Evaluation of Plant Growth Regulators and Fertilizer to Fairway Height Creeping Bentgrass

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Introduction

This study was conducted on a mature stand of creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) at the Valentine Turfgrass Research Center, Penn State University, University Park, Pa. The objective of the study was to determine the efficacy of plant growth regulators alone or in combination with a liquid fertilizer using color ratings, measurements of plant height, and fresh weight foliar yield.

Methods and Materials

This study was a randomized complete block design with three replications. Treatments were applied on June 6 (JUNE) and July 11, 2006 (4 WAT) using a three foot CO_2 powered boom sprayer calibrated to deliver 40 gpa using one, flat fan, 11004E nozzle at 40 psi.

The test site was maintained similar to that of a golf course fairway with respect to irrigation, fertilization and mowing. Turfgrass height was measured using a Turfcheck 1 prism. Clipping weights were taken once a week with a John Deere walk behind reel mower bench set to 0.485" with an actual height of cut 0.500".

Results and Discussion

Turfgrass phytotoxicity was evaluated seven times during the study (Table 1). On the July 26th and August 3rd rating dates turfgrass treated with Primo MAXX plus Trimmit with or without fertilizer had unacceptable phytotoxicity (below 7.0). No unacceptable phytotoxicity was found on any of the other rating dates.

Turfgrass color was evaluated eleven times during the study (Table 2). At no time during the study did treated or non turfgrass color ratings fall below acceptable (7.0).

Turfgrass height was evaluated eleven times during the study (Table 3). On the June 14th rating date, turfgrass treated with Primo MAXX at 0.09, 0.12, and 0.17 lb ai/A plus fertilizer and Primo MAXX at 0.125 oz/M plus Trimmit had significantly lower turfgrass height compared to non treated turfgrass.

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On the June 21st rating date, only turfgrass treated with Trimmit plus fertilizer were not significantly different than non treated turfgrass. On the June 28th rating date, turfgrass treated

with Primo MAXX plus Trimmit with or without fertilizer had significantly lower turfgrass height than non treated. On the July 13th rating date, only turfgrass treated with Trimmit plus fertilizer had significantly higher height than non treated. On the July 19th rating date Primo MAXX at 0.07, 0.12, 0.17 lb ai/A plus fertilizer and Primo MAXX plus Trimmit with or without fertilizer had significantly lower turfgrass height than non treated. On the July 26th rating date, turfgrass treated with Primo MAXX at 0.07, 0.09, 0.12, 0.17 lb ai/A plus fertilizer, and Primo MAXX plus Trimmit with or without fertilizer had significantly lower turfgrass height than non treated. Finally, on the August 23rd rating date, turfgrass treated with Primo MAXX plus Trimmit plus fertilizer had significantly lower turfgrass height than non treated.

Turfgrass fresh clipping weights were evaluated ten times during the study (Table 4). On the June 14th and June 21st rating dates, all treated turfgrass had significantly less yield than non treated turfgrass. On the June 28th rating date, all treated turfgrass had significantly less yield than non treated. On the July 13th rating date, turfgrass treated with Trimmit plus fertilizer and Primo MAXX plus Trimmit plus fertilizer had significantly greater yield than non treated. On the July 19th rating date, turfgrass treated with Primo MAXX at 0.09, 0.12, 0.17 lb ai/A plus fertilizer and Primo MAXX plus Trimmit with or without fertilizer had significantly less yield than non treated. On the July 26th rating date, all treated turfgrass had significantly less yield than non treated turfgrass except for turfgrass treated with Trimmit plus fertilizer. On the August 3rd rating date, turfgrass treated with Primo MAXX plus Trimmit plus fertilizer had significantly less yield than non treated turfgrass. Finally on the August 23rd rating date, turfgrass treated with Primo MAXX at 0.09 and 0.17 lb ai/A plus fertilizer, and Primo MAXX plus Trimmit with or without fertilizer had significantly greater yield than non treated.

Generally, the rebound effects of the PGRs used in this study were apparent as were the reduction in plant growth. Future research should be conducted to evaluate the intervals of application timings in order to better understand when rebound might occur. In general, all of the materials evaluated in this study preformed well and could be apart of a turfgrass management scheme.

Table 1. Phytotoxicity ratings on a scale of 0-10 where 0 = dead turf, 7= acceptable, and 10 = no phytotoxicity of materials applied to creeping bentgrass taken in 2006.

Treatment	Form	Rate	Timing	(----------Phytotoxicity----------						
		lb ai/A		6/11	6/21	6-28	7/19	7-26	8/3	8/16
PRIMO MAXX	1MEC	0.07	JUNE/4 WAT	10.0	9.7	10.0	10.0	10.0	10.0	10.0
ECO-N (24-0-0)	2.2L	0.144 lb N/M	JUNE/4 WAT							
PRIMO MAXX	1MEC	0.09	JUNE/4 WAT	10.0	9.7	10.0	10.0	10.0	10.0	10.0
ECO-N (24-0-0)	2.2L	0.18 lb N/M	JUNE/4 WAT							
CHECK				10.0	10.0	10.0	10.0	10.0	10.0	10.0
PRIMO MAXX	1MEC	0.12	JUNE/4 WAT	10.0	9.7	10.0	10.0	10.0	10.0	10.0
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT							
PRIMO MAXX	1MEC	0.17	JUNE/4 WAT	10.0	9.3	10.0	10.0	10.0	10.0	10.0
ECO-N (24-0-0)	2.2L	0.35 lb N/M	JUNE/4 WAT							
TRIMMIT	2SC	0.25	JUNE/4 WAT	10.0	10.0	10.0	10.0	10.0	10.0	10.0
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT							
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	10.0	8.7	10.0	10.0	6.0	6.2	10.0
TRIMMIT	2SC	0.25	JUNE/4 WAT							
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	10.0	10.0	10.0	10.0	6.3	6.5	10.0
TRIMMIT	2SC	0.25	JUNE/4 WAT							
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT							

Table 2. Color ratings on a scale of 0-10 where 0 = brown, 7= acceptable, and 10 = dark green of materials applied to creeping bentgrass taken in 2006.

Treatment	Form	Rate	Timing	6/14 [1]	6/21	6/28	7/5	7/13	7/19	7/26	8/3	8/16	8/23	8/30
		lb ai/A												
PRIMO MAXX	1MEC	0.07	JUNE/4 WAT	7.8	8.8	8.5	8.8	8.5	9.3	9.3	9.2	8.0	8.0	7.5
ECO-N (24-0-0)	2.2L	0.144 lb N/M	JUNE/4 WAT											
PRIMO MAXX	1MEC	0.09	JUNE/4 WAT	7.8	8.8	8.7	9.2	8.8	9.5	9.3	9.2	8.0	8.0	7.5
ECO-N (24-0-0)	2.2L	0.18 lb N/M	JUNE/4 WAT											
CHECK				7.7	8.3	8.2	8.2	8.2	8.7	8.3	8.2	8.0	8.0	7.5
PRIMO MAXX	1MEC	0.12	JUNE/4 WAT	8.0	9.3	8.8	8.8	9.0	9.3	9.5	9.5	8.0	8.0	7.5
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT											
PRIMO MAXX	1MEC	0.17	JUNE/4 WAT	8.0	8.7	8.8	9.3	9.2	9.8	9.5	9.7	8.0	8.0	7.5
ECO-N (24-0-0)	2.2L	0.35 lb N/M	JUNE/4 WAT											
TRIMMIT	2SC	0.25	JUNE/4 WAT	8.0	8.8	8.5	8.8	8.7	9.0	8.7	9.0	8.0	8.0	7.5
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT											
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	7.8	7.5	8.3	9.2	8.7	9.0	8.3	7.0	8.0	8.0	7.5
TRIMMIT	2SC	0.25	JUNE/4 WAT											
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	8.5	9.3	8.8	9.2	9.3	9.3	8.5	7.0	8.0	8.0	7.5
TRIMMIT	2SC	0.25	JUNE/4 WAT											
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT											

1 – Color ratings exclude phytotoxicity if present (see Table 1 for phytotoxicity ratings).

Table 3. Height ratings (in inches) of materials applied to creeping bentgrass taken in 2006.

Treatment	Form	Rate	Timing	(----------Height [1]----------					
		lb ai/A		6/14	6/21	6/28	7/5	7/13	7/19
PRIMO MAXX	1MEC	0.07	JUNE/4 WAT	0.42bcd	0.44bc	0.67a	0.62b	0.53b	0.50cd
ECO-N (24-0-0)	2.2L	0.144 lb N/M	JUNE/4 WAT						
PRIMO MAXX	1MEC	0.09	JUNE/4 WAT	0.39cd	0.44bc	0.66a	0.62b	0.55ab	0.54bc
ECO-N (24-0-0)	2.2L	0.18 lb N/M	JUNE/4 WAT						
CHECK				0.49ab	0.57a	0.72a	0.66ab	0.54b	0.62ab
PRIMO MAXX	1MEC	0.12	JUNE/4 WAT	0.40cd	0.42c	0.66a	0.66ab	0.53b	0.50cd
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT						
PRIMO MAXX	1MEC	0.17	JUNE/4 WAT	0.38d	0.39c	0.63a	0.65ab	0.52b	0.49cd
ECO-N (24-0-0)	2.2L	0.35 lb N/M	JUNE/4 WAT						
TRIMMIT	2SC	0.25	JUNE/4 WAT	0.52a	0.52ab	0.62a	0.72a	0.68a	0.59abc
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT						
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	0.41cd	0.38c	0.48b	0.70ab	0.64ab	0.43d
TRIMMIT	2SC	0.25	JUNE/4 WAT						
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	0.42bcd	0.43c	0.53b	0.71ab	0.64ab	0.41d
TRIMMIT	2SC	0.25	JUNE/4 WAT						
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT						

1 - Means followed by same letter do not significantly differ (P= 0.05 Duncan's New MRT)

Table 3 (continued). Height ratings (in inches) of materials applied to creeping bentgrass taken in 2006.

Treatment	Form	Rate	Timing	(----------Height [1]----------)				
		lb ai/A		7/26	8/3	8/16	8/23	8/3
PRIMO MAXX	1MEC	0.07	JUNE/4 WAT	0.49bcd	0.52abc	0.50a	0.53b	0.67c
ECO-N (24-0-0)	2.2L	0.144 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.09	JUNE/4 WAT	0.47bcd	0.51abc	0.52a	0.57b	0.72abc
ECO-N (24-0-0)	2.2L	0.18 lb N/M	JUNE/4 WAT					
CHECK				0.60a	0.49abc	0.47a	0.52b	0.72abc
PRIMO MAXX	1MEC	0.12	JUNE/4 WAT	0.44cde	0.53abc	0.54a	0.59ab	0.73abc
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.17	JUNE/4 WAT	0.47bcd	0.57ab	0.54a	0.58ab	0.70abc
ECO-N (24-0-0)	2.2L	0.35 lb N/M	JUNE/4 WAT					
TRIMMIT	2SC	0.25	JUNE/4 WAT	0.51abc	0.59a	0.54a	0.59ab	0.73abc
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	0.41de	0.43c	0.52a	0.59ab	0.80ab
TRIMMIT	2SC	0.25	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	0.36e	0.43c	0.50a	0.66a	0.81a
TRIMMIT	2SC	0.25	JUNE/4 WAT					
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					

1 - Means followed by same letter do not significantly differ (P= 0.05 Duncan's New MRT)

Table 4. Fresh clipping weight (grams) of materials applied to creeping bentgrass taken in 2006.

Treatment	Form	Rate	Timing	(----------Fresh Clipping Weight [1]----------)				
		lb ai/A		6/14	6/21	6/28	7/5	7/13
PRIMO MAXX	1MEC	0.07	JUNE/4 WAT	1.2c	6.7bcd	45.3bcd	31.0abc	12.6c
ECO-N (24-0-0)	2.2L	0.144 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.09	JUNE/4 WAT	0.8c	4.7bcd	39.2b-e	23.7c	9.6c
ECO-N (24-0-0)	2.2L	0.18 lb N/M	JUNE/4 WAT					
CHECK				5.9a	23.0a	81.8a	29.0abc	13.0c
PRIMO MAXX	1MEC	0.12	JUNE/4 WAT	0.9c	5.3bcd	36.6b-e	26.5bc	8.4c
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.17	JUNE/4 WAT	1.1c	2.9cd	25.0cde	20.7c	9.8c
ECO-N (24-0-0)	2.2L	0.35 lb N/M	JUNE/4 WAT					
TRIMMIT	2SC	0.25	JUNE/4 WAT	3.1b	7.0bcd	37.8b-e	43.2a	32.5a
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	1.1c	2.5d	17.1e	29.1abc	20.2abc
TRIMMIT	2SC	0.25	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	1.2c	2.3d	19.4de	40.6ab	30.4ab
TRIMMIT	2SC	0.25	JUNE/4 WAT					
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					

1 - Means followed by same letter do not significantly differ (P= 0.05 Duncan's New MRT)

Table 4 (continued). Fresh clipping weight (grams) of materials applied to creeping bentgrass taken in 2006.

Treatment	Form	Rate	Timing	(----------Fresh Clipping Weight [1]----------)				
		lb ai/A		7/19	7/26	8/3	8/16	8/23
PRIMO MAXX	1MEC	0.07	JUNE/4 WAT	6.9cde	5.0bcd	11.0ab	20.6ab	18.7bc
ECO-N (24-0-0)	2.2L	0.144 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.09	JUNE/4 WAT	6.1de	5.8bc	9.0ab	31.2ab	26.8ab
ECO-N (24-0-0)	2.2L	0.18 lb N/M	JUNE/4 WAT					
CHECK				14.6bc	9.4a	10.6ab	14.7b	11.5c
PRIMO MAXX	1MEC	0.12	JUNE/4 WAT	6.3de	5.1bcd	8.5ab	21.3ab	27.0ab
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.17	JUNE/4 WAT	5.2e	3.7cde	9.5ab	26.1ab	30.8ab
ECO-N (24-0-0)	2.2L	0.35 lb N/M	JUNE/4 WAT					
TRIMMIT	2SC	0.25	JUNE/4 WAT	14.9bc	7.6ab	15.0a	20.5ab	20.2bc
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	2.3e	1.2e	2.2c	27.0ab	27.6ab
TRIMMIT	2SC	0.25	JUNE/4 WAT					
PRIMO MAXX	1MEC	0.125 oz/M	JUNE/4 WAT	4.2e	2.2de	4.4bc	30.5ab	38.5a
TRIMMIT	2SC	0.25	JUNE/4 WAT					
ECO-N (24-0-0)	2.2L	0.25 lb N/M	JUNE/4 WAT					

1 - Means followed by same letter do not significantly differ (P= 0.05 Duncan's New MRT)