A PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TURFGRASS TRENDS

Section II • Volume 11, Issue 9 • **September 2002**

www.turfgrasstrends.com

WEED CONTROL

Temperatures Affect Primo Applications

By Matt Fagerness

Bermudagrass is the most commonly grown warm-season turfgrass species in the southeastern United States. The aggressiveness of bermudagrass is attributable to a C-4 carbon assimilation pathway and to rhizomatous and stoloniferous growth habits (Beard, 1973). The ability of bermudagrass to grow rapidly vertically and horizontally has led to the extensive use of plant growth regulators (PGRs), which effectively control numerous species (Johnson, 1990).

Several PGRs are available for use on bermudagrass, but the most common of which is trinexapac-ethyl (Primo, Primo Maxx). Multiple applications of PGRs are usually required for effective long-term growth inhibition, as warm-season grasses have the potential for rapid growth over an extended period (Fagerness and Yelverton, 2000).

Preliminary field observations suggest that late season PGR applications might predispose bermudagrass to winter kill.

Although the main purposes for Primo applications to bermudagrass are to improve visual quality and slow growth during high temperatures, there are some indications that additional effects can occur. Recent research suggests summer applications of Primo may delay the onset of bermudagrass dormancy (Fagerness and Yelverton, 2000). Also, Primo applications near the end of the bermudagrass growing season can aid overseeding by assisting the transition to the cool-season species.

Preliminary field observations, however, suggest that these late-season PGR applications might also predispose bermudagrass to winter kill. The main objective of this study was to investigate growth of bermudagrass in response to Primo in different temperatures and during the transition into winter dormancy. We also examined whether Primo treatments altered the freezing tolerance of field-grown bermudagrass.

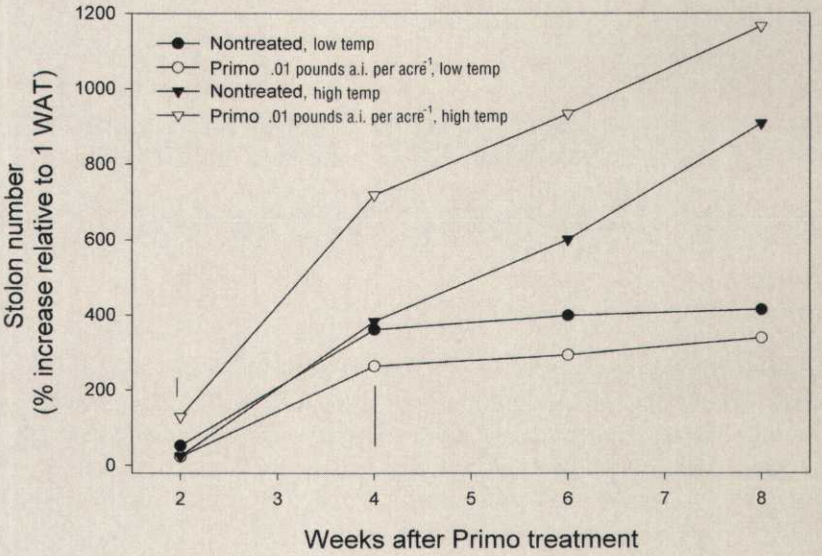
Materials and methods

To achieve our objectives, two different experiments were performed. Growth-chamber experiments were conducted to examine the connection between temperature and Primo on bermudagrass growth. Temperatures were approximately to 68 to 95 degrees Fahrenheit during the day, and 59 to 77 degrees at night. For growth chamber experiments that measured clipping biomass and lateral growth, turf was collected as 3.9-inch-diameter sod cores, all from a uniform field stand of bermudagrass. Samples were placed in pots and backfilled with soil from the collection site. Primo was applied to sod cores three weeks after their introduction to growth chambers at a rate of .01 pounds of active ingredient per acre. The bermudagrass was mowed to a height of .75 inches three times

AN ADVANSTAR ★ PUBLICATION

FIGURE 1

Effects of growth temperature and Primo on the number of stolons emerging from the central core of transplanted bermudagrass sod. Vertical lines above each time point represent Lowest Stastistical Difference values at a significance level of 5 percent.



per week for seven weeks. Clippings were dried in an oven at 158 degrees Fahrenheit for 72 hours and then weighed. Lateral growth was estimated by counting the number of stolons emerging from the central sod core.

Field experiments were conducted in 1997 and 1998 near Pinehurst, N.C., on bermudagrass plots established in 1995 in a sandy soil. The turf was verticut each spring, received monthly fertilizer from May through September, and was irrigated as needed. Turf was mowed at a height of .75 inches.

Primo treatments simulated recommended application practices in North Carolina. Spray applications were all made at the recommended .01 pounds of active ingredient per acre rate. Initial applications were made in June or July, once the bermudagrass was actively growing. Sequential applications were made four and eight weeks later. Early fall applications of Primo were made to previously nontreated turf in September, with the intent of simulating Primo use as an overseeding aid.

Turfgrass quality was evaluated on five occasions. Visual quality ratings were a function of turfgrass color, texture and density, and were based on a 1 to 9 scale (1=dead or fully dormant turf, 9=ideal turf, and 5=minimally acceptable turf). Shoot density and root biomass were measured three times during the autumn at monthly intervals, beginning in late September when the early fall application of Primo was made.

Freezing tolerance was based on rhizome and stolon survival and subsequent regrowth. Samples were collected for each treatment in mid-October and again in mid-November to determine survivability at two different degrees of autumn dormancy. Eight segments of rhizomes and stolons, each with at least one node, were separately planted into potting soil. Sprigs were chilled at 37.4 degrees Fahrenheit for 21 days to allow sufficient development of cold hardiness (Beard, 1973).

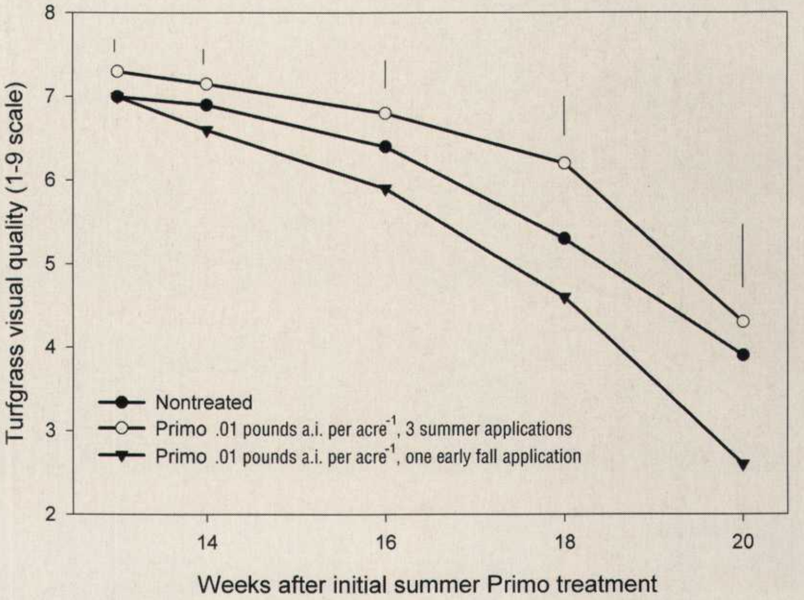
Selected sprigs were frozen to 23 degrees Fahrenheit, maintained at the target freezing temperatures for three hours and then thawed. Sprigs exposed to freezing temperatures were then replanted in potting soil. Samples were maintained at 77 degrees Fahrenheit and monitored for new leaf growth one and three weeks after freezing.

Results, discussion

One main objective of this study was to determine if Primo caused different responses when applied at different air temperatures. Before initiating the experiments, it

FIGURE 2

Effects of Primo on bermudagrass visual quality during the 1997 growing season. Quality was assessed using a 1 to 9 scale (1=dead or fully dormant turf, 9=ideal turf, and 5=minimally acceptable turf). Vertical lines above each time point represent Lowest Statistical Difference values at a significance level of 5 percent.



seemed reasonable to believe that Primo effects would be more pronounced at higher temperatures because of the greater potential for growth reduction when growth is more rapid. Our growth chamber studies, however, revealed that Primo suppresses growth at both high and low temperatures. These studies also showed that Primo increased stolon numbers, but only when turf was growing at higher temperatures (Fig. 1).

Field results showing greater fall shoot density following multiple Primo applications during the warm summer months (Table 1) also reflected these high-temperature stimulated increases in lateral shoot development.

It's not clear why Primo increased stolon growth only at higher temperatures. It's likely that higher bermudagrass growth rates at higher temperatures are associated with greater rates of nitrogen uptake and delivery to shoots. Thus, higher temperatures and more rapid nitrogen uptake likely stimulated growth of the stolons.

Following treatment with Primo, growth suppression would lead to increased allocation of resources (e.g., more nitrogen and carbohydrates would move to lateral meristems), further enhancing lateral stem development.

Our experiments have indicated that temperature also may play a role in how Primo affects bermudagrass dormancy. The process of dormancy, and the physiological basis for it, is still largely undefined. It was observed previously that three summer applications of Primo could delay the onset of bermudagrass dormancy (Fagerness and Yelverton, 2000). The pattern also was observed in the first year of this study (Fig. 2 and Table 1), when turf treated with three summer Primo applications consistently had higher fall quality and shoot density than untreated turf.

In contrast, the 1997 early fall Primo application led to decreases in shoot density (Table 1) and visual quality (Fig. 2), indicating a more rapid progression into dormancy.

Field studies have indicated that Primo can discolor bermudagrass when it is first applied in the summer months (Fagerness and Yelverton, 2000; Wiecko, 1997). Bermudagrass recovers quickly, however, under favorable temperature and growth conditions.

One explanation for the negative effects resulting from the early fall Primo application

TABLE 1

Bermudagrass shoot density and root biomass as influenced by summer and early fall applications of Primo in 1997.

	WEEKS AFTER TREATMENT (WAT)		
Treatment	12	16	20
	SHOOT DENSITY (shoots m-2)		
Nontreated	118,000	110,000	111,250
Primo (3 summer apps.)	98,750	137,500	125,000
Primo (Fall)	117,750	97,500	87,500
LSD=.05	14,021	14,204	29,206

TABLE 2

Bermudagrass stolon freezing tolerance as influenced by harvest date and Primo in 1998.

		Tifway bermudagrass
Treatment	Harvest	Stolons
		PERCENT SURVIVAL
Nontreated	October	22
Primo (3 summer apps.)	October	41
Primo (Fall)	October	56
Nontreated	November	81
Primo (3 summer apps.)	November	81
Primo (Fall)	November	69
LSD=.05		16

in 1997 (Fig. 2) is that the turfgrass was more sensitive to Primo. The early fall application occurred when mean daily temperatures were about 46.4 degrees Fahrenheit cooler than those in the July to August period. Bermudagrass was growing relatively slowly and beginning the transition into dormancy, which may have amplified the initial effects of Primo applied that late in the growing season.

The absence of Primo effects on fall visual quality and density in the second year (1998) was unexpected. It's conceivable this response was due in part to higher growth temperatures. Air temperature monitoring showed that seasonal temperatures were higher throughout 1998. Since air temperatures were higher at the time of the early fall application in 1998, growth regulating effects of Primo may have been offset by more rapid bermudagrass growth.

Variable growth temperatures between 1997 and 1998 corresponded to changes in sprig freezing tolerance between the two seasons. Cooler autumn temperatures in 1997 stimulated the natural development of cold hardiness (Beard, 1973), which may have accounted for the absence of any Primo effects on fall freezing tolerance.

Conversely, warmer fall temperatures in 1998 may have delayed the development of cold hardiness and thus predisposed stolons and rhizomes to winter kill. Accordingly, reduced growth in Primo treated stolons may have resulted in increased freezing tolerance in sprigs harvested in October 1998 (Table 2).

In summary, Primo treatments at different times during the year can lead to different growth responses that can be attributed in part to interactions with temperature.

From a turfgrass management perspective, Primo effects tended to be positive at higher temperatures, with slower growth accompanied by increased density and quality. At lower temperatures, Primo still slowed growth, but bermudagrass may have difficulty recovering from these suppressive effects.

Applications of Primo in the fall can result in decreased competitiveness because of slower growth and decreased density, allowing for this PGR's use during transition to an overseeded cool-season species.

Dr. Matt Fagerness is the extension turfgrass specialist at Kansas State University. His research interests focus on optimizing of turfgrass selection and management and turfgrass weed management for the northern transition zone.

REFERENCES

Beard, J.B. 1973. *Turfgrass Science and Culture*. Prentice Hall, Englewood Cliffs, N.J.

Fagerness, M.J. and F.H. Yelverton. 2000. "Tissue production and quality of Tifway bermudagrass, as affected by seasonal applications of trinexapac-ethyl." *Crop Sci.* 40:493-497.

Johnson, B.J. 1990. "Response of bermudagrass (*Cynodon* spp.) cultivars to multiple plant growth regulator treatments." *Weed Technol.* 4:549-554.

Wiecko, G. 1997. "Response of Tifway bermudagrass to trinexapac-ethyl." *J. Turfgrass Man.* 2:29-36.