

Plant Growth Regulators and Mowing Reduction

By Dr. John Stier, Department of Horticulture, University of Wisconsin-Madison



Plant growth regulators were initially developed and used to reduce mowing requirements. The first PGRs such as maleic hydrazide (Slo-Gro), mefluidide (Embark) and amidochlor (Limit) often visibly reduced mowing needs but caused unacceptable phytotoxicity to fine turf. Other growth regulators developed and sold beginning in the 1980s included paclobutrazol (Scotts TGR, Trimit) and flurprimidol (Cutless). These PGRs had less phytotoxicity and a different mode of action, reducing cell elongation by suppressing production of the plant hormone gibberellic acid (GA). In the 1990s trinexapac-ethyl (Primo) and ethephon (Proxy) were commercialized for the turf market. Primo also suppresses GA production but is foliar-absorbed, an advantage in some cases over paclobutrazol and flurprimidol. Proxy is foliar-absorbed, but has a unique mode of action. Proxy suppresses foliar growth by inducing ethylene production in the plant, another hormone that restricts cell size.

Superintendents quickly learned that the GA-inhibiting PGRs had the unintended yet pleasant effect of increasing turf quality. Turf treated

with GA inhibitors turns darker green and may increase its overall shoot density as plant energy is put into axillary bud development rather than increased leaf size (Stier and Rogers, 2001). Recently it seems as if the turf quality aspect is sometimes more important than any clipping yield reduction.

Most growth regulators though are still used because they may reduce clipping yields. Numerous projects have been conducted to show their effectiveness at reducing clipping yields (e.g., Ervin and Koski, 2001; Stier et al., 2000). Many authors have used information based on clipping yield reduction to deduce the number of mowings that could be eliminated, providing a reasonable cost justification.

In reality, though, few scientific data are available that document the effect of PGRs on actual mowing requirements. In 2003 we set out to document the effects of Primo and Proxy growth regulators on turf, including their effect on actual mowing requirements.

Materials and Methods

A field experiment was conducted at the O.J. Noer Turfgrass Research and Education Facility

on a mature, mixed stand of Kentucky bluegrass and perennial ryegrass maintained under fairway conditions (0.5 inch, or 12 mm, mowing height). Plots were 3ft x 6ft arranged in a randomized complete block design with four replications. Treatments were applied with a CO₂ powered boom sprayer, using XR Teejet 8005 VS nozzles, at 30 psi, in water equivalent to 2 gal./1000ft². The first treatment applications were made after the second mowing of the season on May 2, 2003. Treatments included Primo Maxx + urea, Primo Maxx alone, Proxy + urea, Proxy alone, Urea alone, and an untreated check (Table 1). All treatments containing Primo Maxx were sprayed on a 14 day interval and all treatments containing Proxy were sprayed on a 42 day interval. Urea alone and in combination with Primo or Proxy was applied on a 14 day interval. Turf density and quality ratings were collected visually bi-weekly on a 1 to 9 scale, with 9 = excellent turf and 6 = minimum acceptable fairway quality. The turf height on each individual plot was measured 3 times per week using a turf prism.

Table 1. Treatments and application interval for PGR and mowing frequency study.

Treatment	Formulation	Rate	Application interval
1. Primo MAXX	1 EW	0.25 fl oz/1000 ft ²	14 day
Urea	46-0-0 granular	0.3 lb/1000 ft ²	14 day
2. Primo MAXX	1 EW	0.25 fl oz/1000 ft ²	14 day
3. Proxy	2 EW	5 fl oz/1000 ft ²	42 day
Urea	46-0-0 granular	0.3 lb/1000 ft ²	14 day
4. Proxy	2 EW	5 fl oz/1000 ft ²	42 day
5. Urea	46-0-0 granular	0.3 lb/1000 ft ²	14 day
6. Untreated check	---	---	---

Plots were mowed using the 1/3 Rule, i.e. when turf height reached 18 mm. The number of mowings per season was recorded.

Results and Discussion

Both PGR plus urea combinations provided the best turf quality throughout the study (Fig. 1). Urea usually provided similar quality except during late August and September when quality of urea plots declined. Proxy and Primo MAXX without urea provided lower turf quality, similar to the untreated and unfertilized check. These results indicate the importance of providing nitrogen fertility when using PGRs.

As expected both Primo MAXX and Proxy significantly reduced the number of mowings required to maintain turf using the 1/3 Rule of mowing which requires no more than one-third of the foliage height

be removed with any single mowing. Interestingly enough, though, the routine use of urea negated the growth reduction effect of both PGRs. These results disagree with many previous studies, however, many previous studies measured only clipping yields rather than basing the data on the number of mowings required to maintain turf using the 1/3 Rule.

Conclusion

Data suggest that superintendents who use PGRs throughout the season may reduce the effectiveness of PGRs to eliminate mowing requirements in some cases when moderate to high rates of nitrogen are routinely applied. Since data can vary greatly between years, though, and the results presented are from only one year, any conclusions are tentative. Further work should be conducted

to confirm or refute data collected in 2003. Other data are needed to correlate clipping yields with mowing frequency requirements and to better define the best amount and frequency of nitrogen application when PGRs are used.

References Cited

- Ervin, E., H., and A.J. Koski. 2001. Kentucky bluegrass growth responses to trinexapac-ethyl, traffic, and nitrogen. *Crop Sci.* 41:1871-1877.
- Stier, J.C., and J.N. Rogers, III. 2001. Trinexapac-ethyl and iron effects on supina and Kentucky bluegrasses under low irradiance. *Crop Sci.* 41:457-465.
- Stier, J., Z. Reicher, and G. Hardebeck. 2000. Effect of the growth regulator Proxy on creeping bentgrass fairway turf. *J. Env. Hort.* 18(1):53-58. 🌿

Table 2. Plant growth retardant and urea effects on mowing frequency of a Kentucky bluegrass:perennial ryegrass turf maintained at 0.5 inch height, Verona, WI, 2003.

Treatment	No. mowings to July 23	No. mowings to Oct. 3
Primo MAXX + Urea	25.0 b†	43.5 c
Primo MAXX	18.8 d	34.3 e
Proxy + Urea	28.0 a	47.0 b
Proxy	21.5 c	38.8 d
Urea	28.3 a	49.8 a
Untreated check	25.5 b	44.5 bc

† Values followed by the same letter were not statistically significant at $P < 0.05$.

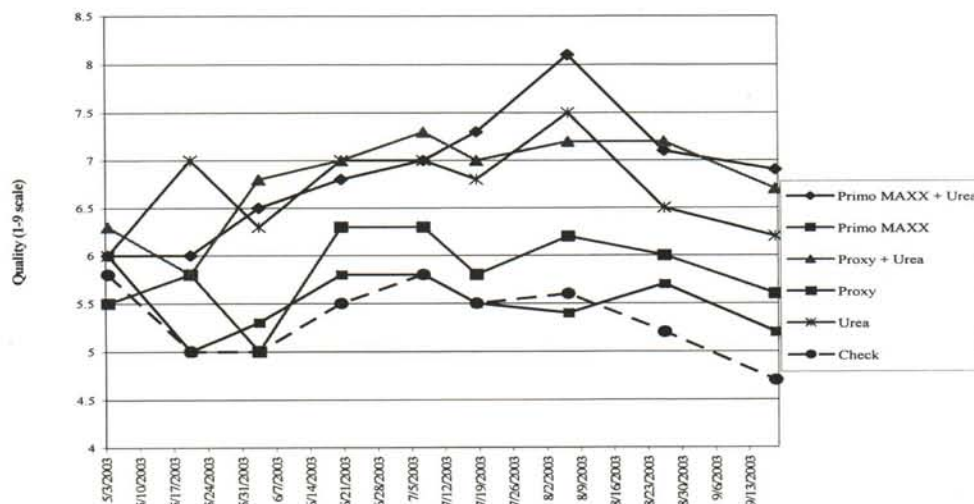


Fig. 1. Turf quality as affected by the plant growth regulators Primo MAXX and Proxy, with and without urea fertilization, on Kentucky bluegrass:perennial ryegrass turf maintained at 0.5 inch height, Verona, WI, 2003.