EFFECTIVE USE OF PGR'S IN TURF

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The effective use of growth regulators begins with the recognition that these compounds are an additional management tool for controlling turfgrass shoot growth. Growth regulator programs can supplement complete mechanical mowing of turf and reduce the overall cost of growth control. Mechanical mowing is a time consuming and expensive turf maintenance procedure. Estimates for mowing roadside and industrial landscapes have averaged $25 to 35 per acre. However, growth regulator applications costing about $7 to $25 per acre can result in 90 to 100% suppression of seedheads and a 30 to 50% reduction in turfgrass shoot growth for up to a 10 week period. The cost for mechanical trimming and edging around various landscape structures is considerably greater than that for open mowing. The use of growth regulators as trimming agents can reduce the number of trimmings required and still leave a functioning turf to compete with weeds and prevent soil erosion losses which can occur following the repetitive use of soil sterilants and nonselective herbicides.

Many landscape sites are inaccessible to mechanical mowers, but can be reached with spray equipment. Growth regulators can reduce the need for mowing around bleachers, benches, fire hydrants, fences, foundations, ditchbanks, roadsides and utility rights-of-ways. Many labor intensive and difficult to mow sites, particularly rocky or sloped areas, are also dangerous for the mower operator or nearby personnel. Limiting the need for using mowing equipment in such areas by using growth regulators can enhance maintenance safety as well as free personnel for work in more visible locations.

Turfgrasses following growth regulator applications usually exhibit some degree of leaf discoloration. This discoloration is typically a browning of the leaf blade tips. Shoot growth suppression restricts the new leaf growth that would normally hide discoloring leaves. Leaf tip discoloration generally is most evident at about 3 to 4 weeks after growth regulator treatment. Discoloration can be magnified if the treated turf is under stress (water, traffic, etc.) at or shortly after application. Increased nitrogen fertilization has been shown to reduce discoloration following growth regulator treatment. Nitrogen applications of 1 to 2 lbs N/1000 ft^2 during the fall have been found to improve tall fescue color following spring growth regulator applications. Nitrogen fertilization near the time of regulator treatment will diminish turf discoloration, but may shorten the duration of growth suppression to less than the normal 6 to 10 week range. Turf treated with growth regulators typically recovers from this discoloration and often has color that exceeds untreated turf at 8 to 9 weeks after application.

Leaf tip discoloration has often be cited as the primary difficulty in using growth regulators on turf despite the data demonstrating that this discoloration is temporary and usually acceptable for roadsides, rights-of-ways and other lower maintenance areas. The temporary

discoloration around mowing obstacles following growth regulator treatment is a more aesthetically pleasing landscape when compared to the results of soil sterilants or nonselective herbicide applications. Additionally, mechanical mowers often result in various types of discoloration from scalping, when used under wet conditions or when not adjusted properly.

Stand density reductions have also been reported following regulator applications. However, this response is most often associated with treatments on stressed turf or multiple applications per year. Root system losses have also been reported in greenhouse and growth chamber studies. Such losses have not been generally observed under field conditions where the turf receives only one application per year. Whether mechanically or chemically mowing turf, it is important to permit a period of recuperation between treatments. Continually mowing too low and scalping of the turf will result in loss of stand.

Commercially available turfgrass growth regulators (see Table 1) include amidochlor (Limit), chloroflurenol (Maintain CF125), chlorsulfuron (Telar), EPTC (Short-stop), glyphosate (Roundup) maleic hydrazide (MH), mefluidide (Embark), sethoxydim (Poast) and sulfometuron-methyl (Oust). Many of these compounds have only recently been labelled for turf use. Some of these compounds also act as herbicides when used at higher application rates.

Maleic hydrazide has been evaluated for over 30 years, particularly on low maintenance turf (eg. rights-of-way). It is foliarly absorbed and is typically applied during the spring to turf at rates from 2 to 4 lb ai/A. Maleic hydrazide is an excellent (> 90%) seedhead suppressant of many grasses (bluegrasses, fescues, bahiagrass) and often results in significant vegetative inhibition as well. Fall applications of maleic hydrazide to tall fescue have been much more phytotoxic than spring treatments. Injury symptoms have included leaf tip burn and delayed spring green-up.

Mefluidide was labelled for turf use in the late 1970s and is also foliarly absorbed. Mefluidide has been applied at rates from 0.125 to 0.5 lb ai/A for seedhead inhibition. Vegetative growth suppression by mefluidide is equivalent to that observed for maleic hydrazide. Seedhead suppression of tall fescue by mefluidide has been best at rates of 0.38 to 0.5 lb ai/A along with the use of a surfactant at 0.5% v/v. Mixtures of mefluidide (0.125 lb ai/Ai and chlorsulfuron (0.125 oz ai/A) have also provided better than 95% suppression of tall fescue seedheads. Additionally, mefluidide has been applied alone at 0.125 lb ai/A for annual bluegrass seedhead suppression in golf course fairways and tees. Overall, mefluidide is active on a wide range of turfgrasses (bluegrass, fine fescue, tall fescue, ryegrass, centipedegrass, St. Augustinegrass and common bermudagrass), but it will not control bahiagrass seedheads.

Amidochlor was labelled in 1985 for use on cool season turf. Unlike maleic hydrazide and mefluidide, amidochlor is primarily root absorbed and has a labelled application rate of 2.5 lb ai/A. Seedhead suppression of bluegrass, fine fescues, tall fescue and ryegrass of 90% or more has been observed following amidochlor treatment. Amidochlor is generally less active on warm season turfgrass than maleic hydrazide. However, amidochlor is a more active vegetative growth suppressant of tall fescue than maleic hydrazide or mefluidide.

Table 1. Turfgrass growth regulators studied at North Carolina State University.

Trade name	Common name	Application rates	Absorption site
Cutlass	flurprimidol	0.75, 1, 2 lb	Root
Embark	mefluidide	0.125, 0.25, 0.38, 0.5 lb	Foliar
Escort	DPXT6376	0.125, 0.25, 0.5 oz	Foliar/Root
Limit	amidochlor	2, 2.5, 3, 5 lb	Root
Oust	sulfometuron methyl	0.5, 1, 2, 3, 4 oz	Foliar/Root
Parlay	paclobutrazol	0.75, 1, 2 lb	Root
Poast	sethoxydim	0.15 lb	Foliar
Roundup	glyphosate	0.19, 0.25, 0.5 lb	Foliar
Short-Stop	EPTC	4, 5, 6, 8 lb	Root/Foliar
Slo Gro	maleic hydrazide	2, 3, 4 lb	Foliar
Telar	chlorsulfuron	0.125 oz	Foliar/Root
	ACP1900	4.5, 8, 16, 18, 32 grams	------
	XE1019	1.0, 2.0 lb	------

The use of trade names in this paper does not imply endorsement of the products named, nor criticism of similar ones not mentioned.

EPTC was labelled as Short-stop during 1985 for use in the suppression of tall fescue seedheads in low maintenance areas such as roadsides and utility rights-of-way. In trials at Raleigh, NC, tall fescue seedhead suppression following EPTC application rates of 6 to 8 lb ai/A has been more variable than that observed for maleic hydrazide and mefluidide.

Glyphosate (a nonselective herbicide) at 0.19 to 0.25 lb ai/A has provided 8 to 10 weeks suppression of bahiagrass seedheads. Sequential application of glyphosate (0.25 lb ai/A in May followed by 0.13 lb ai/A in July) resulted in stand losses during the second year of treatment. Glyphosate applications at 0.25 to 0.5 lb ai/A have resulted in about 90% suppresion of tall fescue seedheads.

Tall fescue stand density and turf quality was adversely affected by applications of sethoxydim (0.15 lb ai/A), chlorsulfuron plus maleic hydrazide (0.125 oz + 3 lb ai/A) and metsulfuron methyl plus mefluidide (0.125 oz + 0.125 lb ai/A). Flurprimidol and paclobutrazol were ineffective seedhead suppressants of many turfgrasses when applied alone at 0.75 to 1 lb ai/A. However, both of these experimental compounds provided better vegetative growth inhibition than maleic hydrazide, mefluidide or amidochlor.

The success of growth regulator applications for seedhead suppression is dependent on the application date with respect to the plant's seedhead development. While spring seedhead development is affected by fall or winter growth regulator applications, suppression has not exceeded 70% of untreated control turf. Seedhead suppression of tall fescue has been most successful for growth regulator applications after the spring green-up of the turf, but before the seedhead begins to rapidly elongate. Growth regulator applications to tall fescue after the seedhead reaches a length of 1 to 1.5

inches provides unacceptable suppression. At this point, the tall fescue seedhead is still about 2 weeks from emergence out of the boot.

Turfgrass growth regulator programs are effective and economic supplements to complete mechanical mowing. The successful use of these compounds in turf is dependent on many variables including using the appropriate regulators for a given turf seedhead or vegetative growth. Mechanical mowing is nonselective in that all plants within the mower's swath will be clipped. Turfgrass growth regulators are selective in that a given compound may only have activity on certain turfgrasses and/or certain stages of growth (eg. vegetative vs seedheads). Application timing and rate, the use of surfactants and other additives, nitrogen fertilization and environmental conditions will also influence the effectiveness of turfgrass growth regulators.

Growth regulators will likely remain limited for use in low maintenance areas such as roadsides and utility rights-of-way for the immediate future. However, recent advances in plant growth regulator development and understanding have provided the chemistry and knowledge to use these compounds in moderately managed turf, particularly for difficult to mow sites (eg. steep slopes, fence rows, foundation edging, and cemeteries). Additional innovative uses such as marking/growth regulator mixes for maintaining lines on athletic fields remain to be discovered.