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Research Reports

Influence of Plant Growth Regulators on Suppression and Quality of 'Meyer' Zoysiagrass¹

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Abstract

Proxy and EXP310309D suppressed zoysiagrass at various rates for 4 to 6 weeks during 1999 and 2000. Maximum suppression with Proxy at 3.4 kg ai/ha (3.0 lb ai/A) was 30 to 40% at 3 to 4 weeks after the initial treatment and 32% at 3 and 4 weeks after the second application both years. Maximum suppression at the same time for EXP310309D at 2.7 kg ai/ha (2.4 lb ai/A) was about 45% following the initial treatment and 39% following the second treatment. The suppression was similar when the PGR was applied at the highest (5.3 kg ai/ha) rate. The suppression with Primo at 0.1 kg ai/ha (0.09 lb ai/A) was not as good as EXP310309D in 1999, but the response was similar in 2000. In general, Proxy and Primo did not reduce turf visual quality or color, while both rates of EXP310309D reduced quality and color by 21 to 25% at 2 to 3 weeks after treatment. These data suggest that Proxy and Primo are safe and effective PGRs for use on 'Meyer' zoysiagrass maintained as a fairway.

Index words: clipping reduction, ethephon, mowing, plant growth regulator, trinexapac-ethyl.

Growth regulators used in this study: Primo (trinexapac-ethyl) [4-(cyclopropyl- α -hydroxy-methylene)-3,5-dioxo-cyclohexanecarboxylic acid ethyl ester], Proxy and EXP310309D (ethephon) [2-(chloroethyl) phosphonic acid].

Species used in this study: *Zoysia japonica*.

Significance to the Nursery Industry

Proxy at 3.4 kg ai/ha (3.0 ai/A) and a similar experimental formulation EXP310309D at 5.3 kg ai/ha (4.8 lb ai/A) and 2.7 kg ai/ha (2.4 lb ai/A) suppressed shoot growth of fairway-height 'Meyer' zoysiagrass by 25 to 45% for 4 to 6 weeks during the summers of 1999 and 2000. In general, Primo at

0.1 kg ai/ha (0.09 lb ai/A) suppressed growth by 15 to 50% for only 4 weeks. Proxy, not presently labeled for use on zoysiagrass, when applied at its cool-season turfgrass labeled rate of 3.4 kg ai/ha (3.0 ai/A), did not affect turf visual quality or color. EXP310309D, at 5.3 kg ai/ha (4.8 lb ai/A) and 2.7 kg ai/ha (2.4 lb ai/A), suppressed zoysiagrass as well as Proxy, but the higher rate caused some unacceptable quality and color reductions. Our results indicate that Proxy can be safely and effectively applied at 4 to 6 week intervals, while Primo should be applied at no greater than a 4 week interval.

Introduction

Synthetic plant growth regulators (PGRs) have been studied for almost 50 years as management tools to reduce labor, mowing frequency, clipping yield, and equipment wear and

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tear. Most of the older PGRs reduced growth by inhibiting cell division, often resulting in unacceptable leaf discoloration and reduced quality under environmental stress (9, 11). Over the last 20 years, PGRs labeled for turf reduce yields by inhibiting gibberellic acid (GA) biosynthesis, limiting leaf elongation without stopping cell division. Primo, released in 1991, is one of these GA-inhibitors that has been shown to reduce clipping yields (2, 3, 4, 5, 6, 7, 12) and increase tillering (2, 3, 4) without negatively affecting turf quality. Proxy, introduced for the cool-season turf market in 1998, is an ethylene-releasing substance that restricts leaf expansion and stem elongation of numerous plants (1). Proxy has been shown to be at least as effective at reducing creeping bentgrass (*Agrostis palustris*) fairway clipping yields as Primo without reductions in quality or color (10). Primo is currently the primary PGR used on zoysiagrass fairways for shoot suppression. Information is lacking regarding its magnitude and length of effectiveness on zoysiagrass. Information is also needed as to the safety and efficacy of Proxy compared to Primo for growth regulation of zoysiagrass maintained as a fairway turf. The objective of this study was to determine the effect of repeat applications of Primo, Proxy, and an experimental formulation of Proxy on suppression, quality, and color of 'Meyer' zoysiagrass maintained at fairway height.

Materials and Methods

Experiments were conducted at the University of Missouri Turfgrass Research Center in Columbia, MO, during the 1999

and 2000 growing seasons. The experimental area consisted of 'Meyer' zoysiagrass that had been maintained under fairway conditions for at least 15 years and grown on a Mexico silt loam with pH of 6.5, 4.9% OM, 92 kg/ha P (82 lb/A), and 442 kg/ha K (394 lb/A). Irrigation was supplied at 80% of estimated ET once weekly, mowed at 1.4 cm (0.56 in) and no pesticides were applied. Nitrogen was applied as urea to supply 49 kg/ha (44 lb/A) in early June and August of each year. Plots were 1.5 × 1.8 m (5 × 6 ft) with treatments arranged in a randomized complete block with three replications. Treatments included two applications each of Primo 1EC (12% ai), Chipco Proxy 2SL (21.7% ai), and EXP310309D applied at a 28-day interval in 1999 and a 49-day interval in 2000. Primo was applied at the high-label rate (1×) of 0.1 kg ai/ha (0.09 lb ai/A), Proxy at a 1×-rate of 3.4 kg ai/ha (3.0 lb ai/A), and EXP310309D was applied at two rates, designated as 1× and 0.5×: 5.3 kg ai/ha (4.8 lb ai/A) and 2.7 kg ai/ha (2.4 lb ai/A). Primo is the only product of the three currently labeled for use on *Zoysia japonica*. Proxy is currently labeled for use only on cool-season turfgrass species. EXP310309D is an experimental formulation from Aventis Environmental Science (Montvale, NJ) consisting of 35% ethephon and 4.3% cyclanilide. Applications were made with a CO₂-powered backpack sprayer equipped with flat fan nozzles using 524 liters water/ha (56 gal/A) and a 207 kPa (20 psi) spray pressure on June 11 and July 9 in 1999 and June 8 and July 27 in 2000.

Clippings were harvested once weekly with one pass of a 51 cm (20 in) wide reel-type greens mower and oven dried

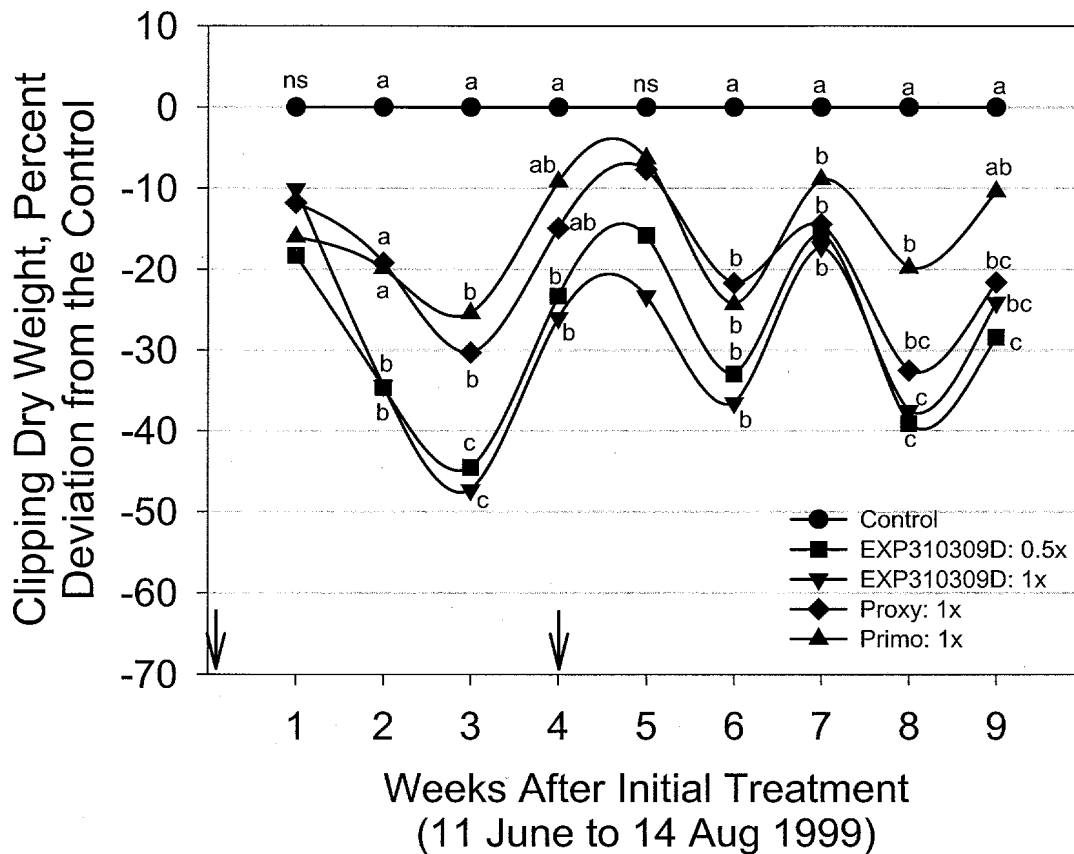


Fig. 1. Effect of Proxy, EXP310309D, and Primo on suppression of 'Meyer' zoysiagrass maintained at fairway height in 1999. Means separation at each week as determined by LSD (0.05) are indicated by letters at each data point; arrows represent treatment applications. EXP 0.5× = 5.3 kg ai/ha (2.4 lb ai/A), EXP 1× = 2.7 kg ai/ha (4.8 lb ai/A), Proxy 1× = 3.4 kg ai/ha (3 lb ai/A), and Primo 1× = 0.1 kg ai/ha (0.09 lb ai/A).

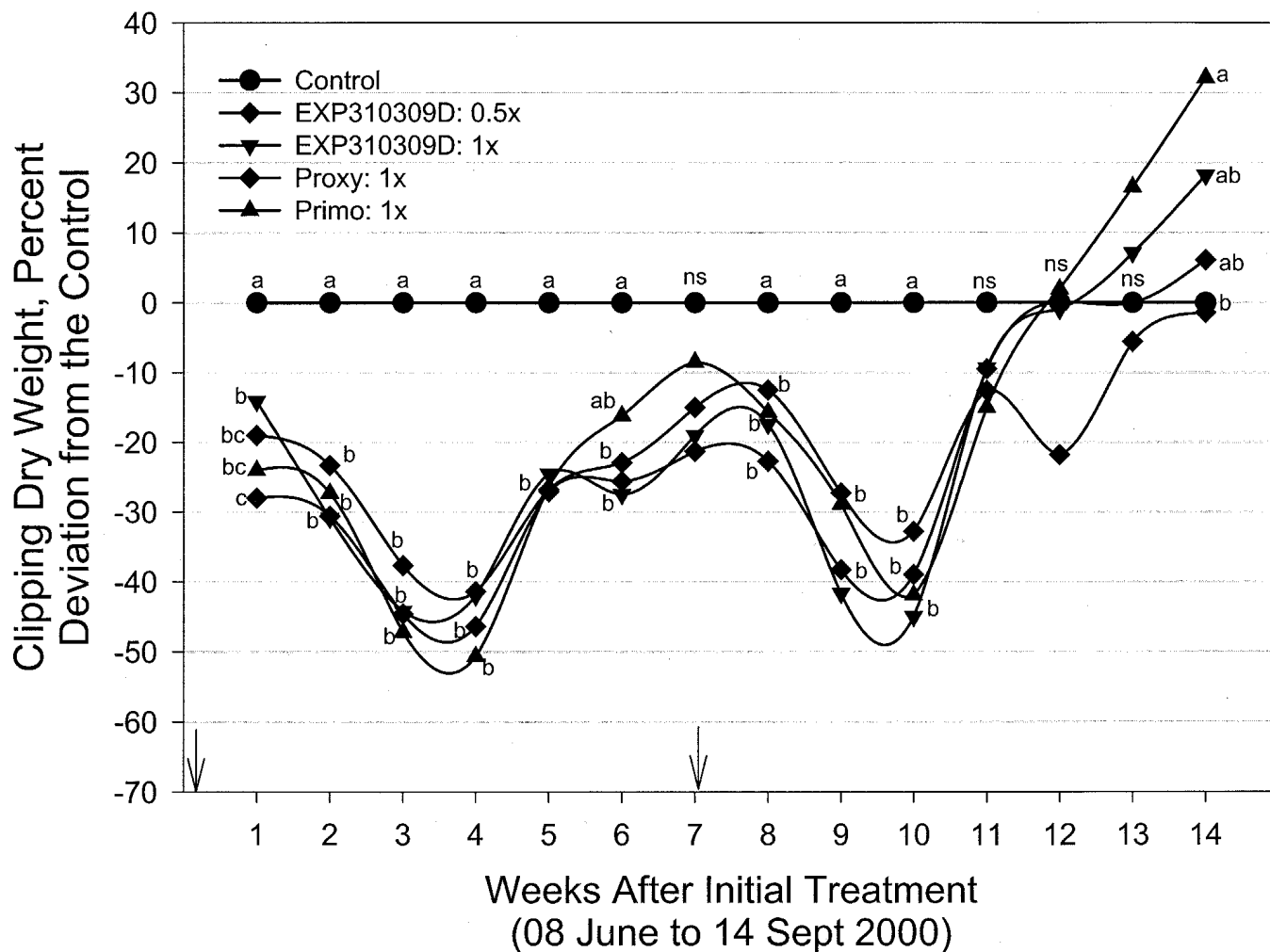


Fig. 2. Effect of Proxy, EXP310309D, and Primo on suppression of 'Meyer' zoysiagrass maintained at fairway height in 2000. Means separation at each week as determined by LSD (0.05) are indicated by letters at each data point; arrows represent treatment applications. EXP 0.5x = 5.3 kg ai/ha (2.4 lb ai/A), EXP 1x = 2.7 kg ai/ha (4.8 lb ai/A), Proxy 1x = 3.4 kg ai/ha (3 lb ai/A), and Primo 1x = 0.1 kg ai/ha (0.09 lb ai/A).

at 70C (160F) for 24 hours. All samples were weighed after they were dried and converted to percent suppression. Immediately after clipping harvest, the entire plot was mowed with a triplex mower and allowed to grow for 7 days prior to the next harvest.

Visual quality of plots was rated weekly on a scale of 1 to 9 where 1 = dead turf, 5 = minimum acceptability as a fairway, and 9 = excellent. The estimation of turf quality was based on the primary components of color, density, uniformity, and texture. Color was also rated visually on a scale of 1 to 9 where 1 = dead turf, 5 = minimum acceptable green color for fairways, and 9 = dark green. All data were analyzed with MSTAT (8) to detect differences among treatment effects. Means were separated with Fisher's protected least significant difference (LSD) test at a 95% probability level.

Results and Discussion

Turfgrass suppression. The response of Proxy, Primo, and EXP310309D on suppression of zoysiagrass was similar (10 to 18%) at one week after the initial treatment during 1999 (Fig. 1). However, by 2 weeks the suppression with EXP310309D at both rates was 34% compared to only 20%

for Primo and Proxy. The highest zoysiagrass suppression from the initial application of all PGRs occurred at 3 weeks. The suppression was 47% for EXP310309D at the 1x-rate, 30% for Proxy, and 25% for Primo. The suppression of all PGRs by 4 weeks decreased to a non-significant level at which time repeat applications were made.

Maximum suppression from the second EXP310309D application at the 1x-rate was 37% at 6 weeks (6 weeks after the first application and 2 weeks after the second application) and 38% at 8 weeks, but reduced to 24% by 9 weeks. During the same period, the suppression with Proxy ranged from 21% at 6 weeks to 32% by 8 weeks, while the suppression with Primo was 24% at 6 weeks and 20% by 8 weeks.

In 2000, all PGR treatments suppressed zoysiagrass for 5 weeks after the initial application and for 3 weeks after the second application (Fig. 2). Maximum suppression was $\geq 40\%$ for EXP310309D at the 1x-rate at 3 and 4 weeks after the first application and 2 and 3 weeks after the second application. The suppression with Proxy was $\geq 38\%$ during the same periods. Primo suppressed zoysiagrass $\geq 42\%$ at 3 and 4 weeks after the second application. Suppression for all PGRs was $< 30\%$ at other dates during 2000. A post-inhibition growth

Table 1. Influence of PGRs on quality of ‘Meyer’ zoysiagrass.^a

Treatment ^b	Weeks after treatment						
	1	3	5	7 ^c	9	11	13
1999							
Control	7.0a ^w	6.7a	7.0a	5.7a	5.3a		
EXP310309D: 0.5×	7.0a	5.7ab	6.3a	4.3b	5.3a		
EXP310309D: 1×	7.0a	5.3b	6.7a	4.3b	5.7a		
Proxy: 1×	7.0a	6.3ab	6.7a	5.3ab	5.7a		
Primo: 1×	7.0a	5.7ab	7.0a	5.7a	6.3a		
2000							
Control	7.3a	7.2a	7.3ab	7.3a	6.8a	6.5b	6.7a
EXP310309D: 0.5×	7.2a	7.2a	7.7a	7.5a	7.2a	6.7ab	6.8a
EXP310309D: 1×	7.2a	7.0a	7.5a	7.5a	7.3a	6.5b	6.8a
Proxy: 1×	7.0a	7.5a	7.5a	7.5a	7.2a	6.5b	6.7a
Primo: 1×	7.2a	6.7a	6.7b	7.5a	6.8a	6.8a	6.8a

^aTwo treatment applications were made in 1999 at a four-week interval and two in 2000 at a seven-week interval.

^bEXP 0.5× = 5.3 kg ai/ha (2.4 lb ai/A), EXP 1× = 2.7 kg ai/ha (4.8 lb ai/A), Proxy 1× = 3.4 kg ai/ha (3 lb ai/A), and Primo 1× = 0.1 kg ai/ha (0.09 lb ai/A).

^cQuality reductions at 7 WAT in 1999 were associated with zoysia mite damage.

^wVisual quality scale: 1 = poor, 9 = best.

increase due to Primo occurred 7 weeks after the second application in 2000.

Turfgrass quality and color. In 1999, EXP310309D at the 1×-rate reduced zoysiagrass quality 21% at 3 weeks after the initial application and both rates reduced quality 25% at 3 weeks after the second application (Table 1). Neither Proxy nor Primo affected quality during 1999. In 2000, Primo reduced quality 21% at 4 weeks after the initial application (data not shown). There were no other differences in quality of zoysiagrass due to PGR treatments. Color reductions, due to leaf-tip burn, were observed for both rates of EXP310309D at 2 WAT and for just the 1×-rate at 6 and 7 WAT in 1999 (data not shown). The quality reductions that occurred for both rates of EXP310309D at 7 WAT were due to a combination of this slight phytotoxicity and a small zoysiagrass mite (*Eriophyes zoysiae*) outbreak. No color reductions were evident in 2000.

We are unaware of any previous reports regarding the suppression and quality effects of Primo, Proxy, and EXP310309D on ‘Meyer’ zoysiagrass. However, the extent and duration of suppression in this study due to Primo and Proxy were similar to those reported for Kentucky bluegrass, creeping bentgrass, perennial ryegrass, and creeping red fescue (3, 5, 10). Maximum suppression of 51% occurred at 3 and 4 weeks after initial treatment and lasted for as long as 5 weeks for Primo and 6 weeks for Proxy and EXP310309D. Periodic loss of quality in 1999 due to phytotoxicity of EXP310309D indicates that this product should be used with caution on ‘Meyer’ zoysiagrass, especially at the 1× rate. Our results indicate that Primo and Proxy can be safely and effectively used on ‘Meyer’ zoysiagrass fairway turf to re-

duce clipping yields for 4 weeks with Primo and 6 weeks with Proxy.

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