



Getting What You Want with Primo

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Over the past fifteen years, Primo (Trinexapac-ethyl) has become one of the most popular plant growth regulators used on golf courses. It has come into fashion for many reasons. Primo provides growth suppression with less phytotoxic effects than other plant growth regulators (Watschke, DiPaola, 1995). Perhaps another reason for the Primo boom is due to the secondary benefits associated with the chemical. Primo is said to increase turfgrass density, root mass, color, and visual quality, while decreasing clipping production (Dernoeden, 2002). All these characteristics lend to its use on golf course putting greens.

The labeled rate for Primo on creeping bentgrass putting greens is 0.125 fl oz/M at a 4 week application interval. According to the label, that rate should provide a 50% reduction in clipping production. However, the label states that the application rate can be altered to fit environmental conditions and management practices. This stipulation has led to a wide array of application rates and frequencies. I have observed different Primo regimes on three golf courses in Wisconsin. One course used 0.18 fl oz/M of Primo every 4 weeks on their USGA bentgrass greens. Through casual observa-

tion of these greens I noted a decrease in color, quality, and clipping production. Another golf course with bentgrass USGA greens applied Primo at 0.05 fl oz/M every week. The turfgrass seemed to have an increase in color, density, and quality, but didn't experience much of a reduction in clipping production. The last golf course used Primo at 0.10 fl oz/M every two weeks. These bent/poa push up greens seemed to have a decrease in clipping production without a significant change in other turfgrass qualities. Although the total amount of product applied was about the



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same on the three golf courses, the bentgrass seemed to respond quite differently, leading me to question what is the ideal Primo application rate and frequency for bentgrass putting greens.

Our experiment was conducted at the OJ Noer Turfgrass Center during the fall of 2006. The experiment was conducted on a young USGA spec green seeded to 'Penncross' creeping bentgrass in May. The green was split into 4 replicates of 10 different treatments. The treatments tested rates of 0.05 fl oz/M, 0.10 fl oz/M, and 0.20 fl oz/M of Primo, each at application intervals of 1, 2, and 3 weeks. The 10th treatment received no Primo and served as the control. Every week color ratings, chlorophyll indices, quality ratings, and the clipping yields were recorded. At the end of the experiment tiller density and root mass were also measured. The first Primo application was on September 15, 2006 and the last application occurred on October 13, 2006.

The results of the study demonstrated that differing Primo rates and application intervals produced wide ranges in clipping production reduction (Table 1). The low Primo application rate didn't decrease clipping production compared to the control, while the high rate provided the greatest reduction in clipping production (Table 4). The Primo label states a medium rate of 0.125 fl oz/M every four weeks will suppress 50% of clipping production. The only time that we experienced a 50% or greater reduction in clipping production occurred with the high rate applied at 1 and 2 week intervals. As the rate of Primo was increased, clipping production decreased linearly. Also, these trends show that there was no significant difference in yield reduction between one week and two week application intervals regardless of application rate. This tells us that at the high rate, there is no need to apply Primo at an interval of less

TABLES

Table 1. Reduction in Putting Green Clipping Production as Influenced by Rate and Frequency of Primo Application

Primo Application			Percent Reduction in Clipping Dry Weight				
Rate fl oz/M	Frequency Weeks	Total fl oz/M/5 WK	WK1	WK2	WK3	WK4	WK5*
0.05	1	0.25	14.9 abc	4.1 de	0.0 d	12.9 ef	1.7 bc
0.05	2	0.15	21.5 abc	4.2 de	9.5 cd	23.5 de	4.2 bc
0.05	3	0.10	17.2 abc	12.9 cde	0.0 d	4.4 ef	0.0 c
0.10	1	0.50	8.9 bc	32.0 abc	30.8 bc	38.8 cd	25.6 abc
0.10	2	0.30	24.8 abc	29.1 abc	19.9 cd	45.9 bc	42.6 ab
0.10	3	0.20	30.7 ab	24.6 bcd	9.6 cd	4.4 de	3.1 bc
0.20	1	1.00	36.0 ab	51.9 a	59.4 a	68.9 a	61.0 a
0.20	2	0.60	36.9 ab	44.8 ab	50.0 ab	63.8 ab	60.6 a
0.20	3	0.40	43.9 a	43.3 ab	27.7 bc	42.4 cd	46.8 a
Duncan's LSD (p = 0.05)			25.3	22.1	23.0	18.7	46.8

* One week after final Primo application

Table 2. Overall Putting Green Quality Ratings as Influenced by Rate and Frequency of Primo Application

Primo Application			Overall Quality Rating				
Rate fl oz/M	Frequency Weeks	Total fl oz/M/5 WK	WK1	WK2	WK3	WK4	WK5*
Scale of 1 to 9 (perfect quality)							
0.05	1	0.25	5.0	5.9	6.8 a	7.7 a	7.3 a
0.05	2	0.15	4.3	5.6	6.2 a	6.3 bc	6.5 b
0.05	3	0.10	4.4	5.5	6.6 a	6.2 bc	6.3 bc
0.10	1	0.50	5.1	5.7	6.3 a	6.9 ab	6.9 ab
0.10	2	0.30	4.7	5.8	6.6 a	6.7 b	6.6 ab
0.10	3	0.20	4.7	5.5	6.2 a	6.5 bc	6.6 ab
0.20	1	1.00	4.8	5.2	4.9 c	4.7 d	5.3 d
0.20	2	0.60	4.4	5.5	5.3 bc	5.6 c	5.7 cd
0.20	3	0.40	4.8	5.4	5.5 b	6.3 bc	6.4 bc
Control		0.00	5.0	5.9	6.5 a	7.0 ab	6.9 ab
Duncan's LSD (p = 0.05)			NS	NS	0.6	0.9	0.7

* One week after final Primo application

than two weeks. Therefore, it is a waste of time and money to decrease the application interval to one week in an effort to reduce clipping production.

The overall visual turfgrass quality was rated weekly on a scale from 1 to 9 (Table 2). A rating of 6 or above is considered acceptable turf. The application that consistently produced the highest turfgrass quality was the light weekly application. The heavy rate at all application frequencies exhibited the lowest quality

throughout the study (Table 4). All other treatments produced turfgrass quality that was similar to or worse than the control plot.

Bentgrass color was quantified with a chlorophyll meter (Table 3). This meter measures the amount of green light being reflected off the putting green surface. It then creates a chlorophyll index (CI) based on the amount of green light received. The larger the number the greater the amount of chlorophyll detected. The CI values (Table 3) exhibited

Table 3. Chlorophyll Index as Influenced by Rate and Frequency of Primo Application

Primo Application			Chlorophyll Index				
Rate fl oz/M	Frequency Weeks	Total fl oz/M/5 WK	WK1	WK2	WK3	WK4	WK5*
0.05	1	0.25	238	267	304 a	277 a	261 a
0.05	2	0.15	212	248	279 ab	245 abc	235 abc
0.05	3	0.10	229	251	288 ab	258 ab	240 abc
0.10	1	0.50	217	250	295 a	258 ab	246 abc
0.10	2	0.30	224	261	290 ab	255 abc	243 abc
0.10	3	0.20	214	262	299 a	267 ab	241 abc
0.20	1	1.00	216	235	242 b	220 c	214 c
0.20	2	0.60	233	240	272 ab	238 bc	223 bc
0.20	3	0.40	214	238	286 ab	249 abc	258 ab
Control		0.00	233	272	292 ab	256 ab	244 abc
Duncan's LSD (p = 0.05)			NS	NS	44.2	32.2	31.5

* One week after final Primo application

Table 4. Means from Weeks 2-5 of Reduction in Clipping Production, Chlorophyll Index, Overall Quality, Density, and Root Mass as Influenced by Rate and Frequency of Primo Application

Primo Application			Means				
Rate fl oz/M	Frequency Weeks	Total fl oz/M/5 WK	Quality	Clipping reduction	CI	Roots	Tillers
			1 to 9	%		mg	#/cm ²
0.05	1	0.25	6.9 a	3.0 cd	277 a	303 ab	106 ab
0.05	2	0.15	6.2 abc	10.3 cd	252 abc	265 ab	87 bc
0.05	3	0.10	6.2 abc	0.0 d	259 abc	248 ab	93 abc
0.10	1	0.50	6.5 ab	31.8 b	259 abc	293 ab	102 ab
0.10	2	0.30	6.4 ab	35.3 b	262 ab	258 ab	109 a
0.10	3	0.20	6.2 abc	15.3 c	267 ab	275 ab	87 bc
0.20	1	1.00	5.0 d	60.3 a	228 c	235 b	93 abc
0.20	2	0.60	5.5 cd	54.6 a	243 bc	218 b	94 abc
0.20	3	0.40	5.9 bc	40.0 b	258 abc	250 ab	89 abc
Control		0.00	6.6 ab	0.00 d	266 ab	335 a	79 c
Duncan's LSD (p = 0.05)			0.7	12.7	29	81	18

trends similar to the quality ratings (Table 4). The light weekly application had the highest CI. The heavy, frequent applications had the lowest CI. The other plots had a CI similar to the control.

Some of the most interesting data came from measures of root mass and turfgrass density (Table 4). All Primo treatments had higher density than the control plot. The medium rate at two week application intervals produced the highest density. Overall the highest density

for each application interval was the medium application rate. Interestingly, we observed a decrease in root mass with Primo application (Table 4). As the application rate of Primo increased, root mass decreased. The application frequency didn't have much effect on this relationship, suggesting that total product applied doesn't strongly influence root decline. Rather, it appears to be more a function of the rate per application.

In the future I would like to con-

tinue this study with summer and traffic stress. Even under cool fall conditions, the trends suggest that the ideal rates and frequencies were similar to those that superintendents are already using on their greens during the summer. Let's look back at the application rates and frequencies for the three Wisconsin golf courses from before. The course that used 0.05 fl oz/M every week seemed to experience an increase in color, density, and overall quality but not much decrease in clipping production. The course that used 0.10 fl oz/M every two weeks on poa/bent greens seemed to have an increase in density and moderate growth regulation but not a drastic change in turfgrass color. The course that used 0.18 fl oz/M every 4 weeks on bentgrass saw a decrease in color and quality following application but did experience a fair decrease in clipping production. These summer responses were comparable to the results that we obtained during our fall Primo study.


This experiment didn't measure the effect of Primo on green speed. Research conducted in the Carolinas has shown that plant growth regulators don't increase green speed significantly (McCullough et al., 2005). Golfers can only detect change in green speed if the change is greater than 6 inches (Karcher et al., 2001). The data that has come from the Carolinas shows that using Primo only increased green speed a few centimeters (McCullough et al., 2005). In some instances Primo actually slowed green speeds. This decrease in speed occurred during stressful summer months (Fagerness et al., 2000). Additionally, Primo doesn't help maintain green speed throughout the day. Greens will slow down throughout the day even with Primo regulating growth (McCullough et al., 2005). Primo still may have a place in greens maintenance. It has been found that light frequent Primo applications help maintain daily

green speed (McCullough et al., 2005). This treatment won't increase the speed of the green, but it will help to buffer day to day changes in green speed.

If Primo applications don't directly increase green speed, then superintendents need think about what they want to get from Primo. If the superintendent wants dark green, high quality putting greens with little regard for clipping reduction, the light frequent rate is best. If the superintendent wants moderate growth regulation with little change in secondary turfgrass responses the medium rate at two to four week intervals will work. If a large reduction in clipping production is desired, a high application rate at two to three week intervals will accomplish that with a possible decrease in other turfgrass qualities. Again, achieving a decrease in clipping production isn't as dependent on application frequency as it is on application rate. Applying the heavy rate at 1 or 2 week intervals didn't significantly reduce clipping production. Also, remember that using Primo at all rates and frequencies decreased root mass. Using smaller application rates at frequent application intervals preserves more root mass than heavy applications. Primo application rates and frequencies have a dynamic effect on many turfgrass qualities. Using the general trends and relationships from this study can help superintendents design a Primo program that best satisfies the needs of their golf course.

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