PLANT GROWTH REGULATORS FOR FINE TURF

Bert McCarty

Plant growth retardants (PGR's) or inhibitors are increasingly being used to suppress seedheads and leaf growth due to rising mowing costs and danger posed to operators and other personnel. Traditionally, plant growth retardants have been used in the South to suppress bahiagrass (*Paspalum notatum* Flugge.) or tall fescue (*Festuca arundinacea*) seedhead production exclusively in low maintenance areas such as highway roadsides, airports, and golf course roughs. However, in recent years, new chemicals which may be used in higher maintained commercial turf situations have been developed.

Several undesirable characteristics which have been associated with growth retardants include: phytotoxicity (burn) of treated leaves from 4 to 6 weeks following applications; reduced recuperative potential from physical damage to treated turf; and increased weed pressure due to reduced competition from treated turf. Normally, growth retardants are used in low maintenance areas; therefore, these undesirable characteristics do not pose a problem to most managers. However, several growth regulatory materials have recently been developed for use on hybrid bermudagrass fairways and St. Augustinegrass. Vertical topgrowth (clippings) is suppressed, but horizontal spread (runners) is not. Therefore, turf recovery from golf club divots and other injuries occurs while topgrowth remains suppressed. Other uses involve areas where mowing has been discontinued due to heavy rains, equipment failure, etc., but topgrowth remains suppressed if the grass is treated. **Note: These retardants used on hybrid bermudagrass and St. Augustinegrass do not satisfactorily suppress seedhead development.**

PGRs are separated into two groups, Type I and Type II, based on their method of growth inhibition or suppression. Type I inhibitors are primarily absorbed through the foliage and inhibit cell division and differentiation in meristematic regions. They are inhibitors of vegetative growth and interfere with seedhead development. Their growth inhibition is rapid, occurring within 4 to 10 days, and lasts 3 to 4 weeks, depending on application rate. Mefluidide, chlorflurenol, and maleic hydrazide are examples of Type I inhibitors that inhibit mitosis in growth and development. Other Type I PGRs that inhibit plant growth and development through interruption of amino acid or organic acid biosynthesis are herbicides used at low rates. Being herbicides, their margin of safety is narrow and are very rate dependent. Examples of Type I herbicide regulators include glyphosate, imidazolinones, sulfonylureas, sethoxydim, and fluazifop.

Type II inhibitors are generally root absorbed and suppress growth through interference of gibberellic acid bio-synthesis, a hormone responsible for cell elongation. Type II PGRs are slower in growth suppression response, but their duration is usually from 4 to 7 weeks, again, depending on application rate. Type II PGRs have little effect on seedhead development and result in miniature plants. Paclobutrazol and flurprimidol are root absorbed Type II PGRS while trinexapac-ethyl and prohexadione-Ca are foliar absorbed Type II PGRs and systemically translocated to the site of activity. Fenarimol is a type II fungicide that also suppresses annual bluegrass on putting greens.

Proxy 2L is a PGR with best activity on cool-season grasses. It promotes ethylene production in plants which is a regulatory hormone that restricts plant growth.
Root absorbed PGRs are activated by irrigation or rainfall after application and have less likelihood of over-lap leaf burn. Foliar absorbed materials (e.g., mefluidide, MH, and trinexapac-ethyl) require uniform and complete coverage for uniform response and must be leaf absorbed before irrigation or rainfall occurs. Usually low gallonage is used for foliar absorbed materials to minimize runoff from the leaf surface while high gallonage is used for root absorbed materials.

Timing of application for seedhead suppression is somewhat important. Applications made after seedhead emergence may not be effective. For bahiagrass, mow the area as seedheads initially emerge (usually in late May to early June) to knock down these and weeds present. Begin plant growth retardant treatment about two weeks following mowing or just prior to new seedhead appearance. Additional applications 6 to 8 weeks later may be required if new seedheads begin to emerge. A complete weed control program must accompany any plant growth retardant use. Typically, annual broadleaf weeds will become established in PGR use areas as the treated grass is not actively growing, therefore, is not providing its usual competition. Normally, 2,4-D and/or dicamba is included in this broadleaf weed control. Other postemergence herbicides such as Velpar, for grass weed control, may also be incorporated in low maintenance bahiagrass areas. The following tables list chemicals, application rates, and general remarks about each product used to suppress plant growth.

An available plant growth promoter is RyzUp from Abbott Laboratories. RyzUp is gibberellic acid which encourages cell division and elongation. When used, RyzUp helps initiate or maintain growth and prevent color changes (e.g., purpling) during periods of cold stress and light frosts on bermudagrass such as Tifdwarf and Tifgreen. Oftentimes, fall golf tournaments may experience an early light frost before the overseeding has become established. RyzUp helps the turf recover from this discoloration. PGRIV from MicroFlo is a combination of gibberellic acid and indolebutyric acid that is foliar absorbed. Research suggests this combination promotes root growth and vigor of certain plants growing under stressful conditions. Gibberellic acid containing PGRs also are used to “reverse” the inhibitory effects of Type II PGRs.

Characteristics of Plant Growth Regulators used in Fine Turf.

Active ingredient (trade name example)	Turfgrass Uses												Site of Uptake		Specific Uses			Mode of Action
	Bahiagrass	Bermudagrass	Centipedegrass	Creeping bentgrass	Fine fescues	Ky. bluegrass	Kikuyugrass	Perennial ryegrass	*Poa annua*	St. Augustinegrass	Tall fescue	Zoysiagrass	Root	Foliar	Overseeding Aid	Golf Greens	Seedhead suppression	
Ethephon (Proxy)	—	—	—	**Y**	**Y**	**Y**	—	**Y**	—	—	**Y**		—	**Y**	—	—	—	Promotes ethylene which reduces cell elongation
Flurprimidol (Cutless)	—	**Y**	—	**Y**	—	**Y**	—	**Y**	—	**Y**	—	**Y**	**Y**	—	—	**Y**	—	Type II GA inhibitor of cell elongation
Gibberellic acid (RyzUp)	—	**Y**	—	—	—	—	—	—	—	—	—	—	—	**Y**	—	—	—	Chlorophyll (color) retention
Indolebutyric acid + gibberellic acid	—	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	—	**Y**	**Y**	**Y**	—	**Y**	—	**Y**	—	Enhance root growth & plant vigor
Maleic hydrazide (Slo Gro)	**Y**	**Y**	—	—	**Y**	**Y**	—	**Y**	—	—	**Y**	—	—	**Y**	**Y**	—	**Y**	Type I growth & seedhead inhibitor
Mefluidide (Embark 2S)	—	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	—	**Y**	**Y**	—	**Y**	Type I growth & seedhead inhibitor
Paclobutrazol (Trimmit/TGR)	—	**Y**	—	**Y**	**Y**	**Y**	—	**Y**	—	**Y**	**Y**	—	**Y**	—	**Y**	**Y**	—	Type II GA inhibitor of cell elongation
Trinexapac-ethyl (Primo)	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	—	**Y**	**Y**	**Y**	—	Type II GA inhibitor of cell elongation
Prohexadione-Ca (Anuew 27.5WP)	—	**Y**	—	**Y**	—	**Y**	—	**Y**	—	—	—	—	—	**Y**	—	**Y**	—	Type II GA inhibitor of cell elongation
Amidochlor (Limit)	—	—	—	—	—	**Y**	—	**Y**	—	—	**Y**	—	**Y**	—	—	—	**Y**	Type I cell division inhibitor

Y = Yes.

* Embark T&O 0.2S can be used to control *Poa annua* seedheads in creeping bentgrass fairways.

Chemicals for Seedhead and Plant Growth Suppression (*Refer to Herbicide Label for Specific Turf Species Use Listing*)

Turf Use	Chemical Name (rate, lbs ai/acre)	Trade Names (rate, product)	Remarks
Bentgrass, Kentucky Bluegrass, Perennial Ryegrass, Tall and Fine Fescue Fairways, Roughs, and Commercial Areas	ethephon (3.4)	Proxy 2L (1.7 gal/acre or 5 fl oz/1000 ft^2)	Apply only to actively growing turfgrass not suffering heat, moisture, disease, or insect stress. Seven to 10 days are necessary for activity. Repeat applications can be made 4 weeks following the first for bentgrass and fescues & 7 weeks for Kentucky bluegrass & perennial ryegrass. A spreader/sticker is not needed.
	amidochlor (2.5)	Limit 4F (0.625 gal/acre)	Root absorbed. Use on nonresidential medium to low-managed turf such as cemeteries, parks, industrial and office sites and low maintenance areas (e.g., roughs, out-of-play areas) on golf courses. Water in within 5 days of application & before mowing. May cause some yellowing. Not recommended for areas of play. Also control some broadleaf weeds.
	paclobutrazol + flurprimidol + trinexapac-ethyl (0.14 to 0.28 lb)	Musketeer 1L (18 to 36 oz/acre)	For turf growth suppression, make the initial spring application at 18 to 30 oz/a with repeat applications 2 to 6 weeks later at 18 to 36 oz/a.
	prohexadione-Ca (0.031 to 0.75)	Anuew 27.5 WP (1.8 to 43.6 oz/acre)	Foliar uptake for managing growth of bermudagrass, bentgrass, Ky. bluegrass, and perennial ryegrass grown for all turf areas. Rates include: bentgrass greens at 1.8 to 7.25 oz/acre; bermudagrass at 29.1 to 43.6 oz/acre; bluegrass/ryegrass fairways/roughs at 4.5 to 29.1 oz/acre. Apply in 1 to 2 gal/1,000 ft^2, add NIS, and wait 4-hr before irrigating and 1-day before mowing.
Turfgrass Clipping Management/Turfgrass Enhancement	mefluidide (0.125 to 1.0)	Embark 2S (0.5 to 4 pts/15-150 gal water) Embark T&O 0.2S [5 pts (St. Augustinegrass)]	Foliar absorbed. Apply to common bermudagrass (4 pts/A Embark 2S), tall fescue & Ky. bluegrass (1.5 pts/A Embark 2S), and St. Augustinegrass (Embark Lite) only. Apply in spring approximately 2 weeks before seedhead appearance. Do not apply to turf within 4 growing months after seeding. Do not water-in and do not reseed within 3 days after application. Treated turf may appear less dense and temporarily discolored. Adding 1 to 2 qts of a nonionic surfactant per 100 gal of spray solution may enhance suppression; however, discoloration may also be increased. *Poa annua* seedhead control in fairways is with 0.5 pt/a in early January. Iron applications may lessen discoloration. Read and follow label recommendations before use. Miscellaneous family.
	flurprimidol (0.375 to 1.5)	Cutless 50 WP (0.75 to 3.5 lb to 200 gal water or 0.28 to 1.3 oz/1,000 ft^2) Cutless MEC (6 to 74 fl oz/A)	Root absorbed. Apply to bermudagrass or zoysiagrass golf course fairways, hard-to-mow and trim areas. Provides 4 to 8 week suppression. Must be uniformly applied and irrigated-in with 0.5-inch water. Flurprimidol does not completely control seedheads. Temporary turf discoloration may follow this treatment. St. Augustinegrass, bahiagrass, and common bermudagrass require the higher rate. Repeat applications every 4 weeks on Tifway bermudagrass with 1.0 lb/A will minimize turf injury. Do not use with SI/DMI fungicides.
	flurprimidol + paclobutrazol + trinexapac-ethyl (0.093 to 0.23)	Musketeer 0.99L (12 to 30 fl oz/A)	Used to suppress annual bluegrass or to manage growth and clippings in bermudagrass, creeping bentgrass, Ky. bluegrass, and perennial ryegrass. Apply 12 to 18 fl oz/A on bentgrass putting greens and up to 30 fl oz/A on other turf species. Spray interval from 2 to 6 weeks depending on desirable growth suppression and rate used.

Chemicals for Seedhead and Plant Growth Suppression (*Refer to Herbicide Label for Specific Turf Species Use Listing*)

Turf Use	Chemical Name (rate, lbs ai/acre)	Trade Names (rate, product)	Remarks
	trinexapac-ethyl (0.02 to 0.086)	Primo MAXX 1L (3 to 11 oz in 20 to 100 gal water)	Foliar absorbed. Use 3 oz/a for Tifdwarf bermudagrass greens and 6 oz/a for Tifgreen bermudagrass greens. Tifway & common bermudagrass fairways require 11 oz/a. Bermudagrass overseeding preparation requires 22 oz/a 1 to 5 days before overseeding and before verticutting, scalping, or spiking. One hour rain-free period is needed after application. Mowing 1 week after application improves results & appearance as will repeat applications in 3 to 4 weeks. Temporary turf discoloration may follow treatment. Do not add a surfactant. A 25 WSP formulation is also available. Cyclohexadione family.
	prohexadione-Ca (0.031 to 0.75)	Anuew 27.5 WP (1.8 to 43.6 oz/acre)	Foliar uptake for managing growth of bermudagrass, bentgrass, Ky. bluegrass, and perennial ryegrass grown for all turf areas. Rates include: bentgrass greens at 1.8 to 7.25 oz/acre; bermudagrass at 29.1 to 43.6 oz/acre; bluegrass/ryegrass fairways/roughs at 4.5 to 29.1 oz/acre. Apply in 1 to 2 gal/1,000 ft^2, add NIS, and wait 4-hr before irrigating and 1-day before mowing.
	paclobutrazol (0.5 to 1)	TGR Turf Enhancer 50WP (1 to 1.5 lb/43 to 100 gal) Trimmit 2SC (1 to 2 gal)	Root absorbed. Apply to well-maintained St. Augustinegrass or hybrid bermudagrass fairways. Used on overseeded golf greens during winter for turf enhancement and for annual bluegrass suppression. Do not apply to saturated soils and treat only dry foliage. Repeat applications 8 weeks apart may be made. Read & follow directions before use.
	flurprimidol + trinexapac-ethyl (0.06 to 0.71)	Legacy 1.52MEC (5 to 30 oz/A) Edgeless 1.51 L (30 to 60 oz/A)	A pre-tank combination of flurprimidol + trinexapac-ethyl to provide darker green turf color, improved turf quality, longer growth suppression than either product alone, *Poa annua* suppression, extended growth suppression, and less scalping/rebound effect. Used on bentgrass, Ky. bluegrass, P. ryegrass, bermudagrass, and seashore paspalum fairways and sports fields.
	prohexadione-Ca (0.031 to 0.76 lb)	Anuew TGR 27.5G (1.8 to 44 oz/a)	For use on bermudagrass, bentgrass, Ky. bluegrass, and perennial ryegrass on all managed turf sites. Low rates for bentgrass greens/tees with higher rates for fairways/roughs. Application intervals: 2 to 4 weeks for fairways/roughs; 1 to 2 weeks for greens/tees. Apply in 1 to 2 gal of water/1,000 ft^2 and add a NIS to improve leaf coverage. Foliar uptake.
Foliar Suppression of Overseeded Bermudagrass	mefluidide (0.125)	Embark 2S (0.5 pts/15-150 gal water)	Foliar absorbed. Do not apply to turf within 4 growing months after seeding, and do not reseed within 3 days after application. Treated turf may appear less dense and temporarily discolored. Adding 1 to 2 qts of a nonionic surfactant per 100 gal of spray solution may enhance suppression; however, discoloration may also be increased. *Poa annua* seedhead control in fairways is with 0.5 pt/A in early January. Iron applications may lessen discoloration. Read and follow label recommendations before use.
	flurprimidol (0.375 to 1.5 lb)	Cutless 50W (0.75 to 3 lb/50 to 200 gal water)	Root absorbed. Apply to zoysiagrass or bermudagrass in late spring-early summer and/or late summer-early fall. Time the second application at least 3 months before expected dormancy. Do not apply to putting greens. Do not exceed 1.5 lb/A per application on sandy soils. Irrigate with 0.5 in. water & resume mowing 3 to 5 days after application. Do not use with SI/DMI fungicides.

Chemicals for Seedhead and Plant Growth Suppression (*Refer to Herbicide Label for Specific Turf Species Use Listing*)

Turf Use	Chemical Name (rate, lbs ai/acre)	Trade Names (rate, product)	Remarks
	paclobutrazol (0.25 lb)	Turf Enhancer 50WP (0.5 lb/40 to 100 gal water)	Root absorbed. Repeat applications may be made 3 weeks apart. Do not use if *Poa annua* exceeds 70%. Application should be in early January.
	flurprimidol + trinexapac-ethyl paclobutrazol + flurprimidol + trinexapac-ethyl (0.156 to 0.31 lb)	Legacy 1.51L (5 to 10 fl oz/A) Musketeer 1L (20 to 40 oz/a)	For *Poa annua* and turf growth suppression in overseeded ryegrass (except bermudagrass putting greens). Apply in early spring and late fall to suppress annual bluegrass or to suppress turf growth and to manage clippings. Treatment intervals every 2 to 6 weeks. Use lower rates on putting greens with >50% annual bluegrass populations. Delay applications on overseeded fairways until 4 weeks after germination.
Poa annua var. *reptans* (perennial biotype) Conversion/Management in Bentgrass Golf Greens	paclobutrazol (0.375)	Turf Enhancer 50WP (0.75 lb/acre or 0.28 oz/1000ft^{2}) Trimmit/Turf Enhancer 2SC (24 oz/acre or 0.55 fl.oz./1000ft$^{2)}$	Root absorbed. Apply 30 days apart 2 to 3 times in mid-fall (September to early Dec.) plus 2 to 3 times in very early spring (late Feb. to early May) when bentgrass is actively growing. Increased Poa control often occurs if a sterol inhibitor fungicide (DMI) such as Banner Maxx at 1 oz/1000 sq.ft. is applied 2 weeks following each paclobutrazol application. Do not use if *Poa annua* populations exceed 70% as severe stand thinning or discoloration may result. **Note:** This program is designed as a gradual transition or conversion from *Poa annua* to bentgrass. Repeat applications over several years will be required. Treated Poa will appear noticeably lighter green in color while treated bentgrass may appear 'grainy.' It is highly recommended to start at lower rates (e.g, 8 to 12 oz/a) to ensure proper coverage and application calibration before using more aggressive rates.
	ethephon (3.4 lbs)	Proxy 2SL, Ethephon 2SL (1.7 gal/A)	Make initial application before seedheads emerge. Repeat applications are needed every 10 to 21 days during seedhead emergence. Often mixed with trinexapac-ethyl PGR for improved turfgrass quality.
	flurprimidol (0.125 to 0.5)	Cutless 50W (0.25 to 0.5 lbs/acre) Cutless MEC 1.3L (6 to 24 fl oz/A)	Apply in spring or in the fall. Repeat at 3 to 4 week intervals with the final application 8 weeks before winter dormancy or summer stress. Delay reseeding for 2 weeks after application.
	paclobutrazol + flurprimidol + trinexapac-ethyl (0.10 to 0.17 lb)	Musketeer 1L (12 to 22 oz/a)	For *Poa annua* and turf growth suppression. Use lower rates if the % Poa annua population is >50%. Treatment interval are 2 to 4 weeks apart.
Extending the Life of Painted Lines on Sports Fields	trinexapac-ethyl	Primo MAXX 1EC (1 oz/gallon paint) Primo 25 WSB (0.5 oz/gallon paint)	Used to extend the life of painted lines which reduces labor costs. The life expectancy of painted lines is extended 7 to 14 days on cool-season grasses and up to 30 days on warm-season grasses. One gallon of paint should treat approximately 1000 sq.ft. of line surface area.

Chemicals for Seedhead and Plant Growth Suppression (*Refer to Herbicide Label for Specific Turf Species Use Listing*)

Turf Use	Chemical Name (rate, lbs ai/acre)	Trade Names (rate, product)	Remarks
Chemicals for Growth & Color Promotion of Bermudagrass such as Tifdwarf & Tifgreen	Gibberellic Acid (10 grams ai/A)	RyzUp/ProGibb 4% active solution (10 fl oz/A or 0.23 fl oz/1000 sq.ft.)	Apply 10 grams ai/acre weekly or 25 grams ai/acre biweekly in 25 to 100 GPA to promote the growth and prevent discoloration (e.g., purpling) during periods of cold stress and light frosts on bermudagrass such as Tifdwarf or Tifgreen. Do not apply when night temperatures exceed 65F. A combination product of indolebutryric acid + gibberellic acid is available as PGR IV.

Read and follow all label recommendations. Products listed are for use by professional turf managers only. Trade and brand names are used for information only. The South Carolina Cooperative Extension Service does not guarantee nor warrant the standard of any product mentioned; neither do they imply approval of any product to the exclusion of others which may also be suitable. The following conversions may be useful. Gal/acre x 2.938 = oz/1,000 ft^2; Qt/acre x 0.7346 = oz/1,000 ft^2; Pint/acre x 0.3673 = oz/1,000 ft^2; lbs/acre x 0.02296 = lb/1,000 ft^2.

Herbicide and PGR Common and Trade Names*
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Common Name	Trade Name(s)
Amicarbazone	-Xonerate 70WDG, 4SC
Aminoclopyrachlor	-Imprelis 80DF, 2SL
Aminoclopyrachlor + chlorosulfuron	-Perspective
Aminoclopyrachlor + chlorsulfuron + sulfometuron	-Plainview
Aminoclopyrachlor + metsulfuron	-Streamline
Aminoclopyrachlor + metsulfuron + imazapyr	-Viewpoint
Aminopyralid	-Milestone 2L
Aminopyralid + 2,4-D	-ForeFront 3.74L
Aminopyralid + metsulfuron	-Opensight
Aminopyralid + triclopyr amine	-Milestone VM 2L
Ammoniated soap of fatty acids	-Quick-fire, Herbicidal Soap
Asulam	-Asulox 3.34L, Asulam 3.3L
Atrazine	-AAtrex, Atrazine Plus, Purge II, Aatrex 90, Atrazine 4L, Bonus S, St. Augustine Weedgrass Control + others
Benefin	-Balan 2.5G. 1.5EC, Crabgrass Preventer, + others
Benefin + oryzalin	-Surflan XL 2G, XL 2G
Benefin + oxadiazon	-Regalstar 1.5G
Benefin + trifluralin	-Team 2G, Crabgrass Preventer 0.92%, Team Pro
Bensulide	-Betasan, Pre-San 12.5 & 7 G, Bensumec 4L, Lescosan, Weedgrass Preventer, Betamec, Squelch, + others
Bensulide + oxadiazon	-Goosegrass/Crabgrass Control 6.56G
Bentazon	-Basagran T/O 4L, Lescogran 4L, Nutgrass ‘Nihilator
Bentazon + atrazine	-Prompt 5L, Laddock S-12
Bispyribac-sodium	-Velocity 80WP, 17.6 WDG, 0.176SC, Regiment 80WP
Bromoxynil	-Broclean, Buctril 2L, Brominal 4L, Bromox 2E, Moxy 2E
Cacodylic Acid	-Montar, Weed Ender
Carfentrazone	-Quicksilver T&O 1.9 L, Aim, Shark
Carfentrazone + 2,4-D + dicamba + MCPP	-Speed Zone Southern 0.81L, Speed Zone Northern and Bermuda 2.2L, Speedzone 2.2L
Carfentrazone + dicamba + MCPA + MCPP	-Power Zone,
Carfentrazone + quinclorac	-Square One 70WDG
Carfentrazone + sulfentrazone	-Spartan Charge 4F
Chlorsulfuron	-Chlorsulfuron 75DF, Corsair 75DF, Telar 75DG
Clethodim	-Envoy 0.94 EC, Clethodim 2EC

Herbicide and PGR Common and Trade Names*
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Common Name	Trade Name(s)
Clopyralid	-Lontrel T&O 3L, Transline 3L, Stinger 3L
Clopyralid + dichlorprop + MCPA	-Chaser Ultra
Clopyralid + MCPA + triclopyr	-Battleship
Clopyralid + triclopyr	-Confront 3L, Confront NR, Redeem R&P, 2D 3L
CMA (CAMA)	-Calar 1L, Ortho Crabgrass Killer - Formula II, Selectrol
Corn gluten	-Dynaweed, WeedzSTOP 100G
Cytokinin	-Agriplex PGR for T&O
2,4-D	-2,4-D Amine 4 & Ester, Barrage HF, Clean Amine, Saber, Weedone LV4, Dacamine, Weedar 64, AM-40, 2,4-D LV4, Dymec, Lesco A-4D, Hardball, Esteron 638, Savana, + others
2,4-D + clopyralid + dicamba	-Millennium Ultra 3.75 L
2,4-D + clopyralid + triclopyr	-Momentum, Confront 3
2,4-D + dicamba	-81 Selective Weedkiller, Four Power Plus, Triple D Lawn Weed Killer, Banvel 2,4-D
2,4-D + dicamba + MCPP + MCPA and/or 2,4-DP	-2 Plus 2, 3D, 33-Plus, Bentgrass Selective Weed Killer, Broadleaf Trimec, Dissolve, Eliminate DG|LO, EndRun, Formula II, Endrun 3.22L, MECAmine-D, Threesome, Three-Way Selective, Trex-San, Triamine 3.9 lb/gal, TriEster, Triplet, Triplet LO|Hi-D|SF, Trimec Bentgrass Formula, Trimec Classic, Trimec Southern, TruPower 2|3, Strike 3, Trimec 899|992|1000, Vessel, Weed-B-Gon, Weed-B-Gon for Southern Lawns, + others
2,4-D + dicamba + MCPP + MSMA	-Trimec Plus 2.64L, Quadmec 2.64L
2,4-D + dicamba + MCPP + pyraflufen	-4-Speed 3.1L, RedZone 2
2,4-D + dicamba + MCPP + sulfentrazone	-Surge 2.18L, SureZone
2,4-D + dicamba + quinclorac	-Quincept 1.875L, Momentum Q, 2DQ
2,4-D + dicamba + sulfentrazone + quinclorac	-Q4 Plus 1.8L
2,4-D + dicamba + sulfentrazone + triclopyr	-T-Zone Broadleaf Herbicide 2.51L
2,4-D + dicamba + triclopyr + pyraflufen	-4-Speed XT 2.9L
2,4-D + dichlorprop (2,4-DP)	-2D + 2DP Amine, Turf D + DP, Fluid Broadleaf Weed Control, Turf Weed & Brushy Control, Weedone DPC Ester & Amine + others
2,4-D + dichlorprop (2,4-DP) + dicamba	-Super Trimec, Brushmaster
2,4-D + dichlorprop (2,4-DP) + MCPP	-Broadleaf Granular Herbicide, Dissolve, Spoiler 4.1L,Triamine, Triamine Jet-Spray Triplet SF, Turf Weeder, Weed Whacker
2,4-D + DSMA	-Weed Beater Plus
2,4-D + fluroxypyr + dicamba	-Escalade 4.4L, Escalade2 4L
2,4-D + fluroxypyr + dichlorprop (2,4-DP)	-Strike Three Ultra 2
2,4-D + glyphosate	-Campaign 3.1 L, LandmasterII 2.2L

Herbicide and PGR Common and Trade Names*
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Common Name	Trade Name(s)
2,4-D + mecoprop (MCPP)	-2D Amine + 2MCPP, 2 Plus 2, MCPP-2,4-D, Phenomec, Ortho Weed-B-Gon Lawn Weed Killer, + others
2,4-D + picloram	-Pathway
2,4-D + triclopyr + fluroxypyr	-Momentum FX2
2,4-D TIPA + fluroxypyr + dicamba	-Escalade Low Odor 4.4L
2,4-D TIPA + MCPP + dicamba	-Triplet Low Odor
2,4-D + triclopyr	-Aquasweep, Turflon II Amine, Chaser 3L Ester, Chaser 2 Amine, Crossbow 3L Ester
Dazomet	-Basamid G
2,4-DP + MCPA + MCPP	-Triamine II, Tri-Ester II
DCPA	-Dacthal W-75 WP, Dacthal 6F
Dicamba	-Diablo, Vanquish 4 L, K-O-G Weed Control, Bentgrass Selective, Banvel 4S, Oracle, Vision, Clarity, + others
Dicamba + diflufenzopyr	-Overdrive 70WG
Dicamba + fenoxaprop + fluroxypyr	-LastCall 0.75L
Dicamba + fluroxypyr + MCPA	-ChangeUp 4.8L
Dicamba + halosulfuron	-Yukon
Dicamba + iodosulfuron + thiencarbazone	-Celsius 68WDG
Dicamba + MCPA + MCPP	-Encore DSC, Tri-Power Dry, Tri-Power Selective, Trimec Encore DSC
Dicamba + MCPA + triclopyr	-Eliminate, Three-Way Ester II, Horsepower 4.56 lb/gal, CoolPower 3.6 lb/gal, Clover Power, Spurge Power
Dicamba + MCPP + triclopyr	-3-Way Ester II
Dicamba + MCPP + quinclorac	-OneTime 2.45L
Dichlobenil	-Casoron 4G, Barrier 4G
Diclofop	-Illoxan 3EC
Dikegulac-sodium	-Atrimmec1.67L, Augeo 1.67L
Dimethenamid	-Tower 6L, Outlook 6L
Dimethenamid + pendimethalin	-FreeHand 1.75G
Diquat	-Diquat SPC 2L, Redwing, Reward 2LS, Solera Diquat, Tsunami DQ, WeedPlex Pro, Watrol, Vegetrol, Aquatate, Aquatrim II
Diquat + glyphosate	-QuikPRO, Prosecutor Swift Acting, Razor Burn 3.1L
Diquat + glyphosate + indaziflam	-Specticle Total 1.95L
Dithiopyr	-CGC 40, Dimension 1L, Dimension Ultra 40WSP, Dithiopyr 40WSB. Lifeguard, Crab and Spurge Preventer, Dimension 270-G
Dithiopyr + oxadiazon	-SuperStar

Herbicide and PGR Common and Trade Names*
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Common Name	Trade Name(s)
Diuron	-Karmex, Diuron
Diuron + imazapyr	-Sahara DG
DSMA	-Ansar, DSMA Liquid, Methar 30, Namate, DSMA 4
Ethephon	-Proxy 2L, Ethephon 2, ProTrim
Ethofumesate	-Prograss 1.5EC, 4.0SC
Fenarimol	-Rubigan 1AS, Patchwork 0.78G
Fenoxaprop	-Acclaim Extra 0.94L, 0.57L, Whip 360
Flazasulfuron	-Katana 25WG
Florasulam	-Defendor 0.417SC
Fluazifop	-Fusilade II T&O, Ornamec 170, Ornamec Over-The-Top
Flucarbazone	-Align 70WDG, Everest
Flumioxazin	-SureGuard 51WDG, BroadStar 0.25G, Payload 51WDG
Fluroxypyr	-Spotlight 1.5L, Vista 1.5L, Vista XRT 2.8L
Fluroxypyr + MCPA + triclopyr	-Battleship III
Fluroxypyr + MCPP	-Bastion T
Fluroxypyr + triclopyr	-PastureGard HL, Tailspin 1.33L
Flurprimidol	-Cutless 50WP, Cutless MEC 1.3L
Flurprimidol + trinexapac-ethyl	-Edgeless 1.51L, Legacy 1.52 MEC
Flurprimidol + paclobutrazol + trinexapac-ethyl	-Musketeer 1L
Foramsulfuron	-Revolver 0.19L
Foramsulfuron + iodosulfuron-methyl + thiencarbazone-methyl	-Derigo 36.4WDG
Foramsulfuron + halosulfuron + thiencarbazone-methyl	-Tribute Total 60.5WDG
Fosamine	-Krenite 4S
Gibberellic Acid	-RyzUp, ProGibb T&O
Gibberellic Acid + indolebutyric acid	-PGR IV
Glufosinate	-Finale 1L, Liberty, Ignite
Glyphosate	-Departure, Roundup Pro 4L, Roundup ProDry, Accord 4L, Gly-Flo, Clear-Out 41 Plus, Glypro, Glyfos, AquaNeat, Razor Pro, Rodeo 5.4L, Kleenup Pro, Pronto, Refuge, Showdown, Weed Wrangler, Prosecutor, Touchdown Pro, Trailblazer, Glyphomate 41 (3.8L), Fireball 1.55L (acid) + others
Glyphosate + imazapic	-Journey 2.25L

Herbicide and PGR Common and Trade Names*
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Common Name	Trade Name(s)
Glyphosate + imazapyr	-Pronto Vegetation Killer 0.36L
Glyphosate + prodiamine	-ProDeuce 4.75L
Halosulfuron	-Sedgehammer 75WP, Sandea 75WP, Manage 75WP, Sempra 75WP, Prosedge 75WP, Permit 75WP
Hexazinone	-Velpar 2L
Imazamox	-Raptor 1L
Imazapic	-Plateau 70DG, Panoramic 2SL, Impose 2L
Imazapyr	-Arsenal 2S, Arsenal Powerline 2L, Arsenal Applicators Concentrate 4L, Habitat, Chopper, Stalker
Imazaquin	-Image 1.5L, 70DF
Imazethapyr + sulfentrazone	-Dismiss South 4SC
Imazosulfuron	-Celero 75WDG
Indaziflam	-Specticle 20WP, Specticle Flo 0.622L
Isoxaben	-Gallery 75DF, Isoxaben 75WG
Isoxaben + oxyfluorfen + trifluralin	-Showcase 2.5G
Isoxaben + trifluralin	-Preen 1.9G, Snapshot 2.5 TG, Gallery + Team Woodace Preen Plus
Maleic hydrazide	-Royal Slo-Gro
MCPA	-Weedar MCPA 4 lb/gal, MCPA-4 Amine, MCPA Ester 4 + others
MCPP (mecoprop)	-Mecomec 4, Chickweed & Clover Control, Lescopex, MCPP-4 Amine, MCPP-4K + others
MSMA	-120 Herbicide, Bueno 6L, Crab-E-Rad, Daconate 6, Daconate Super, Dal-E-Rad, MSMA 6.6L, Drexar 530, 912 Herbicide, MSMA Turf, Summer Crabicide, Target MSMA, Weed Hoe, + others
Mefluidide	-Embark T&O, Embark 2S, Sta-Lo
Mesotrione	-Tenacity 4L
Methiozolin	-PoaCure 2SL
Methyl chlorflurenol	-Maintain CF
Metribuzin	-Sencor 75DF
Metolachlor	-Pennant 7.8 lb/gal, Pennant Magnum 7.62L
Metsulfuron	-Manor 60 DF, Escort 60 DF, Patriot 60 WDG, Metsulfuron Pro, MSM Metsulfuron 60DF, MSM Turf, Mansion
Metsulfuron + nicosulfuron	-Pastora 71DF
Metsulfuron + pyraflufen-ethyl	-Caliente
Metsulfuron + rimsulfuron	-Negate 37WG
Metsulfuron + sulfentrazone	-Blindside 66WG
Methyl Bromide	-Brom-O-Gas, Terr-O-Gas, MB 98, MBC

Herbicide and PGR Common and Trade Names*
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Common Name	Trade Name(s)
Napropamide	-Devrinol 50 DF, 2G, 10G, Ornamental Herbicide 5G
Napropamide + oxadiazon	-PrePair 6G
Norflurazon	-Predict
Oryzalin	-Surflan AS 4 lb/gal, Oryzalin Pro, Weed Impede, Surflan Coated Granules, Proazlin 4L
Oxadiazon	-Ronstar 2G, 50WP, Ronstar Flo 3.17 L, Oxadiazon 50 WSP, 2G, & SC
Oxadiazon + pendimethalin	-Kansel + (20-2-13) 3G
Oxyfluorfen	-Goal 2XL
Oxyfluorfen + oryzalin	-Rout
Oxyfluorfen + oxadiazon	-OO-Herbicide 3G, Regal OO, LaSar
Oxyfluorfen + pendimethalin	-OH2
Paclobutrazol	-Cutdown, Turf Enhancer 50WP, 2SC, Trimmit 2SC, TGR, Armor Tech PAC 223, Tide Paclo 25C
Paraquat	-Gramoxone Max 3L
Pelargonic Acid	-Scythe, Quik
Pendimethalin	-Pendulum (3.3EC, 2G), Pendulum AquaCap (3.8 CS), Hurdle, Turf Weedgrass Control, Halts, Corral 2.68G, ProPendi, Pendiflex 32, Pentagon, PRE-M, Pin-Dee 3.3 T&O
Pendimethalin + oxadiazon	-Kansel + (20-2-13) 3G
Penoxsulam	-LockUp G, Sapphire, Grasp, Granite
Picloram	-Grazon, Tordon K
Prodiamine	-Barricade 65WDG, Endurance 65 WDG, eVade 4L, Factor 65 WDG, Guardrail 65WDG, Kade 65WDG, RegalKade 0.5G & 0.37G, Prodiamine 4L & 65 WDG, Stonewall, ProClipse 65WDG, Cavalcade + others
Prodiamine + oxadiazon	-Regalstar II 1.2G
Prodiamine + quinclorac	-Cavalcade PQ
Prodiamine + sulfentrazone	-Echelon 0.3G, 4SC
Prohexadione-Ca	-Anuew 27.5G
Pronamide	-Kerb 50WP, Kerb SC T&O 3.3L
Pyraflufen-ethyl	-Octane 2%SC (0.177 lbs/gal)
Quinclorac	-Drive 75DF, XLR8 (1.5L), Facet, Paramount, Quinclorac 75DF, 1.5L, Eject 75DF, QuinPro Herbicide
Quinclorac + sulfentrazone	-Solitaire 75WG
Rimsulfuron	-Rimsulfuron 25DF, TranXit GTA 25DG Matrix, Titus
Sethoxydim	-Grass Getter, Poast, Poast Plus, Segment 1L, Sethoxydim G-Pro 1L, Vantage 1L
Siduron	-Tupersan 50WP, 3.5%G, 4.6%G, 470, Crabgrass Control

Herbicide and PGR Common and Trade Names*
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Common Name	Trade Name(s)
Simazine	-Princep 4 lb/gal, T&O, 80WP, Simazine 4L & 90DF, Wynstar, Sim-Trol 90DF, + others
Sulfentrazone	-Dismiss Turf Herbicide 4L, Spartan 4F, Authority
Sulfometuron-methyl	-Oust 75DG, Spyder 75DG, SFM G-Pro 75EG
Sulfosulfuron	-Certainty 75WDG, Outrider 75WDG, Monitor, Maverick
Topramezone	-Pylex 2.8SC, Impact
Triclopyr	-Turflon Ester 4L, Garlon 3A (amine), 4A (ester), & Ultra 4L (ester), Pathfinder 1L (RTU), Tahoe 3A & 4E, Grandstand, Remedy Ultra, Triclopyr 4
Trifloxysulfuron	-Monument 75WG, Envoke
Trifluralin	-Treflan 5G, Trifluralin 4EC, Trilin 4EC, 5EC, Preen, Vegetable and Ornamental Weeder
Trinexapac-ethyl	-Primo 1EC, Triple Play, Primo WSP, Primo MAXX, Governor 0.055% 5-0-10; 0.17%, Palisade, Groom PGR, PGR 113, Podium, RegiMax PGR, T-NEX, T-Pac Epro, Trinexapac-ethyl 1AQ
Xanthomonas campentris	-X-Po

*Refer to the herbicide label for specific site and use registration.

All chemicals mentioned are for reference only. Not all are available for turf use. Some may be restricted by some states, provinces, or federal agencies. It is advisable to check the current status of the pesticide being considered for it use. Always read and follow the manufacturer's label as registered under the Federal Insecticide, Fungicide, and Rodenticide Act. Mention of a proprietary product does not constitute a guaranty or warranty of the product by the authors or the publishers of this book and does not imply approval to the exclusion of other products that also may be suitable.