Chipco Proxy™!: A New Growth Regulator for Bentgrass

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

INTRODUCTION

Growth regulators may be either stimulants or retardants. The stimulants are typically plant hormones such as cytokinin or gibberellic acid (GA). Cytokinins are hormones that induce cell division, gibberellins promote cell expansion. Growth stimulating compounds are occasionally used to enhance turf growth during adverse environmental conditions (e.g., cool spring weather, drought period).

Growth retardants are the most common type of plant growth regulators used on turf. Retardants are primarily used to reduce clipping yields. Side effects on turf may include transient phytotoxicity, reduced seedhead production, darker color, increased root growth, and improved stress tolerance.

Three groups are generally acknowledged: herbicidal, cell division inhibitors, and cell expansion inhibitors (GA-inhibitors). At low rates, herbicides such as glyphosate (Roundup) may be used as retardants. Such use is rare due to the high risk potential from an over-application. The remaining growth retardants are usually classified into two types: Type I and Type II. Type I retardants inhibit cell division and include mefluidide (Embark) and amidochlor (Limit). Embark especially is useful for reducing seedhead production of *Poa annua*. Type I growth retardants tend to be more phytotoxic than is desirable for fine turf, however, and their acceptance has been limited. Type II retardants include paclobutrazol (Scotts TGR), flurprimidol (Cutless), and trinexapac-ethyl (Primo). Scotts TGR and Cutless were designed for root uptake and need to be irrigated into the soil for proper effect. Primo is foliar-absorbed. All three inhibit production of gibberellic acid, a plant hormone which occurs naturally in turfgrasses.

Chipco Proxy is the newest growth retardant to be labeled for turf use. The common name is ethephon (2-chloroethyl phosphonic acid). Like Primo, Proxy is foliar-absorbed. Chipco Proxy has several unique properties which distinguish it from other growth retardants. Proxy is a clear liquid which is 100% water soluble. Virtually odorless, it has a low toxicity: dermal LD50 ranges from 2,000 to 20,000 mg/kg. It can cause moderate skin and eye irritation due to its low pH of 1.92 (similar to vinegar). It is unique because its mode of action is completely different from other turf retardants.

Proxy is readily metabolized by turf to form ethylene, a gaseous plant hormone. Ethylene, well-studied since the 1920's in other plant systems, causes a "triple response": stem elongation is reduced, lateral growth is increased, and a unique horizontal growth results. Plants naturally produce ethylene in response to stresses such as leaf removal, wounding, and to resist disease pathogens upon infection. Ethephon can also prevent self-pollination. This is important for seedhead reduction of *P. annua* since it is a self-pollinated species.

Ethephon has been used in greenhouse production of flowering plants for over 30 years. Research during the 1980s showed ethephon effectively reduced clipping yields on Kentucky bluegrass and fine fescue with minimal phytotoxicity (Dernoeden, 1984; Diesburg and Christians, 1989). In order for full acceptance on golf courses, additional research was needed on creeping bentgrass.

In 1998 we conducted a study at the O.J. Noer Research and Educational Facility to determine the effects of Proxy on creeping bentgrass maintained as fairway turf. The study had three objectives: 1) Determine the appropriate rate for bentgrass fairway turf, 2) Determine the effect of multi-

ple applications during the season, and 3) Compare Proxy to Primo.

MATERIALS AND METHODS

Mature plots of 'Penncross' creeping bentgrass were used for testing. One pound of N/1000 ft2 was applied during the last week of April using urea formaldehyde. The slow release of urea formaldehyde helped prevent turf growth flushes which would have affected the results. Proxy was tested at three rates, 3, 6, and 12 oz/1000 ft2; Primo was tested at 0.25 oz/1000 ft2 (the label rate for fairway height bentgrass). All treatments were replicated three times and were applied in a complete randomized block design. Growth retardant treatments were applied the beginning of May, June, and July (Table 1). Untreated controls were used for comparison.

The turf was mowed twice weekly with a walking greensmower at 0.5 inch height. Clippings were collected, oven-dried, and weighed. Turf color and quality were rated weekly on a 1 to 9 scale. Turf density was estimated as percent turf cover. Turf rigidity was evaluated by rolling a golf ball on the turf and estimating the depth to which it sank into the turf. Turf rigidity was rated on a 1 to 9 scale where: 1= ball sank 1/3 or more into the turf, while 9 = ball sat completely on top of the turf.

RESULTS

Clipping yields. Proxy treatments actually stimulated foliar production within the first week by about 50% compared to the untreated control (Table 2). By the second week, Proxy and Primo treatments had reduced clipping yields by 20-30%. By the third week all treatments reduced clipping yields by over 50%. Proxy had a longer residual compared to Primo through mid-summer. By mid-August, approximately three weeks after the third and final treatment, treatment effects dissipated as the

Table 1. Treatments for Proxy evaluation, Madison, WI, 1998.

Treatment	Name	Rate (oz/M)	Application date
1	Untreated control	0	---
2	Proxy	3	5 May, 3 June, 6 July
3	Proxy	6	5 May, 3 June, 6 July
4	Proxy	12	5 May, 3 June, 6 July
5	Primo	0.25	5 May, 3 June, 6 July
6	Proxy	6	5 May
	Primo	0.25	10 June
	Proxy	6	9 July

Table 2. Percent reduction of clipping yields on 'Penncross' fairway turf by Proxy and Primo growth retardants, Verona, WI, May through mid-August, 1998.

	Week Number						
Treatment †	1‡	2	3	7	9	12	13
2	+47	20	56	43	52	44	+ 9
3	+44	25	72	49	45	49	+22
4	+63	29	72	51	58	51	+21
5	20	15	50	38	20	38	2
6	+22	+3	54	50	47	49	10
LSD (0.05)	38	ns	30	28	10	28	ns

† 2=Proxy, 3 oz/M, 3=Proxy, 6 oz/M, 4=Proxy, 12 oz/M, 5=Primo, 0.25 oz/M, 6=Proxy, 6 oz/M followed by Primo, 0.25 oz/M, followed by Proxy, 6 oz/M at five week intervals.

‡ Growth retardants were applied at the beginning of weeks 1, 5, and 10.

hot weather reduced clipping yields in all plots to minimal levels. Proxy treatments appeared to actually stimulate growth during the hot weather stress period although the results were not statistically significant.

Turf quality and color. Turf quality was not consistently affected by Proxy. In the spring and early summer, one to two applications of Proxy either slightly increased turf quality or had no effect. Turf quality was reduced several weeks after the third application in the summer (Table 3), particularly at the high rate. The reduced quality was due primarily to a lighter green color induced by the Proxy (Table 4): there was no phytotoxicity. Primo usually caused a darker green color compared to Proxy after the third application.

Turf density and rigidity. Turf density was excellent throughout the trial. The 12 oz rate of Proxy occasionally reduced turf density although it recovered by late summer (Table 5). The six and twelve ounce rates of Proxy increased turf

Table 3. Quality of 'Penncross' Creeping Bentgrass on Selected Dates during 1998†.

Treatment	12 May	9 June	7 July	28 July	18 August
Control	6.5‡	6.3	6.2	5.8	6.3
Proxy, 3 oz	6.2	6.8	7.2	5.5	5.5
Proxy, 6 oz	6.3	7.0	6.8	5.3	5.3
Proxy, 12 oz	5.5	6.5	6.2	5.3	4.7
Proxy, 0.25 oz	6.7	6.3	7.8	7.7	6.5
Proxy, Primo, Proxy	6.0	7.2	7.8	6.2	5.7
LSD (0.05)	ns	ns	0.4	0.7	0.7

† **Treatments were applied 5 May, 3 June, 6 July.**

‡ **Quality was ranked on a 1-9 scale; 1= dead turf, 9=dark green, dense, uniform turf.**

Table 4. Color of 'Penncross' Creeping Bentgrass on Selected Dates during 1998†.

Treatment	12 May	9 June	7 July	28 July	18 August
Control	6.5‡	6.8	5.3	6.1	6.5
Proxy, 3 oz	6.0	6.0	5.6	5.3	7.0
Proxy, 6 oz	6.0	5.8	6.0	5.1	6.1
Proxy, 12 oz	5.5	5.1	5.1	5.0	5.6
Proxy, 0.25 oz	6.8	8.3	6.5	7.6	7.1
Proxy, Primo, Proxy	5.8	6.1	6.6	5.8	6.0
LSD (0.05)	0.7	0.9	ns	0.9	1.0

† **Treatments were applied 5 May, 3 June, 6 July.**

‡ **Color was ranked on a 1-9 scale; 1= necrotic turf, 9=dark green**

Table 5. Turf density and rigidity of 'Penncross' Creeping Bentgrass treated with Proxy and/or Primo, 1998 (selected dates)†.

	Density			Rigidity		
Treatment	1 July	5 Aug	25 Aug	1 July	14 July	13 Aug
Control	96.7‡	98.0	93.7	5.7	6.0	5.3
Proxy, 3 oz	97.0	97.3	93.0	6.0	6.5	6.5
Proxy, 6 oz	99.3	99.0	92.3	7.0	6.7	6.3
Proxy, 12 oz	98.7	95.3	93.0	8.0	7.3	6.3
Proxy, 0.25 oz	96.7	99.3	95.7	5.7	7.0	6.2
Proxy, Primo, Proxy	95.0	97.0	94.0	6.0	6.2	6.7
LSD (0.05)	ns	2.3	ns	1.3	ns	ns

† **Treatments were applied 5 May, 3 June, 6 July.**

‡ **Density was evaluated as percent turf cover. Rigidity was ranked on a 1 to 9 scale, 1= a rolled golf ball came to rest at 1/3 or greater buried within the canopy, 9 = ball sat completely on top of the canopy.**

rigidity during spring through early summer, but the effect disappeared by mid-summer as temperatures increased to supraoptimal for turf growth.

DISCUSSION

Proxy effectively reduced clipping yields without significantly reducing turf quality. Up to three sequential applications can be applied at label rates without harm through mid-summer, but the primary activity can be achieved with one or two applications during spring and early summer. Data are still lacking on autumn treatment effects and timing, although a late summer/early autumn application should provide approximately the same type of control obtained by the early summer application.

The low rate of Proxy (3 oz/1000 ft2) was generally as effective as higher rates. The suggested label rate will be 5 oz/1000 ft2. Proxy will cost approximately $23.75/gallon: at 3 oz/1000 ft2, one application would cost $0.56, while a 5 oz rate would cost $0.92. Primo, which costs $305/gallon, costs $0.60/1000 ft2 when applied at 0.25 oz/1000 ft2. This is comparable to a three to four ounce rate of Proxy.

Proxy will be labeled for fairway, rough, and commercial uses. In addition to creeping bentgrass, Proxy will be labeled for Kentucky bluegrass, perennial ryegrass, tall and fine fescue. Application intervals will be four weeks for bentgrass and fescues, eight weeks for Kentucky bluegrass and perennial ryegrass.

In 1999, we will test the effect of Proxy on establishment of both creeping bentgrass and Kentucky bluegrass. The enhanced tillering caused by Proxy should be beneficial to turf establishment. Young, immature plants may be more sensitive to Proxy compared to fully established, mature turf, so lower rates may be necessary. These plots will be on display for the 1999 WTA/UWEX Field Day on August 10, 1999.

LITERATURE CITED

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