

The Use of Plant Growth Regulators on Turf

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Are they new technology, or just older products packaged in new containers? Can they suppress growth without causing plant damage? Can they be used on all turf types or just on low maintenance turf? These are just some of the many questions frequently asked about the use of plant growth regulators (PGRs) on turf. In this issue of *PACE Insights*, we will present some background information on the applied use of PGRs in turf, as well as an update on recent research results obtained in PACE Turfgrass Research Institute (PTRI) trials with the PGR product, Primo.

Background: Plant growth regulators are chemicals (such as auxins, gibberellins, cytokinins, abscisic acid,

ethylene) that are produced naturally in plant tissues and control growth processes such as dormancy, flower or fruit abscission (drop), fruit ripening, flowering and seed formation, and stem elongation. Beginning in the 1940's chemists were able to produce synthetic versions of naturally occurring PGRs, with the first products used only on low maintenance turf (e.g. to reduce the frequency of roadside mowing). Today's turf PGRs (Table 1) are used on both high and low maintenance turf, and are targeted primarily towards inhibiting the formation of seedheads (regulation of flowering and seed formation) or towards reducing the quantity of clippings (stem elongation).

Table 1. Plant growth regulators registered for use on turf in California.

CHEMICAL NAME	TRADE NAMES	USE PATTERN
maleic hydrazide	Reduce, Royal Slo-gro	suppresses leaf and seedhead development; labeled for use on roughs only due to potential for turf injury
mefluidide	Chek-Turf II, Embark, Gro-Tard II, Slow It II	suppresses leaf and seedhead development; labeled for use on lightly trafficked areas only due to potential for turf injury
trinexapac-ethyl	Primo*	inhibits node elongation, causing new plant parts to develop in miniature size; labeled for use on greens (bentgrass, Tifdwarf and Tifgreen only), tees, fairways and roughs

*products with similar mode of action to Primo, but not registered yet in California include flurprimidol (Cutless), paclobutrazol (Scotts TGR) and uniconazole (Sumagic).

Successful use of the PGR products above can result in decreased labor costs, decreased green waste, and higher quality turf. Although many PGRs are successful in reaching these objectives, there is sometimes a cost -- yellowing or browning (usually temporary) of turf. The primary reason for this type of plant damage is directly related to the fact that turf is in a constant state of turn-over, with the life span of each grass leaf only 3 - 7 weeks. Therefore, to keep turf green, it's important to keep new leaves actively regenerating and growing. The dilemma we face with PGRs is that although we want to slow down turf growth to a certain extent (enough to cut down on clippings, or to reduce seedhead formation), we don't want to slow it down so much that new growth comes to a standstill, and the only leaves remaining are the old, senescing, yellowing foliage. It is for this reason that the labels of most PGRs advise the user to apply product only to green, actively growing turf.

The Ideal PGR: If we were to design the ideal PGR for use on turf, it would exhibit some or all of the following characteristics:

- regulate stem elongation (reduce clippings)
- improve turf quality
- enhance root growth
- improve sod establishment
- control weeds
- undesirable turf suppression in overseeding programs
- no plant damage
- inhibit flowering and seeding
- enhance lateral growth to maintain density

As one of the first turf PGRs registered in many years in California, Primo has received a great deal of attention from the turf industry and from researchers.

To determine how well Primo meets the characteristics of the "ideal PGR" outlined above, PTRI, with support from Novartis and the Hi-Lo Desert GCSA, and the superintendents listed below, has conducted field research over the past 3 years. This research (all of which was conducted on golf courses in replicated plot trials) is summarized below.

Stem elongation and turf quality: Trials conducted in 1995 and 1996 with Reed Yenny, superintendent Mesa Verde Country Club, evaluated the role of Primo in suppressing growth and improving quality of kikuyugrass fairways. Results showed that:

- at all rates tested (0.15 - 0.6 oz/1000 sq ft), turf treated with Primo Liquid was of higher quality and scalped less than non-treated turf (Figure 1)
- Primo Liquid applied at rates of 0.15 - 0.6 oz/1000 sq ft significantly reduced clippings (Figure 2). A rate of 0.5 oz/1000 sq ft applied every 4 weeks maintained clipping reduction levels at 50%
- some reversible discoloration of turf was observed during the first 2 weeks after application; however, the initial application of Primo appeared to "condition" turf, resulting in reduced negative impact from additional Primo applications

Figure 1. Effect of Primo treatments on kikuyugrass quality. Mesa Verde Country Club, Costa Mesa, CA.

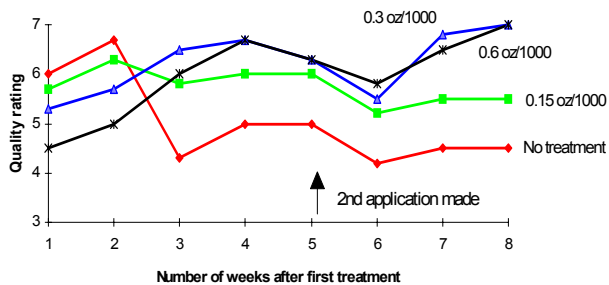
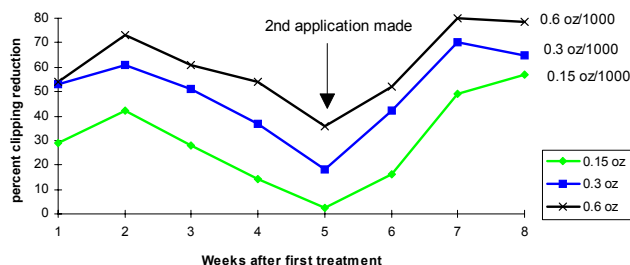


Figure 2. Effect of Primo treatments on percent kikuyugrass clipping reduction. Mesa Verde Country Club, Costa Mesa, CA. June 4 - July 31, 1996.

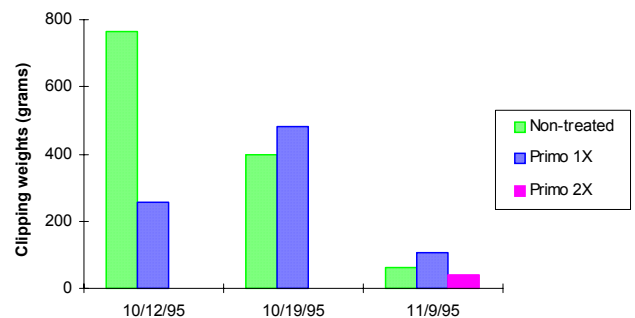


Improved sod establishment and enhanced root growth: Trials conducted with Jeff Beardsley, superintendent at Big Canyon Country Club, evaluated the ability of Primo to improve establishment of Crenshaw bentgrass sod following harvest and transplant, as well as the effect of Primo on root growth. We found that a single application of Primo (0.2 oz/1000 sq ft) immediately before sod harvest promoted sod establishment by:

- decreasing vertical growth of the transplanted sod, and therefore allowing the superintendent to delay the first mow (Figure 3)
- preventing scalping at the first mow
- having no negative impact on root growth

Although Primo did not negatively impact root growth, it did not enhance root growth vs. the non-treated check. A second application of Primo was necessary 3 - 4 weeks after sodding to maintain growth regulation.

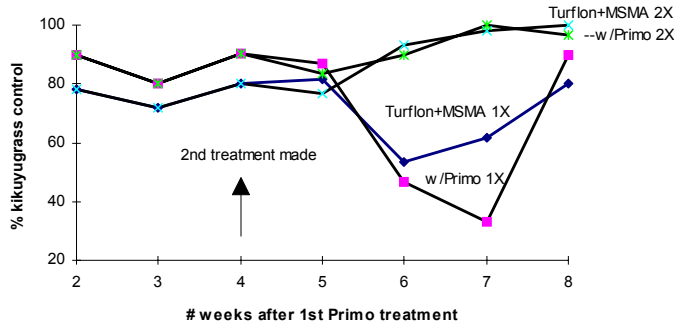
Figure 3. Bentgrass clipping yields following sod establishment, Big Canyon Country Club, Newport Beach, CA. Primo was applied once (1X ;9/27/95) or twice (2X;9/27 and 10/26/95).



Weed Control: With the cooperation of superintendents Reed Yenny (Mesa Verde Country Club) and Karl Sellery (Ocean Hills Golf Course), the efficacy of Primo in combination with Turflon and MSMA was evaluated for kikuyugrass control. Conclusions from the trial were:

- combinations of Turflon plus MSMA (0.4 oz + 1.5 oz/1000 sq ft), with or without the addition of Primo (0.3 oz/1000 sq ft), provided good control of kikuyugrass for up to 5 weeks; in other words, Primo did not enhance the control provided by Turflon plus MSMA (figure 4)
- a second application of herbicides was necessary to extend control beyond 5 weeks
- none of the treatments caused damage to either Bermudagrass or annual bluegrass

Figure 4. Effect of herbicide treatments on kikuyugrass control. Mesa Verde Country Club, Costa Mesa, CA. Applications were made 6/11/96 for plots with 1 application (1X) and on 6/11 and 7/10/96 for plots with 2 applications (2X). Treatments consisting of Turflon+MSMA+Primo are denoted as "w/Primo".



Use in Overseeding Programs: Trials were conducted to:

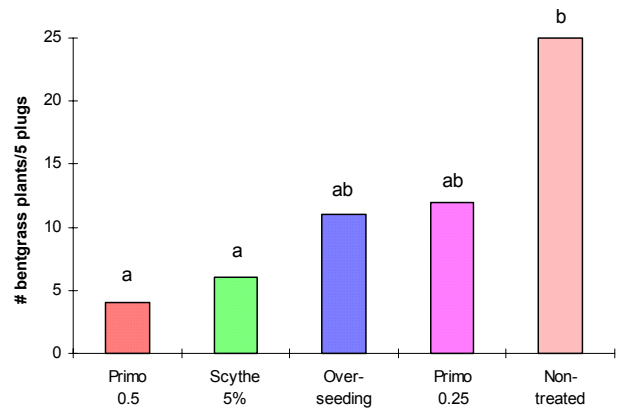
1. determine the role of Primo in converting poa greens to bentgrass greens (Mesa Verde Country Club, Reed Yenny, superintendent)
2. evaluate Primo rates and application timing for improved transition and turf quality on Bermudagrass fairways overseeded with ryegrass (Indian Wells Country Club, Tom Baty, superintendent)

Results indicated that:

- when applied (0.25 or 0.5 oz/1000 sq ft) on a predominantly poa green, Primo Liquid was unable to increase bentgrass establishment (figure 5); we haven't yet investigated, however, how Primo will perform on greens with lower initial poa infestations but it is possible that efficacy will be improved under these conditions
- when applied to Bermudagrass fairways in prior to Fall overseeding, the best quality turf resulted from two applications of Primo, the first application (0.5 -

1.0 oz/1000) made 2 weeks before overseeding, and the second application (0.5 - 0.75 oz/1000) made within 2 -5 days of the first mowing following overseeding. This trial will be completed in July, 1997 and therefore the results presented here are preliminary.

Figure 5. Number of bentgrass plants per five plugs of turf, after application of various chemical treatments, followed by bentgrass overseeding. Mesa Verde Country Club, 1995. Values followed by the same letter are not significantly different (Fisher's LSD, P<0.05).



Based on the results above, as well as on the scientific literature, we can now evaluate commonly used PGRs vs. the "ideal PGR" (see Table 2 on page 4).

To answer the questions posed at the beginning of this article, PGR products have improved significantly since their introduction in the 1940s, with newer products that are safer to use, and produce more consistent results. New uses for PGRs continue to be discovered, many of them by superintendents experimenting with products to meet their special needs. Let us know about your successes (and failures) so that we can add your experiences to our data base, and share it with other superintendents.

Table 2. Characteristics of the Ideal Plant Growth Regulator for Turf: How do the Products Rate? A plus (+) indicates that the product has been shown to perform these functions, a minus (-) indicates that research has shown the product does not perform these functions effectively, and a blank box indicates that no information is available on product performance for this characteristic.

CHARACTERISTIC	maleic hydrazide (e.g. Reduce, Slow-Gro)	mefluidide (e.g. Embark)	trinexapac-ethyl (e.g. Primo)
regulate stem elongation	+	+	+
improve turf quality		+/-	+
enhance root growth	-	-	-
improve sod establishment			+
weed control	+	-	-
use in overseeding programs	+	+	+/-
no plant damage	-	-	+/-
inhibit seed head formation	+	+	
enhanced lateral growth	-	-	

References

- Kaufman, J.E. 1994. Understanding Turfgrass Growth Regulation *in* Handbook of Integrated Pest Management for Turf and Ornamentals. Lewis Publishers, Boca Raton, FL. pp. 267-274.
- Watschke, T.L., Prinster, M.G. and J.M. Breuninger, 1992 *in* Turfgrass: Agronomy Monograph #32. American Society of Agronomy, Madison, WI. pp. 557-588.

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