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Annual Bluegrass Control in Non-Residential Commercial Turfgrass in Georgia

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Annual bluegrass (*Poa annua* L.) is a problematic winter annual weed. Compared to most turfgrasses, annual bluegrass has a lighter green color, coarser leaf texture and produces unsightly seedheads. Contrary to its name, both annual (live for one season) and perennial (live for many seasons) biotypes of annual bluegrass may be found in turf. Perennial biotypes are more prevalent on closely mowed turf that receives frequent irrigation and high nitrogen fertilization. Perennial biotypes will be more prevalent in shady or highly trafficked areas with compacted soil. While the two biotypes may not be easily distinguished from each other, annual types are more upright in growth and produce more seed than lower-growing perennial types.

Annual bluegrass seed germinates in late summer/early fall once soil temperatures fall below 70° F. Seedlings grow and mature in fall, overwinter in a vegetative state and produce seed in spring. Annual bluegrass is a prolific seed producer and individual plants may produce hundreds of viable seed, even when closely mowed. Annual bluegrass flowers over several months in spring and produces seed that may remain dormant in soil for years before germinating. Annual bluegrass grows well under short day lengths and cool conditions, and may out-compete other turf species during late fall and early spring. Annual bluegrass often dies from summer stresses but may survive if it is irrigated and pests are adequately controlled, especially for perennial biotypes.

Cultural Control

Several cultural practices can be utilized to control annual bluegrass. Deep and infrequent irrigation encourages turfgrass root development, which improves the ability of desired grasses to compete with annual bluegrass in mixed stands. Withholding water until desirable turfgrass species exhibit initial drought stress symptoms can help reduce soil moisture for potential annual bluegrass infestations. Overwatering, especially in shady areas, may predispose the site to annual bluegrass invasion.

Practices that promote soil compaction should be avoided to promote turfgrass growth and competition with annual bluegrass populations. Core aerifications should be conducted during active turf growth and favorable periods for quick recovery. Voids left in turf with exposed soil following aerifications may permit annual bluegrass invasion during periods of peak germination. For cool-season grasses, fall aerifications should be timed before annual bluegrass germinates. Warm-season grasses should have enough time to recover from summer aerifications to promote dense, high quality turf prior to annual bluegrass germination in fall.

Nitrogen fertilization should be reduced during peak annual bluegrass germination and periods of vigorous growth. High nitrogen at these times encourages annual bluegrass spread and survival into winter and spring. Fertilizing dormant turfgrasses when annual bluegrass is actively growing may also exacerbate infestations and should be avoided.

Mowing height, frequency and equipment requirements vary among turfgrass species and practitioners should maintain turf under appropriate regimes for successful long-term culture (Table 1). Raising the mowing height during peak annual bluegrass germination may encourage turf competition to reduce potential infestations. Lower mowing heights may predispose turf to stress and reduce competition with annual bluegrass populations. Turfgrass should also be mowed frequently during periods of vigorous growth to prevent scalping. Scalping thins out turf and may enable weeds,

such as annual bluegrass, to establish. While returning clippings is recommended to recycle nutrients to the soil, removal of clippings may be useful when annual bluegrass is present and producing seedheads. Removal of clippings at this time will reduce the spread of viable seed.

Chemical Control

Preemergence Control

Preemergence herbicides may prevent annual bluegrass seed germination. However, preemergence herbicides will not eradicate established plants and will not effectively control perennial biotypes of annual bluegrass from spreading vegetatively. Application timing of preemergence herbicides for annual bluegrass control is very important. Herbicides must be applied in late summer/early fall before annual bluegrass germination. A second application can be applied in winter to control later germinating plants. Fall-applied preemergence herbicides should not be used if reseeding or resodding is needed to repair areas of damaged turf within several months after herbicide applications.

Several preemergence herbicides used for summer annual weed control will effectively control annual bluegrass in fall and winter (Table 2). Fall applications of herbicides such as bensulide (Betasan), dithiopyr (Dimension), oxadiazon (Ronstar, Starfighter), pendimethalin (Pendulum, others) and prodiamine (Barricade, others) may effectively control annual bluegrass. Herbicides, rates and application information are presented in Table 3. Combination herbicide products are also available that may improve efficacy of applications. These products include oxadiazon plus bensulide (Anderson's Crab and Goose), oxadiazon plus prodiamine (Regalstar) and benefin plus oryzalin (Team 2G or Team Pro). Many preemergence herbicides are available under a wide variety of trade names and formulations, and turf mangers should carefully read label directions before applications.

Atrazine (Aatrex, Purge, others) and simazine (Princep, WynStar, others) are labeled for centipedegrass, zoysiagrass, St. Augustinegrass and bermudagrass. Atrazine can be applied to actively growing and dormant centipedegrass or St. Augustinegrass but bermudagrass can be injured if treated while actively growing. Both herbicides have excellent preemergence activity on annual bluegrass but soil residual is generally shorter (four to six weeks) compared to aforementioned herbicides. Several atrazine products are restricted-use pesticides, and turf managers should check labels for further information before use.

Mesotrione (Tenacity) is labeled for use in centipedegrass, perennial ryegrass, St. Augustinegrass (sod production only), tall fescue and dormant bermudagrass (Table 3). Mesotrione may be applied during establishment of these grasses (except bermudagrass) and effectively controls annual broadleaf and grassy weeds. Preemergence applications of mesotrione control or suppress annual bluegrass but postemergence use is ineffective for control of established plants. Mesotrione may be applied in tank-mixtures with atrazine or simazine on centipedegrass to improve efficacy of applications.

Most preemergence herbicides will provide similar initial efficacy if applied before annual bluegrass germination and sufficient rain or irrigation is received. Preemergence herbicides require incorporation from irrigation or rainfall so that weeds may absorb the applied material. In order to effectively control annual bluegrass, preemergence herbicides must be concentrated in the upper 1/4 to 1/3 inch of the soil profile. Retention on leaf tissue can be avoided by irrigating turf immediately after application for effective soil incorporation and herbicide activation.

Compared to irrigated turf, preemergence herbicide applications on non-irrigated sites have less potential for residual control from product loss, poor soil incorporation and failure to activate the herbicide. Practitioners should return clippings on non-irrigated sites to help move potential herbicides remaining on leaf tissue to the soil. If clippings are collected as part of routine maintenance, practitioners should consider returning clippings until at least 1/2 to 1 inch of rainfall is received. Granular products may also be applied to non-irrigated sites for better soil incorporation than liquid formulations. Granular products may be easier to handle and apply with less equipment necessary than sprayable formulations. Granular herbicides should be applied when morning dew is no longer present to avoid interference from leaf tissue.

Postemergence Control

Annual bluegrass may be selectively controlled with postemergence herbicides (Table 4). Practitioners managing warm-season grasses have more options for selective postemergence annual bluegrass control than with cool-season grasses. Flazasulfuron (Katana), foramsulfuron (Revolver), rimsulfuron (TranXit) and trifloxysufluron (Monument) are labeled for bermudagrass and zoyia-

grass non-residential commercial lawns and other sites (Table 5). Flazasulfuron and rimsulfuron are also labeled for use in centipedegrass. Efficacy of these herbicides generally increases under warm temperatures in spring compared to winter, and non-ionic surfactants may enhance efficacy.

Pronamide (Kerb) is a restricted-use herbicide for annual bluegrass control in non-residential bermudagrass, centipedegrass, St. Augustinegrass, seashore paspalum and zoysiagrass (Table 5). Pronamide is root-absorbed and must be watered in following applications. Pronamide efficacy is generally slower than most sulfonylureas and activity for annual bluegrass control may take approximately four to six weeks.

Atrazine (Aatrex, Bonus S, others) and simazine (Princep, WynStar, others) may also be applied to bermudagrass, centipedegrass, St. Augustinegrass and zoysiagrass for selective postemergence annual bluegrass control (Table 5). These herbicides often provide erratic control of annual bluegrass but may control other grassy and broadleaf weeds. Actively-growing bermudagrass is sensitive to atrazine and applications are recommended only during the late fall and winter months.

Sulfosulfuron (Certainty) and metsulfuron (Blade or Manor) may control young annual bluegrass plants but are generally less effective on mature populations (Table 5). These herbicides are labeled for bermudagrass, centipedegrass, St. Augustinegrass and zoysiagrass. Sulfosulfuron can also be applied to bahiagrass and seashore paspalum. Repeat application may be required for complete annual bluegrass control in warm-season grasses.

Dormant bermudagrass may be treated with nonselective herbicides, such as glyphosate (Roundup, Touchdown, others), glufosinate (Finale) and diquat (Reward) (Table 5). These herbicides will injure or kill existing vegetation, including annual bluegrass, and managers should only spray at peak dormancy when no green turfgrass foliage is observable. Nonselective herbicides should only be applied to completely dormant bermudagrass. Applications during early spring may delay greenup with significant turf injury.

Selective annual bluegrass control options in cool-season lawns are limited. Ethofumesate (Prograss) controls established annual bluegrass in perennial ryegrass, tall fescue and dormant bermudagrass (Table 5). Two or three ethofumesate applications may be applied in late fall at three- to four-week intervals. Annual bluegrass control may be seen that fall, but control is usually observed the following spring. Annual bluegrass control with ethofumesate may vary greatly over years depending on environmental conditions. Bispyribac-sodium (Velocity) has shown potential for selective annual bluegrass control in tall fescue and perennial ryegrass lawns; however, this herbicide is currently registered for creeping bentgrass and perennial ryegrass on golf courses and sod farms only (Table 5). Spot treatments of nonselective herbicides are generally the most effective treatment regime for annual bluegrass control in cool-season grasses.

Managing Herbicide Resistance

Annual bluegrass is a genetically diverse species and various biotypes present in turf may have differential responses to herbicides. Repeated use of one herbicide chemistry may effectively control annual bluegrass but resistance may develop in local populations if herbicides with different modes of action are not incorporated into management regimes. Herbicide resistance is the survival of a segment of the population of weeds following an herbicide dosage lethal to the normal population. Resistance occurs from repeated use of the same herbicide or mode of action over years and may be a concern with problematic annual weeds, such as annual bluegrass.

Triazine herbicides, atrazine and simazine, have been repeatedly used for years due to the wide spectrum of weeds controlled as pre- or postemergence treatments in warm-season grasses. Resistance in weed populations has been reported with these herbicides, which may contribute to inconsistent efficacy for annual bluegrass control in turf. Resistance to sulfonylureas has been reported in weed populations in agronomic crops and repeated use in turfgrasses may also contribute to resistance in annual bluegrass populations.

Preemergence chemistries, such as the dinitroanalines, may have resistance among weed populations from repeated use of herbicides, like pendimethalin, over years. Turf managers should rotate preemergence herbicides from mitotic inhibitors to other modes of action, such as Protox inhibitors like oxadiazon, to reduce the potential for developing herbicide resistance in annual bluegrass populations. Combination herbicides are also available, such as oxadiazon + prodiamine (Regalstar), oxadiazon + bensulide (Anderson's Crab and Goose) and prodiamine + sulfentrazone (Echelon), with more than one mode of action that effectively controls annual bluegrass in turf.

Table 1. Mowing requirements for commercial turfgrasses in Georgia.

Species	Mowing Requirements for Turfgrasses		
	Mower Type	Height (inches)	Frequency (days)
Bermudagrass			
Common	Rotary/reel	1 to 2	5 to 7
Hybrid	Rotary/reel	0.5 to 1.5	3 to 4
Centipedegrass	Rotary	1 to 2	5 to 10
Perennial Ryegrass	Rotary/reel	0.5 to 2	3 to 7
St. Augustinegrass	Rotary	2 to 3	5 to 7
Tall Fescue	Rotary	2 to 3	5 to 7
Zoysiagrass	Reel	0.5 to 2	3 to 7

Table 2. Efficacy of preemergence herbicides for annual bluegrass control in commercial turfgrasses.

Preemergence Herbicides	
atrazine	E
benefin	E
bensulide	F
dithiopyr	G
ethofumesate	G-E
mesotrione	F
oryzalin	G
oxadiazon	G
pendimethalin	G
prodiamine	E
pronamide	E
simazine	E

E = Excellent (90 to 100%), G = Good (80 to 89%),
F = Fair (70 to 79%), P = Poor (<70%).

Table 3. Rates and recommendations for preemergence herbicides used for annual bluegrass control in commercial turf.

Preemergence Herbicides: Applications must be made prior to weed emergence or poor control will result. Recommended dates for annual bluegrass and selected winter annual weeds are September 1-15 in north Georgia and October 1-15 in south Georgia.

Use Stage and Herbicide	Broadcast Rate/Acre			
	Turfgrasses	Amount of Formulation	Pounds Active Ingredient	Remarks and Precautions
atrazine (Aatrex) 4L (Aatrex) 90DG (Aatrex) 80W	centipede, St. Augustine, dormant bermudagrass, zoysia	 1.0 - 2.0 qts. 1.1 - 2.2 lbs. 1.2 - 2.5 lbs.	 1.0 - 2.0 1.0 - 2.0 1.0 - 2.0	Atrazine provides both preemergence and postemergence control of annual broadleaf weeds. Control of summer annual grasses is weak. Aatrex formulations are labeled for applications from October 1 to April 15. Avoid application s during green-up. For bermudagrass, atrazine should be applied only to dormant turf. DO NOT overseed 4 months before or 6 months after treatment. DO NOT apply within the active root zone of azaleas, camellias, boxwoods, etc. DO NOT apply more than 1.0 lb. ai/A on hybrid bermudagrasses. Atrazine is a Restricted Use Herbicide. Refer to atrazine - POSTEMERGENCE.

Use Stage and Herbicide	Broadcast Rate/Acre Turfgrasses	Amount of Formulation	Pounds Active Ingredient	Remarks and Precautions
Preemergence Herbicides (*continued*)				
benefin (Balan) 2.5G (Other trade names)	Ky. bluegrass, bermudagrass, centipede, tall fescue, St. Augustine, zoysia	80 - 120 lbs.	2.0 - 3.0	Controls annual grasses and selected broadleaf weeds. An additional application may be made 8 weeks after the initial treatment for continued weed control. DO NOT apply to newly sprigged grasses until these turfs are well established. DO NOT use on golf course greens. DO NOT apply Balan 2.5G in the spring to fall planted turfgrasses. Delay reseeding for 6 weeks after application for the low rate, and for 12 to 16 weeks at the high rate.
bensulide (Bensumec) 4LF (Pre-San) 7G	Ky. bluegrass, bermudagrass, centipede, tall fescue, St. Augustine, zoysia	1.9 - 3.1 gals. 107 - 180 lbs. 107 - 180 lbs.	7.5 - 12.5 7.5 - 12.5 7.5 - 12.5	Controls annual grasses and selected broadleaf weeds. Apply high rate in fall for annual bluegrass control. Apply a light irrigation immediately after treatment. DO NOT apply to newly sprigged grasses. Delay reseeding for 4 months after treatment. May be used on bermudagrass and bentgrass greens.
dithiopyr (Dimension 1EC) (Dimension Ultra 40%WSP) (each 5.0 oz. water soluble bag contains 0.125 lb. of dithiopyr) (Dimension 2EW)	Ky. bluegrass, buffalograss, bermudagrass, carpetgrass, centipede, tall fescue, zoysia, St. Augustine, seashore paspalum	2.0 qts. 0.95 lb. 2.0 pts.	0.5 0.38 0.5	Provides preemergence control of annual grasses and certain annual broadleaf weeds. Dimension will also provide postemergence control of crabgrass (when treated prior to the tillering stage of growth). Apply as a spring or fall application. For split applications, use Dimension 1EC up to 1.5 qts./acre per application, Dimension 2EW up to 1.5 pts./acre per application or Dimension Ultra at 0.625 lbs./acre per application. Bermudagrass can be overseeded with perennial ryegrass 6 to 8 weeks after a Dimension application. For other turfgrass areas do not reseed, overseed or sprig treated areas for 2.5 to 4 months after treatment (see label).
mesotrione (Tenacity) 4.0 lbs./gal.	Ky. Bluegrass, centipede, tall fescue, St. Augustinegrass (grown for sod), perennial ryegrass	4.0 - 8.0 fl. ozs.	0.125 - 0.25	Provides preemergence control of crabgrass, yellow foxtail and certain annual broadleaf weeds such as carpetweed and chickweed sp. Tenacity may be tank-mixed with preemergence herbicides such as Barricade for extended control of crabgrass and foxtail. Tenacity may also be applied at the time of seeding Ky. Bluegrass, centipede, or tall fescue. It may also be applied after new seedlings have been mowed two times or 4 weeks after emergence (whichever is longer). Do not exceed 4.0 fl. oz.s./acre on St, Augustine sod Tenacity may cause temporary whitening of turfgrass foliage (see label). If Tenacity is tank-mixed with atrazine or simazine for use on St. Augustine or centipede use only 4.0 fl. ozs. of Tenacity and 0.5 lbs. ai/acre of either atrazine or simazine. Zoysia, bermudagrass and seashore paspalum are sensitive to Tenacity. Do not use on golf course putting greens and maintain a five foot buffer between treated areas and putting greens.

Use Stage and Herbicide	Broadcast Rate/Acre Turfgrasses	Amount of Formulation	Pounds Active Ingredient	Remarks and Precautions
Preemergence Herbicides (*continued*)				
oryzalin (Surflan) 4AS (Harrier) 85WDG	bermudagrass, buffalograss, centipede, tall fescue, zoysia, St. Augustine	1.5 - 2.0 qts. 1.75 - 2.4 lbs.	1.5 - 2.0 1.5 - 2.0	Controls annual grasses and selected broadleaf weeds. Apply 2.0 qts./A for summer annual grass control, or apply 1.5 qts./A and apply an additional 1.5 qts./A 8 to 10 weeks after the initial application. Split applications are recommended for improved goosegrass control and for tall fescue. DO NOT apply to newly sprigged grasses until well established. DO NOT apply to golf course greens. DO NOT make a spring application to fall planted turfgrasses. Surflan is recommended for use on healthy, established turf. Delay reseeding for 3 to 4 months after application.
oxadiazon (Ronstar) 2G (Oxadiazon) 2G (Ronstar) 50WSP (Oxadiazon) 50WSB (Starfighter) 3.17L	Ky. bluegrass, bermudagrass, buffalograss, seashore paspalum, tall fescue, zoysia, St. Augustine bermudagrass, St. Augustine, zoysia – dormant applications	100 - 200 lbs. 4.0 - 6.0 lbs. 2.5 - 3.8 qts.	2.0 - 4.0 2.0 - 3.0 2.0 - 3.0	Controls annual grasses and selected broadleaf weeds. DO NOT apply more than 3.0 lbs. ai/A on St. Augustine. May cause temporary discoloration of bermudagrass and St. Augustine which is normally outgrown in 2 to 3 weeks. DO NOT apply to wet turf. Delay reseeding for 4 months after treatment. DO NOT apply to centipede or golf course greens or tees. Ronstar 50WSP and Oxadiazon 50WSB are labeled only on bermudagrass, St. Augustinegrass and zoysia. Ronstar 2G may be used immediately prior or immediately after sprigging bermudagrass or zoysiagrass at 2.0 to 3.0 lbs. ai/acre to control various annual weeds. Ronstar G may also be applied 10 to 14 days after sprigging seashore paspalum. Ronstar 50WSP and Oxadiazon 50WSB may be applied immediately prior to or after sprigging bermudagrass. Oxadiazon is not labeled for use on home lawns.
pendimethalin (Pendulum) 2G (Pendulum) 3.3 EC (Pendulum AquaCap) 3.8 CS	Ky. bluegrass, bermudagrass, centipede, tall fescue, zoysia, St. Augustine	75 - 150 lbs. 3.6 - 7.2 pts. 3.1 - 6.3 pts.	1.5 to 3.0 1.5 to 3.0 1.5 to 3.0	Controls annual grasses and selected broadleaf weeds. DO NOT use on newly sprigged turfgrasses. Not recommended for turfgrass that has been severely thinned due to winter stress. DO NOT reseed within 3 months of application. Use the low rate for tall fescue and KY bluegrass. The high rate may be used on warm season grasses. On newly seeded or sodded areas, delay application until after the fourth mowing. In established turfgrasses that have been reseeded, delay application until grass seedlings have been mowed 4 times. (This may be up to 3 months from the date of seeding.) Refer to label for information on split applications.

Use Stage and Herbicide	Broadcast Rate/Acre			
	Turfgrasses	Amount of Formulation	Pounds Active Ingredient	Remarks and Precautions
Preemergence Herbicides (continued)				
prodiamine (Barricade) 65WDG (ProClipse) 65WDG (Cavalcade) 65WDG (StoneWall) 65WDG (Knighthawk) 65WDG	Ky. bluegrass, bermudagrass, buffalograss, centipede, St. Augustine, seashore paspalum, zoysia, tall fescue	1.15 lbs.	0.75	Controls annual grasses and broadleaf weeds. DO NOT apply to newly seeded, sprigged or sodded turfgrasses. On fall- seeded turfgrasses, delay the application for 60 days after seeding or until after the second mowing, whichever is longer time period. Split applications, each at one-half the maximum annual labeled rate, at a 60 day interval, may also be used. DO NOT apply to golf course putting greens or tees. RegalKade and RegalKade 37 are formulated on a 32-3-12 dry fertilizer carrier. Barricade 65WDG at 0.58 to 1.0 lbs. product/acre may be applied 8 to 10 weeks before overseeding perennial ryegrass into bermudagrass fairways. Reseeding restrictions can range from 4 to 12 months, depending upon the product and rate used, reseeding method and environmental conditions. Refer to the individual product label for additional information.
(Barricade) 4L		1.5 pts.	0.75	
(RegalKade) 0.5G		100 - 300 lbs.	0.5 - 1.5	
(RegalKade) 0.37G		135 - 406 lbs.	0.5 - 1.5	
pronamide (Kerb T/O) 50WSP	bermudagrass, centipede, St. Augustine, zoysia	1.0 - 2.0 lbs.	0.5 - 1.0	Preemergence or postemergence applications of Kerb will control annual bluegrass. May also be used in spring to slowly remove (4 to 6 weeks) overseeded perennial ryegrass from warm-season turfgrasses. For this purpose, apply Kerb at the 50% spring green-up warm-season turfgrass growth stage. A light overhead irrigation is necessary to move Kerb into the weed root zone if no rainfall occurs within 24 to 48 hours. DO NOT apply Kerb to any cool-season turfgrass. DO NOT apply to areas that will be overseeded with cool-season turfgrasses within 90 days of treatment. Kerb is a Restricted Use Herbicide.
simazine (Princep) 90DF (Princep Liquid) 4L Wynstar 90DF	bermudagrass, centipede, St. Augustine, zoysia	1.1 - 2.2 lbs. 1.0 - 2.0 qts. 1.1 - 2.0 lbs.	1.0 - 2.0 1.0 - 2.0 1.0 - 1.8	Apply simazine in October or November for preemergence control of winter annual weeds. Apply December through February for late postemergence control of winter annuals. Apply low rate for annual bluegrass control; or high rate for winter annual broadleaf control. DO NOT overseed with desirable turfgrass within 4 months before or 6 months after treatment. DO NOT apply more than 1.0 lb. ai/A on newly sprigged turfgrass or on hybrid bermudagrass such as Tiflawn, Tifway and Ormond.
benefin + oryzalin (XL) 2G	bermudagrass, centipede, tall fescue, zoysia, St. Augustine	100 - 150 lbs.	1.0 to 1.5 benefin + 1.0 to 1.5 oryzalin	Controls annual grasses and selected broadleaf weeds. DO NOT apply to newly sprigged grasses until well established. DO NOT apply to golf course greens. DO NOT make a spring application to fall planted turfgrasses. Delay reseeding for 6 weeks (low rate) and for 12 to 16 weeks (high rate) after application.

Use Stage and Herbicide	Broadcast Rate/Acre			
	Turfgrasses	Amount of Formulation	Pounds Active Ingredient	Remarks and Precautions
Preemergence Herbicides (*continued*)				
benefin + trifluralin (Team Pro) 0.86G	Ky bluegrass, bermudagrass, centipede, tall fescue, zoysia, St. Augustine	174 - 349 lbs.	0.75 to 1.5 benefin + 0.75 to 1.5 trifluralin	Team Pro is a dry fertilizer based product that contains 0.43% benefin and 0.43% trifluralin. The fertilizer analysis will depend upon the respective company marketing the product. Controls summer annual grasses and annual bluegrass. Split applications of 233 lbs. product/acre followed 10 weeks later by an additional 233 lb. product/acre may also be used. DO NOT apply to newly sprigged grasses until well established. DO NOT apply to putting greens. Delay reseeding for 8 weeks (low rate) and for 12 to 16 weeks (high rate) after application.
(Team) 2G		100 - 150 lbs.	1.3 to 2.0 benefin + 0.7 to 1.0 trifluralin	
bensulide + oxadiazon (Goosegrass/Crabgrass Control) 5.25% + 1.31% G	Ky. bluegrass, bermudagrass, tall fescue, zoysia	115 lbs.	6.0 ensulide + 1.5 oxadiazon	Controls summer annual grasses. Apply a light irrigation after treatment. DO NOT use on newly sprigged grasses until well established. Delay reseeding fore 5 months after treatment. Recommended for professional applicator use. May be used on bermudagrass and bentgrass greens under conditions of heavy goosegrass infestations. See label for precautions concerning use on putting greens.
oxadiazon (1.0%) + prodiamine (0.2%) (Regalstar II) (Regalstar G)	Ky. Bluegrass, bermudagrass, centipede, St. Augustine, tall fescue, zoysia	200 lbs.	2.0 oxadiazon + 0.4 prodiamine	Controls annual grasses. Regalstar II is formulated on a 38-0-0 ureaform nitrogen carrier. Regalstar G does not contain fertilizer. Apply to dry foliage. Delay applications to newly sprigged bermudagrass until after stolons have rooted and the grass has filled in. DO NOT apply to putting greens.
sulfentrazone + prodiamine (Echelon) 4SC	Ky. Bluegrass, bermudagrass, buffalograss, carpetgrass, centipede, seashore paspalum, tall fescue, zoysia	18 - 36 fl. ozs.	0.56 to 1.125	Controls annual grasses, certain annual broadleaf weeds, annual sedges, kyllingasp. and yellow nutsedge. Use in established turfgrasses. May be applied after the second mowing of seeded grasses provided the grass has developed a uniform stand and a good root system. The high rate of 36.0 fl. ozs./acre is recommended only for use on bermudagrass. This product can provide postemergence control of some, small annual broadleaf weeds. Do not apply to newly installed sod until the sod has rooted and exposed edges have grown in. Do not add an adjuvant or surfactant to the spray solution. In sod fields do not apply Echelon within 3 months of harvest. Echelon is not labeled for use on golf course putting greens.

Table 4. Efficacy of postemergence herbicides for annual bluegrass control in commercial turfgrasses.	
Postemergence Herbicides	
atrazine	E
bispyribac-sodium	F-E
clethodim	F
flazasulfuron	G-E
foramsulfuron	E
glufosinate	E
glyphosate	E
imazaquin	P-F
metribuzin	G
pronamide	E
rimsulfuron	E
simazine	G-E
sulfosulfuron	F-G
trifloxysulfuron	E
E = Excellent (90 to 100%), G = Good (80 to 89%), F = Fair (70 to 79%), P = Poor (<70%).	

Table 5. Rates and recommendations for postemergence herbicides used for annual bluegrass control in commercial turf.

Postemergence Herbicides				
	Broadcast Rate/Acre			
Use Stage and Herbicide	**Turfgrasses**	**Amount of Formulation**	**Pounds Active Ingredient**	**Remarks and Precautions**
atrazine (AAtrex) 4L (AAtrex) 90DG (AAtrex) 80W	centipede, St. Augustine, DORMANT BERMUDAGRASS, zoysia	 1.0 - 2.0 qts. 1.1 - 2.2 lbs. 1.2 - 2.5 lbs.	 1.0 - 2.0 1.0 - 2.0 1.0 - 2.0	Apply to dormant bermudagrass for annual bluegrass and winter annual broadleaf weed control. DO NOT apply during bermudagrass green-up. AAtrex formulations may be applied from October 1 to April 15. DO NOT apply over the root zone of ornamental shrubs. For spurweed, apply in December or January. For Florida betony, apply in late October and follow with a second treatment in late February. DO NOT apply more than 1.0 lb. ai/A to hybrid bermudagrass. AAtrex is a Restricted Use Herbicide.
bispyribac-sodium (Velocity) 80SP (Velocity) 17.6SG	bermudagrass overseeded with perennial ryegrass on golf course fairways	2.0 oz./1.5 acres 6.0 ozs.	0.06	Apply Velocity between February 1 and March 15 to bermudagrass overseeded the previous fall with perennial ryegrass for annual bluegrass control and seedhead suppression. Earlier or later applications may decrease efficacy or increase risk of injury to perennial ryegrass. The first application should be made just as soon as annual bluegrass seedhead begin to emerge from the leaf sheath. Apply a second application at the same rates 14 to 21 days after the first application. DO NOT apply if air temperatures are less than 50°F. or if maximum temperatures are expected to be less than 50°F. for the first three days after application. Two applications as described above will be

Use Stage and Herbicide	Broadcast Rate/Acre			
	Turfgrasses	Amount of Formulation	Pounds Active Ingredient	Remarks and Precautions
Postemergence Herbicides (*continued*)				
bispyribac-sodium (*continued*)				needed for control. Chlorosis (yellowing) will typically occur on perennial ryegrass between 7 and 21 days after application. Not recommended for applications above 80°F., or when air temperatures are expected to exceed 80°F. for first three days after application. Foliar fertilization at 3 to 4 days after a Velocity application may reduce chlorosis. It is not necessary to add a spray adjuvant to Velocity. DO NOT apply to golf course greens, non- overseeded bermudagrass, or to ryegrass mowed < 3/8 inches. Not recommended for use on other cool-season turfgrasses. Velocity should not be applied in late spring after bermudagrass begins active growth. DO NOT mow or irrigate for 24 hours after application.
clethodim (Envoy) 0.94 lbs./gal.	centipede (sod farms only)	17.0 - 34.0 fl. oz.	0.125 - 0.25	Envoy may be used for annual grass control and common bermudagrass suppression on centipede sod farms. Add a nonionic surfactant at 0.25% v/v. Use two applications, spaced 3 to 4 weeks apart, for bermudagrass suppression. Apply no sooner than 3 weeks after spring green-up. DO NOT use on centipede being grown for seed. Avoid mowing one week before or after treatment.
diquat (Reward) 2.0 lbs./gal.	Dormant Bermudagrass	1.0 - 2.0 pts.	0.25 - 0.5	Controls certain winter annual broadleaf weeds, such as little barley, annual bluegrass, henbit and Carolina geranium in dormant bermudagrass in lawns, parks and golf courses. A nonionic surfactant at 0.25% v/v should be added to the spray mix. Apply only to dormant bermudagrass.
ethofumesate (Prograss) 1.5EC	Dormant Bermudagrass, tall fescue, perennial ryegrass, creeping bentgrass	5.4 - 5.9 pts.	1.0 - 1.1	Apply Prograss only to dormant bermudagrass in the fall one to two weeks after emergence of perennial ryegrass for the control of annual bluegrass. An additional application at 1.0 lb. ai/acre at 21 to 28 day intervals may be required to maintain control. The initial treatment may cause immediate browning of bermudagrass that is not completely dormant. DO NOT apply Prograss after Jan. 15 to overseeded bermudagrass. Applications after this date can severely delay bermudagrass growth in the spring. Prograss is not labeled for use on golf course putting greens.
flazasulfuron (Katana) 25DF	bermudagrass, zoysiagrass, centipedegrass	See Label	See Label	Apply for: a) control of undesirable cool-season grasses (including tall fescue), b) control of emerged annual bluegrass before overseeding bermudagrass with perennial ryegrass, c) postemergence control of sedges. Apply with a non-ionic surfactant at 0.25% v/v. Urea fertilizer during applications may enhance efficacy for annual bluegrass control and transition from overseeded ryegrass to bermudagrass in spring.

Use Stage and Herbicide	Broadcast Rate/Acre			
	Turfgrasses	Amount of Formulation	Pounds Active Ingredient	Remarks and Precautions
Postemergence Herbicides (*continued*)				
foramsulfuron (Revolver) 0.19 lbs./gal.	bermudagrass, zoysiagrass	8.8 - 26.2 fl. ozs.	0.013 - 0.04	Apply Revolver for: a) control of undesirable cool-season grasses (including tall fescue), b) control of emerged annual bluegrass 1 week before overseeding bermudagrass with perennial ryegrass, c) postemergence control of goosegrass in late spring and early summer, and d) spring transition of bermudagrass overseeded the previous fall with cool-season turfgrasses. For tillered goosegrass, make 2 applications at the high rate 7 to 14 days apart. A tank-mix of Revolver at 26.2 fl. ozs + MSMA (normal rate) applied twice 3 to 4 weeks apart will control dallisgrass. Late summer and early fall applications of this tank-mix usually provide better control than earlier applications. DO NOT apply Revolver within 2 weeks of sprigging. Revolver is rainfast within 2 hours of application.
glufosinate (Finale) 1.0 lb./gal.	Dormant Bermudagrass	3.0-6.0 qts./acre	0.75 - 1.5	Controls numerous winter annual broadleaf weeds and annual bluegrass in completely dormant bermudagrass. DO NOT apply during spring green-up.
glyphosate (Roundup Pro) 4 lbs./gal.	Dormant Bermudagrass	0.75 pt.	0.375	APPLY ONLY TO DORMANT BERMUDAGRASS. Controls annual bluegrass. Apply in 5 to 20 gals. water/A. DO NOT apply during green-up or to actively growing bermudagrass.
imazaquin (Image) 70DG	bermudagrass, centipede, zoysia, St. Augustine	8.6 - 11.4 ozs.	0.37 - 0.5	Controls nutsedge(s), wild garlic and selected broadleaf weeds. Add a nonionic surfactant (1.0 qt./100 gals.). The addition of MSMA (bermudagrass only) will aid in control of nutsedge(s) and escaped weedy grasses. Two applications per year, at an interval of 6 to 8 weeks, will be needed to control purple nutsedge. DO NOT apply when turfgrass is emerging from winter dormancy. Image will severely injury fescue(s) and ryegrass(s). DO NOT apply to newly planted or sprigged lawns or golf greens.
metribuzin (Sencor) 75 Turf	bermudagrass	0.67 lb.	0.5	Dormant bermudagrass: Apply to emerged winter annual weeds. Make only 1 application per season. Actively growing bermudagrass: Apply to bermudagrass that is actively growing and not under stressed conditions. Controls goosegrass and selected annual weeds. DO NOT make more than two applications per season. Sencor may cause temporary discoloration. Delay mowing treated areas for at least 3 days.
pronamide (Kerb T/O) 50WSP	bermudagrass, centipede, St. Augustine, zoysia	1.5 - 3.0 lbs.	0.75 - 1.5	Pronamide will control emerged annual bluegrass, corn speedwell, and common chickweed. Increase rate as annual bluegrass approaches maturity. Pronamide acts slowly (3 to 5 weeks) on seedling to mature annual bluegrass. DO NOT apply to any cool season grass. A light overhead irrigation is necessary to move Kerb into the weed root zone if not rainfall occurs within 24 to 48 hours. Kerb is a Restricted Use Herbicide.

Use Stage and Herbicide	Broadcast Rate/Acre			
	Turfgrasses	Amount of Formulation	Pounds Active Ingredient	Remarks and Precautions
Postemergence Herbicides (*continued*)				
rimsulfuron (TranXit GTA) 25DF	bermudagrass, centipedegrass, zoysiagrass	1.0 - 2.0 ozs.	0.016 - 0.032	May be used: a) to control annual bluegrass before overseeding bermudagrass with perennial ryegrass or Poa trivialis; b) to control annual bluegrass and certain weeds in non-overseeded bermudagrass, centipedegrass and zoysiagrass and c) to remove perennial ryegrass or *Poa trivialis* from bermudagrass in the late spring. Add a nonionic surfactant at 0.25% v/v. Apply 10 to 14 days in late summer or early fall before overseeding bermudagrass. DO NOT apply after overseeding, or to bentgrass putting greens. To hasten spring transition on overseeded bermudagrass, apply at the 60 to 75% green-up growth stage of bermudagrass, or approximately 2 to 3 weeks before transition is desired. DO NOT apply to residential lawns, cool-season turfgrasses or to newly sprigged or sodded bermudagrass.
sulfosulfuron (Certainty) 75DF	bermudagrass, centipede, zoysia, St. Augustine, seashore paspalum, bahiagrass	0.75 - 1.25 ozs.	0.035 - 0.059	Controls nutsedge(s), annual sedges, kyllinga species, annual bluegrass, tall fescue, and certain broadleaf weeds in warm-season turfgrasses. Add a nonionic surfactant at 0.25 v/v to the spray mix. Avoid mowing for 1 to 2 days before and after application. For nutsedge repeat the application at 4 to 10 weeks if regrowth is observed. Certainty may be applied 7 to 10 days before overseeding bermudagrass with perennial ryegrass. Certainty is not recommended for use on putting greens.
trifloxysulfuron-sodium (Monument) 75DG	bermudagrass, zoysiagrass	0.33 - 0.56 oz.	0.015 - 0.026	Controls nutsedge(s), green kyllinga, annual bluegrass, tall fescue, torpedograss and certain broadleaf weeds in established bermudagrass and zoysiagrass. Monument is not recommended for use on other turfgrass species. Not labeled for use on home lawns. Add a nonionic surfactant at 0.25 to 0.5% v/v to the spray mix. Monument at rates of 0.1 to 0.3 oz./acre may be used as a spring transition aid for the removal of perennial ryegrass and *Poa trivialis*. Avoid mowing for 1 to 2 days before and after application. For nutsedge repeat the application at 4 to 6 weeks if regrowth is observed. DO NOT overseed bermudagrass with cool-season turfgrasses for 3 weeks after application.

Learning for Life

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