold, drought). At high rates, Kentucky bluegrass and bentgrass turf may be discolored temporarily.

Site of action Gibberellin biosynthesis inhibitor

Chemical family Class B plant growth regulator

SELECTIVE SEED HEAD SUPPRESSION

ethephon (Proxy, Verve PGR, Ethephon 2 Plant Regulator, Ethephon 2 SL, Ethephon 2, Excelero PGR, NuFarm Ethephon 2 PGR, Oskie Plant Regulator, Helena Oskie Plant Regulator)

Rate 5 fl oz in 1 to 2 gal water/1,000 sq ft. See label for specific application intervals.

Time Apply to golf, parks, and sports turf. Not for residential use.

Remarks Proxy is used to suppress seed head formation in *Poa annua* and white clover, among others, and also to suppress growth of certain cool-season grasses. It is foliar-absorbed and is most effective on actively growing, healthy turf. Apply in a sufficient volume of water to provide uniform coverage. Proxy is rainfast in 2 hours. A spreader/sticker is not necessary. Do not reenter treated area until dry. Delay mowing until the day after the application.

Caution Do not treat turfgrasses with poor root systems, or those growing under stress due to poor soil conditions. Do not use if thatch is excessive. Do not apply Proxy through any type of irrigation system. Mix only the amount of product you expect to use each day. Do not allow mixed solution to stand overnight. Scalping may occur on creeping bentgrass cultivars after more than two applications of Proxy for *Poa* seed head suppression.

Site of action Enhances release of ethylene gas

Chemical family Phosphinic acid

TURFGRASS GROWTH SUPPRESSION

maleic hydrazide

Rate 3.0 lb of product/1,000 sq ft

Time Apply this product to green grass, since brown grass will not absorb the spray. Use of this product is limited to one application per year made either in the Fall or the Spring followed by correct maintenance procedures to produce required turf growth control.

Remarks For spring application (April 15 to June 1) use 1.75 gal product in 50 gal water/a to reduce or eliminate mowing. For fall applications, (Oct. 1 to Nov. 15) use 2.25 gal of this product in 50 gal of water/a to reduce growth next season. The fall treatment should also be applied to green grass before it becomes dormant.

Caution Do not apply during the summer since most permanent grasses become partially dormant in the summer. This product should be applied at temperatures below 85°F under high temperatures and low humidity conditions, this product will crystallize on the leaf surface preventing normal absorption into the plant. To obtain the desired results, the plants should not be stressed from either too much or too little water before or after application. Make only one application per season.

Site of action mitotic inhibitor

Chemical family Class C plant growth regulator

mefluidide (Embark T & O Growth Regulator, Embark 2S, EMBARK 2S IVM)

Rate Apply at 0.75 to 1.8 fl oz/1,000 sq ft depending upon grass species and mowing height; Embark 2S: 0.5 to 4 pints/a; Embark 2S IVM 24 to 32 fl oz/a alone or at 8 fl oz/a in combination with three other possible growth regulators listed on the label. See Table 1 on label for tank mixtures possible on cool season noncropland sites.

Time Embark T & O Growth Regulator may be applied to actively growing cool-season and warm-season turfgrass in commercial or residential lawns, schools, golf courses, recreational areas, and athletic fields. For fall applications, apply at least 1 month before winter dormancy. In turfgrass renovation programs, areas treated with Embark may be reseeded 3 days following application (except in California, where reseeding may not occur within 2 weeks). Embark 2S IVM is for use on established noncropland areas such as highway rights-of-way, municipal, state and federal lands and commercial/industrial areas. Embark 2S IVM is not to be used for sod, commercial seed production or research purposes.

Remarks Embark suppresses seed head formation, decreases the amount of clippings and reduces the mowing requirements for up to 4 weeks. Grass may be mowed up to two days before applying Embark. Clippings and other debris should be removed before spraying. If mowing removes most of the green leaf tissue, spraying should be delayed until sufficient new growth develops to assure product absorption into green leaves. Turf color and quality during week 1 through 3 of the growth regulation period may be improved with an application of FeRRROMEC AC Liquid Iron. Schedule the application of FeRRROMEC AC Liquid Iron within 10 days before the application of Embark T & O Growth Regulator. Optimum seed head control may not be obtained if rainfall or overhead irrigation occurs within 8 hours following application. For athletic fields, Embark can be applied with line marking paints to limit the number of applications of field lines. Generally, one application of Embark with the line marking paint is recommended per season.

Caution Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high water mark. To avoid turf injury, use only on turfgrass that is reasonably free of stress from diseases, insects, excess heat, cold or frost, drought or excess rainfall/irrigation, shaded areas, low soil pH, nematodes, improper mowing or improper applications of fertilizer and pesticides. Multiple applications may be made, but wait at least 6 weeks between applications.

Site of action mitotic inhibitor

Chemical family Class C plant growth regulator

trinexepac-ethyl (Game Up PGR, Goldwing PGR, Governor Growth Reg., Groom PGR, Primo MAXX, Podium, Provair PGR, T-Nex 1AQ)

Rate Rate varies depending upon the product, turfgrass species, mowing height and length of suppression desired.

Time Apply to actively growing grass, including home lawns, parks, recreation areas, golf course roughs, cemeteries, business sites, sports fields, and sod farms that are not under stress.

Remarks Primo MAXX reduces mowing frequency and the amount of grass clippings. It also increases turfgrass density, color, and quality. Useful in difficult-to-mow areas; can minimize the need to edge along sidewalks, curbs, parking lots, driveways, flower beds, and fences and around posts, storage sheds, and

trees. Primo MAXX reaches the growing point by foliar uptake and is rainfast after 1 hour. Water is not needed to activate it.

Caution Any cultural practice that affects turf growth and vigor will influence turf response to Primo MAXX. Rates in the table on the label provide about 50% growth inhibition over a 4-week period with little or no discoloration. With less-than-optimal growth conditions, rates may have to be reduced by 50% due to stress. Multiple applications of Primo MAXX can be made each growing season, but do not exceed a total of 7 fl oz/1,000 sq ft per year. If turf is going into dormancy due to high or low temperatures or lack of moisture, reduce Primo rate. To minimize turf injury, apply Primo MAXX, then wait at least 4 hours before mowing; or mow first, wait at least 1 hour, then apply Primo MAXX.

Site of action Late gibberellin (GA1) biosynthesis inhibitor

Chemical family Class A plant growth regulator

Nutsedge and Perennial Grasses

bentazon (Basagran T/O Herbicide –NON- Homeowner, Willowood Bentazon)

Rate 2 pints/a in 40 to 80 gal water or 0.75 fl oz/1,000 sq ft in 1 to 2 gal water. Second application in 10 to 14 days.

Time Apply to actively growing weeds.

Remarks Available as a soluble liquid. Bentazon acts as a contact herbicide to control yellow nutsedge, annual sedges, and broad-leaf weeds, including chickweed and common purslane. It does not control purple nutsedge. Safe for use on established Kentucky bluegrass, fescues, bentgrass, perennial ryegrass, and several warm-season grasses.

Caution Do not apply to turf under stress from drought, cold, or other herbicides. Do not apply to newly seeded turf. Do not use on putting greens or collars. Note rate restrictions on perennial ryegrass. No more than 4 pints/a or 1.5 fl oz/1,000 sq ft can be applied in one season. Rain after application reduces activity.

Site of action Group 6: photosystem II inhibitor

Chemical family Benzothiadiazole

chlorsulfuron (Alligare Chlorsulfuron 75, Bayer Telar XP Herbicide)

Rate 1 to 5.33 fl oz/a or 0.25 lb ai/a or 0.0057 lb ai/1,000 sq ft

Time Apply when weed is actively growing.

Remarks A dispersible granule herbicide intended primarily for spot treatment to eradicate tall fescue in established Kentucky bluegrass, fine fescue, and bentgrass as well as in some warm-season grasses. Irrigate thoroughly to activate herbicide.

Caution Will kill perennial ryegrass. Treat only bentgrass mowed above 0.5 inch. Do not treat turf under stress from heat, drought, or other factors. Do not apply to saturated soils. Use a nonionic surfactant at 0.25 to 0.33 fl oz/gal of spray solution.

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

Chemical family Sulfonylurea

fluazifop-P-butyl (Fusilade II)

Rate For control of grassy weeds *Zoysia* apply at 3-4 fl oz/a, for weeds in tall fescue apply 5-6 fl oz/a, and for weed control in fine fescue (chewings, hard and creeping red fescue) apply at 8-16 fl oz/a.

Time For best results, make applications in spring and fall when weeds are actively growing. Avoid treatments during July and August. Do not apply to Tall Fescue turfgrass during the summer.

Remarks For the suppression and/or control of common bermudagrass, hybrid bermudagrass and other grass weeds in *zoysia*, fine fescue and tall fescue turfgrass in golf courses, residential, commercial, public and industrial buildings turfgrass areas. Application should be made every 28 days when the grass weeds are actively growing. Complete control of undesirable grass weeds may take multiple sequential applications over 1–2 growing seasons. Apply with a nonionic surfactant at 0.25% v/v.

Caution Do not apply to desirable cool season turfgrass (fine fescue and tall fescue) under heat stress. The higher rates may result in temporary discoloration of the desirable turf with recovery in 10-14 days. Only fine fescue is tolerant to the high rate (8-16 fl oz/a). Use a minimum of 30 gallons of water per acre when applying to fine and tall fescue.

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

Chemical family Aryloxyphenox propionate

halosulfuron-methyl (Profine 75 Herbicide, Sandea, Sedgehammer Turf Herbicide, Sedgehammer+ Turf Herbicide)

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

Time Apply to well-established turfgrass when nutsedge is in the 3- to 8-leaf stage.

Remarks A 75% WDG for selective postemergence control of purple and yellow nutsedge in established turfgrass. Treatments sites include fence rows, fuel storage areas, lumberyards, tank farms and right-of way and roadsides.

Treat nutsedge in the 3- to 8-leaf stage. A second treatment may be required 6 to 10 weeks later. Use 0.5% nonionic surfactant concentration for broadcast applications. No more than 2 applications can be made, with the total use-rate not exceeding 2 2/3 ounces by weight of this product (0.125 lb ai/a per use-season). Use 0.25 to 0.5% v/v of a nonionic surfactant (1 to 2 quarts per 100 gal of spray solution) for broadcast high volume applications.

Caution Do not exceed 1 quart/a of surfactant; higher rates can injure turf. Use only nonionic surfactants with at least 80% ai Do not mow turf for 2 days before or after application. Good results if no rain for 3 hours after application; best results if no rain for at least 4 hours after application. Turf must have a well-developed root system and a uniform stand before product is applied. Do not apply to putting greens or turfgrass under stress. Do not use clippings from treated turf as mulch around ornamentals. This product may not control ALS resistant weeds. This product can be tank mixed with glyphosate herbicide. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

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

Chemical family Sulfonylurea

mesotrione (Tenacity)

Rate 4 to 8 fl oz/a in 30 gal water for both pre- and postemergence control; For new seedlings: use 5 to 8 fl oz/a. For bentgrass control: use 5 fl oz/a in 30 gal water. Do not apply more than 16 oz/a per year, or 0.5 lb/a.

Time Tenacity is a systemic pre- and postemergence herbicide for the selective contact and residual control of weeds in turfgrasses. Applied preemergence, weeds absorb Tenacity during emergence. Dry conditions after application may reduce pre-emergence activity. If rain (0.15 inches) has not fallen within 10 days after a preemergence application, activate with 0.15 inches of irrigation. Used postemergence, susceptible weeds absorb Tenacity through foliar contact and soil absorption. Foliage of treated weeds stops growing after application, then turns white (loss of chlorophyll); and death may take up to 3 weeks. A repeat application is required after 2 to 3 weeks for improved postemergence weed control. Add a nonionic surfactant in postemergence applications. Tenacity may temporarily whiten turfgrass foliage. In general, symptoms appear 5 to 7 days after application and last several weeks. A repeat application to the same site causes less whitening of plant tissue. Tenacity effectively controls weed before or during seeding certain turfgrasses during turf renovation. Do not apply to newly germinated turfgrass until it has been mowed twice, or approximately 4 weeks after emergence. Young, actively growing weeds are easiest to control. Efficacy on mature weeds is reduced under moisture stress. Tenacity can be tank mixed with other herbicides, but check label for tank-mixtures already tested. Herbicides not listed on label as being tested for tank-mixtures must be tested for compatibility, safety, and efficacy before treating large areas. In established turf, Tenacity is more effective as a postemergence application unless combined with another soil active herbicide. Tenacity at 5 fl oz/a in at least 30 gal/a water in a 2- to 3- week interval controls creeping bentgrass. Apply with a nonionic surfactant. Up to three applications can be made. Applications may be more effective in late summer/early fall, just before bentgrass renews growth, than in spring/early summer.

Remarks Use sites include noncrop areas: golf courses, sod farms, athletic fields, parks, residential and commercial properties, cemeteries, airports, and lawns. Do not use on golf greens. Maintain a 5-ft buffer between treated areas and putting greens. Do not exceed 5 fl oz/a per application to perennial ryegrass or fine fescues or mixed stands with more than 50% perennial ryegrass and/or fine fescue. Withhold traffic on treated areas until spray has dried and irrigate lightly to move product from turf foliage before resuming normal irrigation to prevent movement onto sensitive species such as bentgrass. Do not plant any crop other than turfgrass species for 18 months after the last application of Tenacity, or injury may occur. Do not apply an organophosphate or carbamate insecticide within 7 days of a Tenacity application, as turf injury may occur. Do not apply by air or through any type of irrigation system. Do not exceed 16 oz/a Tenacity (0.5 lb mesotrione/a) per year. Restricted-entry interval is 12 hr. Do not use grass clippings from treated turf as mulch around trees or in vegetable/flower gardens.

New Seedlings/New Lawn Establishment: Apply Tenacity at 5 to 8 fl oz per/a in at least 30 gal water/a prior to seeding or post seeding of tolerant turfgrass species listed on this label, except fine fescue. Tenacity may reduce density of fine fescue seedlings. Tenacity can be used on grass seed blends that contain less than 20% by weight of hard or fine fescue. Tenacity will control many monocot and dicot weeds that compete with and slow the

establishment of the turfgrass stands. Apply at grass seeding or close to seeding for best performance. Avoid spraying on newly germinated turfgrass plants. Wait until the newly germinated turf has been mowed two times, or four weeks after emergence (whichever is longer), before making a postemergence application.

Spot Application of Tenacity: apply at 1 gal per 1,000.sq ft		
Spray Mix	Rate of Tenacity (teaspoons)	NIS adjuvant (teaspoons)
2 gal	1	3

Site of action Group 27: inhibits 4-hydroxyphenylpyruvate-dioxygenase (4-HPPD)

Chemical family Triketone

sulfentrazone (Dismiss)

Rate See label. Dismiss turf herbicide will control or suppress sedges at 4 to 12 fl oz/a. Apply the highest rate consistent with the rate needed for turfgrass safety. (See Table 1 on label). Rates lower than 12 fl oz/a will generally control sedges for at least 60 days. Good coverage is needed for optimum control of sedges. For optimum control of purple nutsedge, split applications are recommended. Apply 4 to 8 oz/a as an initial application followed by a second application when evidence of actively growing purple nutsedge is visible.

Time First application of this product can be made following the second mowing providing the turfgrass has developed into a uniform stand with a good root system. Creeping bentgrass, Kentucky bluegrass, rough bluegrass, fine fescue, tall fescue and perennial ryegrasses are tolerant to this herbicide.

Remarks Temporary discoloration of some turf types may result from use of surfactants or adjuvants. High temperatures and high relative humidity may increase the risk of temporary discoloration. Use of surfactants is not recommended. Discolored leaf tissue will be removed with mowing. To also reduce potential for discoloration, do not apply Dismiss Turf Herbicide on turfgrass that is weakened by weather, mechanical, chemical disease or other related stress. Maintain proper cultural practices such as adequate moisture and fertility levels to promote healthy turf growth.

Caution This pesticide is toxic to marine/estuarine invertebrates. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff may be hazardous to terrestrial and aquatic plants in neighboring areas. Do not use on coarse soils classified as a sand and which have less than 1% organic matter. Do not apply to golf course putting greens or tees. Do not use on turfgrasses other than those listed on the label. Temporary turfgrass discoloration has been observed when Primo has been withering-tank mixed or applied within 7 days of a Dismiss Turf Herbicide application. It is recommended that Primo applications be made 7 days prior to, or after Dismiss Turf Herbicide application to reduce risk of turfgrass discoloration. Do not apply to sod within three months of harvest. It is also recommended that the sod be established for at least 3 months before an application of Dismiss turf herbicide.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Triazinone

Annual Grass Weed Control in Turf

Summer annual grasses are rarely a problem in western Washington, or in the Willamette Valley and coastal areas of Oregon. They may be a problem in areas east of the Cascades throughout the Northwest and south of the Willamette Valley in Oregon, depending on local conditions. In controlling annual grasses, it is important to positively identify the grass before acting, to avoid wasting time and chemicals treating perennial grasses.

Preemergence herbicides are very effective in controlling grasses such as crabgrass, barnyardgrass, and foxtails, if applied before they germinate. If annual grasses are consistent problems, apply chemicals in spring when soil reaches 50 to 55°F, the temperature needed for germination. In some areas, this may coincide with late forsythia bloom. Irrigate after application of all preemergence herbicides to incorporate them into the soil where seed germination occurs. Once weedy grasses are observed, it is too late for preemergence control.

Annual grasses are generally difficult to control once they have infested turf. Selective postemergence control is best accomplished if annual grass seedlings are treated when they are small (i.e., five-leaf stage or younger).

Annual Grass Weeds

PREEMERGENCE

benefin + trifluralin (Team 2G)

Rate 75 to 120 lb Team 2G/a

Time Apply to established turfgrasses for preemergence annual grass control.

Remarks Available only in granular form. The 2:1 ratio of benefin to trifluralin effectively controls summer annual grass and *Poa annua*. It kills seedlings as they germinate with no postemergence activity. Team does not leach. See label for timings of multiple split applications for preemergence control.

Caution Do not use on bentgrass mowed to less than 0.5 inch high. Irrigation or rain is required to activate the product.

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

Chemical family (both) dinitroaniline

bensulide (Bensumec 4LF or Pre-San Granular)

Rate 6.25 gal (50 pints)/a or 18 fl oz of Bensumec 4LF/1,000 sq ft; 80 lb/a or 1.8 lb of Pre-San 12G/1,000 sq ft. Maximum of 4.6 lb/1,000 sq ft per year; 180 lb/a or 4.1 lb/1,000 sq ft of Pre-San 7G.

Time Apply to established turfgrasses on golf courses only.

Remarks Bensulide is available in granular and EC formulations. It is effective on most warm-season annual grasses and annual bluegrass. It kills seedlings by inhibiting root growth during germination and has no postemergence activity. Bensulide is unlikely to leach in most soils. It generally is safe on all established cool-season grasses on golf courses and residential lawns.

Caution May stunt roots on putting turf if applied repeatedly or at excessive rates. Product must be watered in.

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

Chemical family Organophosphorus

corn gluten meal (WOW!–WithOut Weeds-Supreme)

Rate 20 lb/1,000 sq ft

Time This product is a preemergence herbicide for use in controlling crabgrass, creeping bentgrass, smartweed, dandelions, redroot pigweed, purslane, lambsquarters, foxtail, barnyardgrass, and bermudagrass. There is not postemergence activity from WOW. Any weeds that have germinated before application of WOW will not be controlled.

Remarks Weed control research in the Pacific Northwest has found this product to be an effective fertilizer, however, it was not an effective product to reduce weed populations as a pre-emergence product.

Caution Do not use on grass which has been recently sown. WOW contains 10% slow-release nitrogen.

Site of action Unknown

Chemical family organic product

DCPA (Dacthal Flowable Herbicide)

Rate Use 14 pints of Dacthal Flowable in 40 to 100 gal of water/a (1 pints/3 to 7 gal/3,000 sq ft) for control of crabgrass. For annual bluegrass control, use a late summer or early fall application before weed seed germination of 10 quarts of Dacthal Flowable in 40 to 100 gal of water/a (0.5 pints/3 to 7 gal/3,000 sq ft) should supplement the early spring application.

Time A selective preemergence herbicide for control of crabgrass and other annual grasses and certain broadleaf weeds. It can be used as a postemergence application for control of creeping speedwell (*Veronica filiformis*) It is for use on nonresidential lawns, golf courses, cemeteries, athletic fields, parks, sod farms and institutional areas where turfgrass is grown.

Remarks Applications to turfgrass should be watered within 4 hours with 0.1 to 0.2 inches of water via irrigation. One application applied in early spring before weed seed germination usually provides seasonal control.

Caution Not recommended for use on bentgrass putting greens. Wait 60 days after application before any new reseeding is done.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Phthalic acid

dithiopyr (Armortech CGC 2L, Dimension 2EW Specialty Herbicide, Dimension EC Specialty Herbicide, Dimension Ultra 40WP Specialty Herbicide, Dimension 270-G Turf & Landscape Ornamental, Dithiopyr 2L Specialty Herbicide, Quali-Pro Dithiopyr 40 WSB Specialty Herbicide, many fertilizer products with dithiopyr on granules.)

Rate Using maximum rates of Dithiopyr 40SB is equivalent to 4 water-soluble pouches/a or 0.46 oz/1,000 sq ft (1.25 lb/a of product) per application, and 12 water-soluble pouches/a or 1.38 oz/1,000 sq ft (3.75 lb/a of product) per year, respectively. For Dimension EC, use no more than 1.5 fl oz/1,000 sq ft (2 quarts/a) per application, and no more than 4.5 fl oz/1,000 sq ft (6 quarts/a) per year, using split of sequential applications.

Time Apply preemergence when soil is about 50°F (about when forsythia blooms). Apply postemergence before crabgrass and annual bluegrass are in first tiller stage.

Remarks Dithiopyr is available in EC, 40WSB and 40WSP formulations, as granules, and on fertilizers. Gives preemergence

control of crabgrasses, foxtails, barnyardgrass, and a number of broadleaf weeds, including purslane, Oxalis species, and spurge. Also gives preemergence control of annual bluegrass (*Poa annua*). Gives postemergence control of crabgrass up to the first tiller growth stage. Dithiopyr appears to be safe on mature creeping bentgrass, Kentucky bluegrass, perennial ryegrass, tall fescue, and some fine fescues.

Caution Do not use on seedling turf; injury will be severe. Do not apply to turf under environmental stress.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Pyridine

ethofumesate (*Poa Constrictor* Herbicide, *Prograss* Herbicide, *Prograss SC* Herbicide, *Thrasher*)

Rate For new seedlings applied preemergence of weeds: 0.2 to 3 pints/a. Postemergence applications: Use 2.25 to 3 pints/a no later than the 4-leaf stage of the weed. Harder-to-control weeds must be treated by the 2-leaf stage of the plant. For established grasses: Use 2.25 to 3 pints/a both pre- and postemergence for perennial ryegrass and tall fescue.

Time Apply to grasses listed as tolerant on label before annual bluegrass reaches the 4-leaf stage.

Remarks Available only as an emulsifiable concentrate (EC). Effective preemergence and early postemergence activity on many annual grasses and broadleaf weeds. Can use selectively in new seedlings of perennial ryegrass to control annual bluegrass, which is susceptible from germination to the 3- to 4-leaf stage. Repeat fall treatments may control mature annual bluegrass in areas east of the Cascades. West of Cascades, ethofumesate has never successfully controlled mature annual bluegrass.

Caution Severely injures most fine fescues. Mature hard fescue turf is more tolerant than Chewings or red fescue. Generally safe on perennial ryegrass, except on mature turf in spring when injury can be severe. Fall applications to bentgrass are highly phytotoxic. Bentgrass may be slightly injured at other times of year.

Site of action Group 16: unknown

Chemical family Benzofuran

mesotrione (*Tenacity*)

Rate 4 to 8 fl oz/a in 30 gal water for both pre- and postemergence control; For new seedlings, use 5 to 8 fl oz/a; For bentgrass control use 5 fl oz/a in 30 gal water. Do not apply more than 16 oz/a per year or 0.5 lb/a.

Time Pre- and postemergence in established turf, and prior to or during seeding of certain turfgrasses during turf renovation.

Remarks Tenacity is a systemic pre- and postemergence herbicide for selective contact and residual control of weeds in turfgrasses. Applied preemergence, weeds absorb Tenacity during emergence. Dry conditions after application may reduce preemergence activity. If rain (0.15 inch) does not fall within 10 days after a preemergence application, activate with 0.15 inch irrigation. Used postemergence, susceptible weeds absorb Tenacity through foliar contact and soil absorption. Foliage of treated weeds stops growing after application, then turns white (loss of chlorophyll); and death may take up to 3 weeks. A repeat application is required after 2 to 3 weeks for improved postemergence weed control. Add a nonionic surfactant in postemergence applications. Tenacity may temporarily whiten turfgrass foliage. In general, symptoms appear 5 to 7 days after application and

last several weeks. A repeat application to the same site causes less whitening of plant tissue. Tenacity effectively controls weed before or during seeding of certain turfgrasses during turf renovation. Do not apply to newly germinated turfgrass until it has been mowed twice, or about 4 weeks after emergence. Young, actively growing weeds are easiest to control. Efficacy on mature weeds is reduced under moisture stress. Tenacity can be tank-mixed with other herbicides, but check label for tank-mixtures already tested. Herbicides not listed on label as being tested for tank-mixtures must be tested for compatibility, safety, and efficacy before treating large areas. In established turf, Tenacity is more effective as a postemergence application unless combined with another soil-active herbicide. Combine Tenacity with a preemergence herbicide for extended control of key annual monocot weeds such as crabgrass and foxtail.

Use sites include noncrop areas: golf courses, sod farms, athletic fields, parks, residential and commercial properties, cemeteries, airports, and lawns. Do not use on golf greens. Maintain a 5-ft buffer between treated areas and putting greens. Do not exceed 5 fl oz/a per application to perennial ryegrass or fine fescues or mixed stands with more than 50% perennial ryegrass and/or fine fescue. Withhold traffic on treated areas until spray dries, and irrigate lightly to move product from turf foliage before resuming normal irrigation, to prevent movement onto sensitive species such as bentgrass. Do not plant any crop other than turfgrass species for 18 months after the last application of Tenacity, or injury may occur. Do not apply an organophosphate or carbamate insecticide within 7 days of a Tenacity application, as turf may be injured. Do not apply by air or through any type of irrigation system. Do not exceed 16 oz/a Tenacity (0.5 lb mesotrione/a) per year. Restricted-entry interval is 12 hr. Do not use grass clippings from treated turf as mulch around trees or in vegetable/flower gardens.

New Seedlings/New Lawn Establishment: Apply Tenacity at 5 to 8 fl oz/a in at least 30 gal water/a prior to seeding or post seeding of tolerant turfgrass species listed on this label, except fine fescue. Tenacity may reduce density of fine fescue seedlings. Tenacity can be used on grass seed blends that contain less than 20% by weight of hard or fine fescue. Tenacity will control many monocot and dicot weeds that compete with and slow the establishment of the turfgrass stands. Apply at grass seeding or close to seeding for best performance. Avoid spraying on newly germinated turfgrass plants. Wait until the newly germinated turf has been mowed two times or four weeks after emergence (whichever is longer) before making a postemergence application.

Spot Application of Tenacity: apply at 1 gal/1,000 sq ft		
Spray Mix	Rate of Tenacity (teaspoons)	NIS adjuvant (teaspoons)
2 gal	1	3

Site of action Group 27: inhibits 4-hydroxyphenylpyruvate-dioxygenase (4-HPPD)

Chemical family Triketone

oxadiazon (Quali-Pro Oxadiazon 50 WSB Herbicide, Quali-Pro Oxadiazon SC Herbicide, Ronstar Flo Herbicide, Ronstar G Herbicide or Ronstar 50WSP Herbicide, Starfighter L Herbicide)

Rate Use Quali-Pro Oxadiazon 2G for crabgrass, goosegrass and crowfoot control at 100 to 200 lb/a (2 to 4 lb ai) or 2.25 to 4.5 lb/1,000 sq ft. Late applications are not recommended and may not be fully effective. For annual bluegrass control use the high end of the label rate. See label for other specific weed rates. Use Ronstar FLO at 1.85 to 2.8 fl oz/1,000 sq ft.

Time Apply to established Kentucky bluegrass and perennial ryegrass turf.

Remarks Effective preemergence against most warm-season annual grasses, annual bluegrass, and some broadleaf weeds. Labeled only for use on mature Kentucky bluegrass and perennial ryegrass turf. The maximum rate of Ronstar FLO is 3.7 fl oz/1,000 sq ft with no more than 2 applications per year. In areas of heavy weed infestation only, 7.4 fl oz/1,000 sq ft or 2.52 gal product/a per year (8 lb ai per year) are allowed.

Caution Phytotoxic to bentgrass and fine fescues. May injure Kentucky bluegrass and perennial ryegrass if applied to wet foliage.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Oxadiazole

pendimethalin (Pre-M or Drexel PIN-DEE 3.3 T&O Herbicide, Everris Corral 2.68G, Hammerkop Hydrocap)

Rate 1.49 to 1.98 lb ai/a Pre-M, 1.53 to 2.01 lb ai/a Corral

Time Apply before weed seeds germinate in spring.

Remarks Controls most warm-season annual grasses, annual bluegrass, Oxalis species, and spotted spurge when applied pre-emergence. It is safe on most established cool-season turfgrasses.

Caution Injures bentgrass and stains concrete and stone. Product should only be applied to bentgrass that is mowed at 0.5 inch or higher. Bentgrass lawns should use a 2.5 lb/a rate with a repeat application of 1.7 to 2.5 lb/a in 6 to 8 weeks.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

prodiamine (Barricade 4L, Barricade 65WG, Cavalcade 65WDG, Evade 4FL, Halts Pro, Proclipse 65WDG, Alligare Prodiamine 65WDG Herbicide, Quali-Pro Prodiamine 4L Herbicide, Quali-Pro Prodiamine 65 WDG Herbicide, Resolute 65WG Herbicide, Resolute 4FL Herbicide, many fertilizer products with active ingredient on granules)

Rate Use Barricade 4FL at 10 to 24 fl oz/a or 0.23 to 0.55 fl oz/1,000 sq ft at maximum rate for cool season turfgrasses. Use Barricade 65WG at 0.5 to 1.5 lb/a or 0.185 to 0.55 fl oz/1,000 sq ft for Kentucky bluegrasses per growing year. Maximum application rate for fine fescue is 1.15 lb/a or 0.42 fl oz/1,000 sq ft. Maximum application rate for bentgrass is 1.0 lb/a or 0.37 fl oz/1,000 sq ft per growing year.

Time Apply before weed seeds germinate.

Remarks Available as a 65% DF, WG or WDG, or 4 F or FL herbicide for use on established cool- and warm-season turfgrasses. If used properly, prodiamine gives preemergence control of crabgrass, yellow foxtail, goosegrass, annual bluegrass, prostrate spurge, and several other weeds.

Caution Water in thoroughly to avoid loss of activity from photodecomposition. Safe at label rates on tall fescue, Kentucky bluegrass, perennial ryegrass, creeping red fescue, and creeping bentgrass. Not intended for use on putting greens.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

prodiamine + sulfentrazone (Echelon 4SC Herbicide)

Rate Echelon 4SC at rates from 0.25 to 1.125 lb ai/a (8 to 36 fl oz/a) or 0.184 to 0.826 fl oz/1,000 sq ft depending upon type of grass being sprayed on the site. See Table 1 on label for the exact rate for each species of grass, as well as some comments below in the Remarks section.

Time Apply for pre- and early postemergence control of crabgrass and for selective pre- and postemergence control of annual grasses, broadleaf weeds, and sedges in turf sites including residential and institutional lawns, athletic fields, commercial sod farms, golf course fairways and roughs, roadsides, utility rights-of-way, railways, and industrial areas.

Remarks Existing weed roots and shoots take up Echelon; it also prevents growth of newly emerged weed seedlings. Echelon may be used on well-established seeded, sodded, or sprigged turfgrasses. Make first application after the second mowing, providing grass has developed into a uniform stand with a good root system. Applied as directed, creeping bentgrass, fine fescue, and perennial ryegrasses tolerate 0.25 to 0.375 lb ai/a of Echelon 4SC. Kentucky bluegrass and tall fescue tolerate 0.57 to 0.75 lb ai/a of Echelon 4SC. Do not exceed 1.125 lb ai/a per calendar year. Sulfentrazone has good activity on creeping buttercup.

Caution Turf may be injured if it is not well established or has been weakened by stresses such as unfavorable weather, disease, chemicals, or mechanical influences. Do not apply to golf course greens and tees. Do not apply to areas where dichondra, colonial bentgrass, velvet bentgrass, or annual bluegrasses are desirable species. Treated sod preharvest interval is 90 days. Do not apply with adjuvants or surfactants.

Site of action (prodiamine) Group 3: microtubule assembly inhibitor; (sulfentrazone) Group 14: protoporphyrinogen oxidase inhibitor

Chemical family (prodiamine) dinitroaniline; (sulfentrazone) triazinone

siduron (Tupersan)

Rate Tupersan at the time of seeding: 1.5 to 4.5 oz/1,000 sq ft, or 4 to 12 lb/a for a single application. Sequential applications should use 2.5 to 4.5 oz + 1.5 to 2.5 oz, or 6 to 12 lb product/a + 4 to 6 lb/a. Fall plantings with a single application should use 6 to 9 oz /1,000 sq ft or 16 to 24 lb/a.

Time Apply for warm-season annual grass control at time of seeding of cool-season turfgrasses.

Remarks Available in wettable powder (WP) and granular formulations. Safe on most cool-season turfgrasses. Can be used on new seedings of cool-season grasses since it is active only against warm-season annual grasses. Will not control annual bluegrass.

Caution May injure some bentgrass varieties. "Penncross," "Seaside," "Highland," and "Astoria" are tolerant.

Site of action Group 7: photosystem II inhibitor

Chemical family Substituted urea

simazine (Simazine 4L Flowable Herbicide, Agrisolutions Simazine 90DF, Princep Liquid SIM-TROL 90DF)

Do not use with cool season grasses

Rate 1 quart/a or 0.75 fl oz/1,000 sq ft of Princep 4L for control of annual bluegrass in warm season grasses. For control of other weeds, use 1 to 2 quarts/a or 0.75 to 1.5 fl oz product/1,000 sq ft. If applying SIMTROL 90DF, use from 2.2 to 4.4 lb/a according to soil texture type. Refer to "Turfgrasses Table" on page 10 of SIMTROL 90DF label to determine rate for soil type.

Time Apply simazine before weeds emerge or after removal of weed growth.

Remarks Simazine is primarily taken up by the roots of the weedy plants. Adequate moisture is necessary to move the herbicide into the root zone. Simazine is effective in controlling annual bluegrass, annual ryegrass, barnyardgrass, burclover, common chickweed, crabgrass, cheatgrass, goosegrass, groundsel, henbit, common lambsquarters, pigweed, pineappleweed, common purslane, ragweed, Russian thistle, shepherdspurse, smartweed, speedwell, tansy mustard and wild oats. Most cool season grasses are sensitive to simazine. This product is for use mainly with warm season grasses such as bermudagrasses or buffalograss. Biotypes of some of the weeds listed on the label have been reported to show some resistance after multiple applications over many years.

Caution For use with warm season grasses such as bermudagrass and zoysiagrass. Do not use with cool season grasses. Do not apply simazine to sand and loamy sand soils where the water table is close to the surface and where these soils are very permeable. Aerial applications are prohibited. Do not apply to frozen ground.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazine

POSTEMERGENCE

dithiopyr (Dimension 270-G Turf & Landscape Ornamental, Dimension 2EW Specialty Herbicide, Dimension 2EC Specialty Herbicide, Dimension Ultra 40 WP Specialty Herbicide, Dithiopyr 2L Specialty Herbicide, many products on fertilizer granules.)

Rate Dimension can be used for early postemergence of crabgrass if it is still at the 1 tiller stage. A nonionic surfactant can be added at 0.5% (v/v) (2 quarts/100 gal spray) to improve postemergence control of crabgrass. Use maximum rates of Dithiopyr 40SB is equivalent to 4 water-soluble pouches/a or 0.46 oz/1,000 sq ft (1.25 lb/a) per application, and 12 water-soluble pouches/a or 1.38 oz/1,000 sq ft (3.75 lb/a of product) per year, respectively. For Dimension EC, use no more than 1.5 fl oz/1,000 sq ft (2 quarts/a) per application and no more than 4.5 fl oz/1,000 sq ft (6 quarts/a) per year using split of sequential applications.

Time Apply to established turf before crabgrass begins tillering.

Remarks Controls crabgrass postemergence if applied before crabgrass produces tillers. After tillering, dithiopyr must be mixed with either MSMA or fenoxaprop to achieve acceptable control.

Caution Do not use on seedling turf or turf growing under environmental stress.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Pyridine

fenoxaprop (Acclaim Extra Herbicide)

Rate Acclaim Extra to suppress common bermudagrass at 20 fl oz/a or 0.46 fl oz/1,000 sq ft, as soon as bermudagrass or Johnsongrass begins to grow. Repeat applications every 28 to 35 days to continue growth suppression. Do not apply more than 120 fl oz/a per season (2.75 fl oz/growing season).

Time Apply to established turfgrasses for specific annual grasses listed on label. Grasses controlled include smooth and large crabgrass, goosegrass, barnyardgrass, foxtail species, Panicum species, Johnsongrass (seedling), sandbur, sprangletop, and Japanese stiltgrass.

Remarks Available as an emulsifiable concentrate (EC). It is effective as a postemergence warm-season annual grass herbicide and is safe on most cool-season turfgrasses. It is foliar absorbed, slow acting, and should be applied with 40 to 80 gal/a for thorough coverage. Do not mow areas for 24 hr after application to allow penetration and translocation into the grassy weeds. Grass clippings can interfere with thorough spray coverage of the target weeds.

Caution Weed control may be reduced if fenoxaprop is mixed with common broadleaf herbicides. Fenoxaprop may injure Kentucky bluegrass and bentgrasses. Repeat applications may be needed for control. Do not exceed a total of 120 fl oz/a per growing season. If turfgrass was stunted after a previous application, avoid applying again until turfgrass completely recovers.

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

Chemical family Aryloxyphenoxy propionate

MSMA (Agri-Star Weed-Hoe)

Rate 4 fl oz per 4 gal water/1,000 sq ft on young plants or at temperatures of 90°F.

Time Apply to established turfgrass for annual grass control, nutsedge or sandbur control.

Remarks Available in liquid formulations. Arsenicals are generally effective but may require two applications at 10- to 14-day intervals to achieve complete control.

Caution Safe for use on established bluegrass, zoysiagrass and bermudagrass lawns. Arsenicals may injure bentgrass and fine fescues. Soil should be moist but not saturated at time of treatment.

Site of action Group 17: not well understood

Chemical family Organoarsenical

sethoxydim (Segment Herbicide)

Rate To control 6-inch tall grasses: use Sethoxydim SPC at 2.14 pints/a or 8 fl oz/1,000 sq ft. To control 12-inch tall grasses: use 3.75 pints/a or 1.4 fl oz/1,000 sq ft. Spot Treatment: for grasses 6 inches tall, use a 1.5% solution; for grasses 12 inches tall and perennial grasses, use 2.25% solution. To calculate required amount for recommended percent solution, see Tables 9 and 10 on label.

Time Apply to actively growing grassy weeds as aerial, broadcast, and/or spot spray at the rates and growth stages listed on the label. The most effective control will result from making postemergence applications of Sethoxydim SPC early, when grassy weeds are small. Delaying application allows grassy weeds to exceed the maximum size stated and may prevent adequate control.

Remarks Use for control of annual and perennial grass weeds in fine fescue. Apply Sethoxydim SPC in the Pacific Northwest using 5 to 50 gal for spray solution/a. Better control is achieved if the site is irrigated 2 to 4 days before the application of Sethoxydim SPC is made. Will control barnyardgrass, colonial and highland bentgrasses, large and smooth crabgrass, downy brome, German velvetgrass, goosegrass, Johnsongrass, quackgrass, annual ryegrass, field sandbur, seedling tall fescue, volunteer barley, oats, rye and wheat, and wild oats. No additives or adjuvants are recommended for use with Sethoxydim SPC when applied to turf. Sethoxydim SPC is rainfast within one hour. Sethoxydim SPC does not control annual bluegrass or rattail fescue.

Caution Use standard high-pressure pesticide flat fan or hollow cone nozzles spaced up to 20 inches apart. Do not use flood, whirl chamber, or controlled droplet applicator nozzles as erratic coverage can cause inconsistency weed control. Do not use selective application equipment such as wiper applicators or recirculating sprayers. Do not use treated area as a pasture. Do not apply through any type of irrigation equipment. Do not apply to turf that is under stress.

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

Chemical family Cyclohexanedione

sulfosulfuron (Certainty Turf Herbicide)

Rate 1.25 oz/a. If you wish to control tall fescue, use another application of the same rate at 3 to 4 weeks after the first application.

Time Apply postemergence when target weeds are actively growing and not disturbed by mowing for at least 2 days after application.

Remarks A postemergence, systemic herbicide with limited soil residual activity. Gives postemergence control of many annual and perennial sedges, grass and broadleaf weeds on highly managed turf, sod farms, and native grass sites in warm season turfgrasses only. A selective herbicide that can be used over the top of many perennial warm-season and selected cool-season turfgrasses. Apply only when grasses are actively growing and mowing is required. Product can control roughstalk bluegrass (*Poa trivialis*). Can apply to residential and commercial turf sites, including apartment complexes, athletic fields, cemeteries, golf course fairways, tees, and roughs, hotel properties, office complexes, parks, public turf areas, retail sites, storage facilities, school grounds, sod and turfgrass seed farms, and other highly managed turfgrass areas. Product is absorbed by both roots and foliage and rapidly inhibits susceptible weeds, whose growth stops within 24 hours of treatment even though visual symptoms are slow to develop. Susceptible weeds usually show yellowing or browning within 2 to 3 weeks. Warm, moist conditions after application accelerate herbicidal activity; cold, dry conditions delay activity. Weeds stressed by drought are less susceptible.

Caution For use on warm season turfgrasses only. Do not apply directly to or within 4 ft of golf course putting greens. Using this chemical on permeable soils, particularly where the water table is shallow, may contaminate ground water. Heavy rain or irrigation within 2 hours after application may wash product off the foliage, and a repeat application may be required for adequate control. Do not exceed a total of 2.66 oz/a per year. Avoid contact with roots or foliage of susceptible nontarget vegetation; injury may occur. This includes areas where product may be washed or moved into contact with roots of desirable vegetation.

Susceptible plants may be injured if seeded or transplanted into treated areas, unless otherwise directed on label. Fall applications, after temperatures drop and regular mowing is no longer required, may increase risk of turf injury and may delay spring green-up. Applications may result in temporary chlorosis and discoloration and may affect desirable turf's growth pattern; symptoms generally appear 7 to 10 days after application and typically go away in 21 to 28 days. Perennial ryegrass, fine fescues, and creeping bentgrass are more sensitive to this product.

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

Chemical family sulfonyleurea

topramezone (Pylex Herbicide)

Rate Broadcast applications for perennial broadleaf weeds.

Option A: 3 applications at 1.0 to 1.33 fl oz/a or 0.023 to 0.030 fl oz/1,000 sq ft applied on 3 to 4 week interval. Option B: 2 applications at 1.5 fl oz/a or 0.034 fl oz/1,000 sq ft applied on 3 to 4 week interval. Broadcast applications for grassy weeds: 1.0 to 1.5 fl oz/a or 0.023 to 0.034 fl oz/1,000 sq ft. DO NOT apply more than 2 fl oz/a per application or 4 fl oz/a/year.

Time A single application should be made when weeds are actively growing and should be applied with a crop oil concentrate (COC) at 0.5% v/v. Weeds should not be under stress from lack of water, excessive water, low fertility, mowing shock, excessive hot or cold temperatures, or injury from other herbicide applications. Pylex can be used for weed control during turfgrass establishment when establishing from seed. Once grass has been seeded, no applications should be made for 28 days. Seeding can occur any time after seeding or at the time of application.

Remarks Pylex provides postemergence control of bermudagrass and goosegrass in cool season turfgrasses. It can also be used for control of clover, ground ivy, oxalis, speedwell, Canada thistle, and many other broadleaf weeds in Kentucky bluegrass, tall fescue, fine fescue, and perennial ryegrass. It has shown variable tolerance on bentgrass (moderate to severe injury) and annual bluegrass (minimal to moderate injury) at labeled use rates (see grassy weed control for grasses controlled). May be applied postemergence to residential (spot spray only) and non-residential turf. See special use directions on label for residential and athletic fields. Pylex is absorbed by leaves, roots, and shoots and is translocated to the growing points of susceptible weeds. Pylex controls weeds by inhibiting carotenoid biosynthesis. Soon after application, treated weeds turn white because of chlorophyll loss and growth stops.

Caution Do not apply directly to water or to areas where surface water is present. Do not apply this product through any type of irrigation system. Do not allow people or pets to enter the treated area until sprays have dried. DO NOT apply to golf course collars or greens. Maintain a 5-ft buffer between treated areas and bentgrass greens. Do not make applications to drought-stressed turfgrass and/or drought-stressed weeds. Do not apply to exposed feeder roots or trees or ornamental or within the dripline of trees and other ornamental species. Do not use grass clippings as mulch around flowers, ornamentals, trees, or in vegetable gardens. Do not apply by air. Do not apply an organophosphate or carbamate insecticide within 7 days of applying Pylex or turfgrass injury may result. To reduce movement into sensitive species such as bentgrass, avoid foot and vehicle traffic until spray has dried. Do not mow for two days before or after application.

Site of action Group 27: HPPD inhibitor

Chemical family Phenyl pyrazole ketone

Chemical Renovation of Turfgrass

Old turf areas eventually are invaded and often dominated by naturalized grasses including bentgrasses, roughstalk bluegrass, annual bluegrass, velvetgrass, tall fescue, quackgrass, and bermudagrass. Managers who desire pure turf stands need to renovate periodically by killing all vegetation and reseeding.

Most attempts at chemical renovation fail outright or provide only short-term control of weedy grasses. For good results, managers must completely kill weeds and prevent re-infestation from seed. To optimize kill of weedy grasses, leave the target turf unmowed for several weeks as it grows vigorously. In spring, the best time to spray cool-season grasses is at early flowering, to maximize kill of difficult grasses such as velvetgrass, bentgrass, and tall fescue. In fall, spray turf when new growth is at least 3 inches tall. Summer sprays often are ineffective due to poor translocation to crowns and rhizomes. Remember, good foliar kill does not always mean complete plant kill.

On renovation sites replanted with straight perennial ryegrass, a selective preemergence herbicide containing ethofumesate can be applied to control germinating annual bluegrass. Applied properly, ethofumesate gives 90% to 100% control of germinating annual bluegrass with no harmful effects on the developing ryegrass turf.

Chemical Renovation and Combination Products for Extended (6 months) Bare Ground (Edging)

NONSELECTIVE POSTEMERGENCE

glyphosate (many brand names)

Rate Most glyphosate products are 41% ai. For those products, when controlling annual weeds, use 12 to 36 fl oz/a. For perennial weeds: use 1.5 to 7.5 pints/a, or for hand-held applications, use 0.75% to 1.5% solutions. Refer to annual and perennial weed control tables on the glyphosate product to calculate amount of product and gallons of water to use for control of specific weeds.

Time Apply when target plants are actively growing.

Remarks Properly applied, glyphosate kills all common weedy grasses and many broadleaf weeds. Results on grasses are best if turf is allowed to grow at least 3 inches tall or to flower. For maximum kill, delay replanting to see whether regrowth is from crowns or rhizomes. Bermudagrass kill is better with summer or early fall sprays. Roundup PRO is for use in industrial (nonagricultural) markets. Roundup PROMAX has a new formulation of surfactants with a Category IV acute toxicity rating and "Caution" signal word. It contains 15% surfactant for faster activity and is rainfast in 1 to 2 hr. Effects on weedy grasses are visible in 2 to 4 days, but on most perennial weeds not for 7 days or more. Roundup PROMAX's active ingredient inhibits an enzyme essential for forming specific amino acids. Roundup ProDry is a water-soluble granule containing surfactant; no additional surfactant is needed or recommended.

Caution Avoid tilling or slice-seeding sprayed areas for at least 7 days to ensure adequate translocation to crowns, rhizomes, and roots. Use caution in spraying turf near ornamentals, which may be injured or killed by drift or direct spray contact. See label for site application for each product.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate (Glypro Plus, Gly Star Original, Gly Star K-Plus, Gly Star Plus, Gly Star Pro Gly-4 Herbicide, gly-4 Plus Herbicide, Glyphos Herbicide, Glyphos Pro Herbicide, Glyphos X-Tra Herbicide, Glypho 41 Herbicide, Glyphogan Herbicide, Glysort)

Rate These products are all 41% ai. See tables on label for amount of product to use for specific weed control.

Time Apply when plants are actively growing for best results.

Remarks Suppresses perennial grasses (see label for specific grasses and rates) and can substitute for mowing. Also can suppress annual rye, wild barley rye, and wild oat in coarse turf on roadsides or in industrial areas. Use only if some damage or discoloration of perennial grasses can be tolerated. Glypro Plus controls most existing vegetation prior to renovating turfgrass or establishing turfgrass from seed or sod. If existing vegetation is being mowed, omit at least one regular mowing before application to allow sufficient growth to intercept the spray well.

Caution Avoid herbicide contact with foliage, green stems, exposed nonwoody roots or fruit of crops, and desirable plants and trees; severe injury or death may result. Do not treat weeds under poor growing conditions such as drought stress, disease or insect damage; weed control may be reduced. Herbicide activity may also be reduced if weeds are very dusty. Do not disturb soil for 7 days after application. Do not feed or graze turfgrass grown for seed or sod production for 8 weeks after applying.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

glyphosate + carfentrazone-ethyl (Rage)

Rate Product contains 5 lb/gal glyphosate and 0.40 lb/gal carfentrazone. For spot treatments: use 0.75% to 8% (1 fl oz/gal to 10.25 fl oz/gal). For suppression of perennial grass growth: use 3 to 4 fl oz in 10 to 20 gal water/a for tall fescues, fine fescue, orchardgrass and quackgrass. Use 4 fl oz in 10 to 20 gal water/a for Kentucky bluegrass.

Time Weed control is best when product is applied to actively growing weeds up to 4 inches high, or to rosettes less than 3 inches across.

Remarks Rage is a broad spectrum, nonselective herbicide, providing contact and systemic herbicide effects. Rage herbicide's two modes of action help minimize herbicide-resistant weed populations. It is a liquid emulsion formulation (EW). Mix with water and a recommended adjuvant to control selective postemergence broadleaf and grass weeds on labeled crops. Rage is absorbed rapidly through plant foliage and is rainfast when spray solution dries. To avoid significant crop response, do not apply within 6 to 8 hours of either rain or irrigation. Within a few hours of application, foliage of susceptible weeds shows signs of desiccation. Plant necrosis and death occur several days after the application. Weeds hardened by droughty conditions are less susceptible. Can be used to trim and edge in many noncrop sites. Mow 3 to 4 days before spraying to even out the height of undesirable grasses. Growth suppression can be achieved on tall fescue, fine fescue, orchardgrass, quackgrass and Kentucky bluegrass.

Caution Product is only for use by individuals/firms certified and/or licensed as pesticide applicators. Large droplet size limits drift. A nonionic surfactant, methylated seed oil, or crop oil concentrate is required for use. See label for specifics.

Site of action (glyphosate) Group 9: inhibits EPSP synthase; (carfentrazone-ethyl) Group 14: protoporphyrinogen oxidase inhibitor

Chemical family (glyphosate) none generally accepted; (carfentrazone-ethyl) triazinone

NONSELECTIVE POSTEMERGENCE AND PREEMERGENCE

glyphosate + prodiamine (ProDeuce)

Rate 3 to 5.75 fl oz/1 gal water/1,000 sq ft

Time Apply to established weeds and weed-prone areas before weeds emerge; for example, treat cracks and crevices in driveways, fence lines, foundations, curbs, retaining walls, or lawn edges. Glyphosate enters through foliage and moves systemically to roots, killing weeds by stopping production of a substance found in plants. Weeds begin to yellow and wilt in a matter of days; kill is complete in 1 to 2 weeks. Prodiamine provides an invisible barrier in soil by preventing growth and development of newly germinated weeds. Spray when air is calm to prevent drift to desirable plants. For best results, apply during warm, sunny weather (above 60°F).

Remarks All plants, trees, shrubs, sod and seed may be planted 6 months after application when applying at the 3-oz/1,000 sq ft rate.

Caution Stay off treated areas until sprays are dry. Take care to prevent tracking product onto desirable grasses. Do not spray desirable plants. Do not use in lawns for lawn renovations, because product will prevent desirable grass establishment for up to 6 months. Do not apply with a galvanized or unlined steel (except stainless steel) sprayer, or through any irrigation system.

Site of action (glyphosate) Group 9: inhibits EPSP synthase; (prodiamine) Group 3: microtubule assembly inhibitor

Chemical family (glyphosate) none generally accepted; (prodiamine) dinitroaniline

pelargonic acid (Scythe)

Rate Annual weeds, moss and young plants within other green plants: 3% to 5% (4 fl oz to 6.66 fl oz/gal water), Burn down of perennial herbaceous plants and sucker control: 5% to 7% (6.3 fl oz to 9.33 fl oz/1 gal water). Maximum burn down, edging or foliar trimming: 7% to 10% (9.33 fl oz to 13 fl oz/1 gal water).

Time For best results, apply when plants are actively growing and day is sunny and warm.

Remarks A nonvolatile, contact, nonselective, broad-spectrum, foliar-applied emulsifiable concentrate (EC). It is nonsystemic with no soil residual and will not move through soil. Controls annual broadleaf and grass weeds less than 6 inches tall. Suppresses biennial and perennial weeds by destroying green foliage. Effects are visible within hours. Does not damage woody plant parts. Can be used to spot-weed or edge turf and landscape areas. Spray to wet but not to the point of runoff. Cool or cloudy weather after treatment may slow activity and delay visible effects.

Caution Avoid spray contact with foliage of desirable turf-grasses, trees, shrubs, or other vegetation because damage may result.

Site of action Group 26: unknown

Chemical family Carboxylic acid

SELECTIVE PREEMERGENCE AND EARLY POSTEMERGENCE

ethofumesate (Poa Constrictor Herbicide, Prograss Herbicide, Prograss SC Herbicide, Thrasher)

Rate For new seedlings applied preemergence of weeds: 0.2 to 3 pints/a. Postemergence applications: 2.25 to 3 pints/a no later than the 4-leaf stage of the weed. Harder-to-control weeds must be treated by the 2-leaf stage of the plant. For established grasses: 2.25 to 3 pints/a both pre- and postemergence for perennial ryegrass and tall fescue.

Time Apply to grasses listed as tolerant on label before annual bluegrass reaches the 4-leaf stage.

Remarks Ethofumesate is available only as an emulsifiable concentrate (EC). It provides effective preemergence and early postemergence control of annual bluegrass in new seedlings of perennial ryegrass. It is root absorbed; water it in after application.

Caution Ethofumesate inhibits germination of most desirable cool-season grasses other than perennial ryegrass. It is highly toxic to seedling fine fescues. Surface organic matter decreases its effectiveness. Remove thatch and other debris before applying.

Site of action Group 26: unknown

Chemical family Benzofuran

Susceptibility of Broadleaf Weeds in Turf to Common Herbicides

Weed	2,4-D	dicamba	MCPP	MCPA	Mixtures with triclopyr	Mixtures without triclopyr
Bindweed, field (<i>Convolvulus arvensis</i>)	S-I	S	I	—	S	S
Buttercup, creeping* (<i>Ranunculus repens</i>)	S-I	S-I	I	S-I	—	I
Carrot, wild (<i>Daucus carota</i>)	I	S	I	—	—	S
Chicory (<i>Cichorium intybus</i>)	S	S	S	—	S	S
Chickweed, common (<i>Stellaria media</i>)	R	S	S-I	—	S	S
Chickweed, mouseear (<i>Cerastium vulgatum</i>)	I-R	S	S-I	—	S	S
Clover, hop (<i>Trifolium spp.</i>)	I	S	S-I	I	S	S
Clover, subterranean (<i>Trifolium subterraneum</i>)	I	S	I	I	S	S
Clover, white (<i>Trifolium repens</i>)	I	S	S-I	I	S	S
Cranesbill (<i>Geranium carolinianum</i>)	S-I	S	S-I	—	S	S
Daisy, English** (<i>Bellis perennis</i>)	R	I	I	—	S	S-I
Daisy, oxeye (<i>Chrysanthemum leucanthemum</i>)	I	I	I	—	—	S-I
Dandelion, common (<i>Taraxacum officinale</i>)	S	S	S-I	S-I	S	S
Dandelion, false (<i>Hypochoeris radicata</i>)	S	I	R	—	S	S
Healall (<i>Prunella vulgaris</i>)	S-I	S	S-I	—	I	S
Henbit (<i>Lamium amplexicaule</i>)	I-R	S	I	—	S	S
Ivy, ground (<i>Glechoma hederacea</i>)	I-R	S-I	I	—	S	R
Knotweed, prostrate (<i>Polygonum aviculare</i>)	I-R	S	I	—	S	S
Lambsquarters (<i>Chenopodium album</i>)	S	S	S	S	S	S
Medic, black (<i>Medicago lupulina</i>)	I-R	S-I	I	—	S	S-I
Mustard, wild (<i>Brassica kaber</i>)	S	S-I	I	S	S	S
Pearlwort (<i>Sagina procumbens</i>)	I-R	S	S	—	—	S
Pigweed, prostrate (<i>Amaranthus blitoides</i>)	S	S	S	S	S	S
Pineappleweed (<i>Matricaria matricarioides</i>)	I-R	I	I	—	—	I
Plantain, broadleaf (<i>Plantago major</i>)	S	R	I	I	S	S
Plantain, buckhorn (<i>Plantago lanceolata</i>)	S	R	I	I	S	S
Purslane, common (<i>Portulaca oleracea</i>)	I	S	R	I	S	S
Shepherdspurse (<i>Capsella bursa-pastoris</i>)	S	S	S-I	S	S	S
Sorrel, red (<i>Rumex acetosella</i>)	I-R	S	R	—	—	S
Speedwells*** (<i>Veronica spp.</i>)	R	R	R	—	R	R
Spurge, prostrate (<i>Euphorbia supina</i>)	I	S-I	I	—	S	S-I
Thistle (<i>Cirsium spp.</i>)	S-I	S	I	I	S	S
Violet, wild (<i>Viola spp.</i>)	I-R	I-R	I-R	—	S	I-R
Woodsorrel, yellow (<i>Oxalis corniculata</i>)	R	I	I-R	—	S	I-R
Yarrow, common (<i>Achillea millefolium</i>)	I	S	I-R	—	S	S-I

S = susceptible;

I = intermediate (may require several successive applications for control);

R = resistant

*Sulfentrazone will give good control of buttercup.

**Penoxsulam gives good control of English daisy.

***Mixtures with triclopyr may control *Veronica chamaedrys*. Quinclorac will control English daisies and common, slender, and thyme-leaf speedwell with one application. See label for seed oil or crop oil additive rates to use with quinclorac.

