Evaluation of Chipco Proxy for Use as a Turf Growth Regulator and Seedhead Inhibitor on Overseeded Fairways

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Summary: In replicated field trials conducted at two locations (The Country Club of Rancho Bernardo, and Admiral Baker Golf Course), the effect of the experimental product ethephon (Proxy) on turf quality, turf growth regulation and *Poa annua* seedhead inhibition was evaluated on bermudagrass fairways that had been overseeded with perennial ryegrass. Key results include:

- The use of Proxy at rates of either 5 oz or 10 oz/1000 square feet resulted in a significant decrease in the density of *Poa annua* seedheads. This effect was observed for as long as seven weeks after a single application of Proxy.

- Primo L (0.5 oz/1000 square feet) also resulted in decreased poa seedhead densities, but this effect was neither as strong nor as consistent as that for Proxy.

- Overall, Proxy applications performed inconsistently in the regulation of cool season turf growth on overseeded bermudagrass fairways. While the 5-oz rate produced significant clipping weight reductions at one location, it took several weeks for the effect to appear. The 10-oz rate of Proxy resulted in significant increases in turf growth on several evaluation dates. This unexpected result was observed at both test locations.

- No phytotoxicity was caused by any of the products tested, although Primo L (0.5 oz/1000 square feet) caused a dark colored cast to appear on treated plots due to growth inhibition and stress caused on senescing bermudagrass. The lack of any damage to bermudagrass or ryegrass caused by Proxy, in combination with its ability to reduce poa seedhead densities, may make it a valuable tool in golf course poa management on fairways and greens, despite its disappointing performance as a cool-season turf growth regulator.

Materials and Methods:

Locations: Research plots were located on overseeded bermudagrass fairways. At the Country Club of Rancho Bernardo (CCRB), the fairway was overseeded with perennial ryegrass (400 lb/A) on October 1, 1998. At the time of trial initiation, the rye cover was good, although approximately 20% of the turf consisted of *Poa annua.* At Admiral Baker Golf Course (ABGC), the fairway was overseeded on October 29, 1998 with perennial ryegrass (200 lb/A). At the time of trial initiation, the ryegrass stand was only fair (50% cover with rye), with the remaining turf a combination of *Poa annua* and bermudagrass.

Experimental design and application: At both locations, plots measured 5 feet by 10 feet and treatments were replicated three times, in a randomized design as illustrated below.

Treatments were applied with a CO_2 backpack sprayer equipped with 8004 VS flat fan nozzles and delivering 0.98 gallons of water per 1000 square feet, with 28 psi at the boom. Calibration of each nozzle was confirmed prior to application to be within 5% of the desired nozzle flow rate. Boom height was 17 inches above the ground. The spray swath was 5 feet. Speed was 3 mph. Spray bottles were agitated by shaking 20 times prior to charging with compressed CO_2. Spray lines were purged with CO_2 and then water prior to changing treatments.

Treatments: Treatment and application dates are listed below (Table 1) for each trial location.

Evaluations: At the Country Club of Rancho Bernardo, turf was evaluated on a weekly basis for clipping reduction, turf quality and the

presence of poa seedheads. At Admiral Baker Golf Course, turf was evaluated for clipping reduction (and turf quality and poa seedhead reduction) for the initial four weeks after application (1/13/99 – 2/4/99). However, clipping reduction evaluations were discontinued on 2/4/99, due to unexpected results that we believed might have been a result of the poor perennial ryegrass stand at this location. However, turf quality and poa seedhead evaluations were continued on a monthly basis at Admiral Baker Golf Course, ending on 4/16/99 (3½ months after the first application). A schedule of evaluation dates for each location appears below (Table 2).

PLOT PLAN
Proxy Turf Growth Regulator Trial, Rancho Bernardo Country Club and Admiral Baker Golf Course.

1	2	3	4	3	1	4	2	4	1	3	2

Table 1. Treatments and application dates. CCRB = Country Club of Rancho Bernardo. ABGC = Admiral Baker Golf Course.

			Application Dates	
Treatment	**Active Ingredient**	**Rate of product (oz/1000)**	**CCRB**	**ABGC**
1) Control		----		
2) Proxy	21.7% Ethephon	5 oz	2/15/99	1/6/99, 2/17/99
3) Proxy	21.7% Ethephon	10 oz	2/15/99	1/6/99, 2/17/99
4) Primo L	12% Trinexapac-ethyl	0.5 oz	2/15/99	1/6/99, 2/17/99

Table 2. Schedule of evaluation dates

	CC at Rancho Bernardo	Admiral Baker Golf Course
Clipping Reduction	2/22, 3/1, 3/8, 3/22, 3/29, 4/5/99	1/13, 1/19, 1/28, 2/4/99
Turf Quality	2/22, 3/1, 3/8, 3/22, 3/29, 4/5/99	1/13, 1/19, 1/28, 2/4, 2/17, 3/10, 4/16/99
Poa seedhead reduction	2/22, 3/1, 3/8, 3/22, 3/29, 4/5/99	1/13, 1/19, 1/28, 2/4, 2/17, 3/10, 4/16/99

Clipping reduction: At Rancho Bernardo, clipping reduction was determined by weighing clippings obtained by mowing individual plots. Plots were mowed weekly by making two passes (each 20 inches wide and 10 feet long, for a total of 33.33 sq ft mowed) per plot with a McClane reel mower set at ½ " (on 2/22/99 and 3/1/99) and 3/8" (remaining evaluation dates). The height was adjusted to 3/8" to obtain enough clippings per plot to accurately weigh. At Admiral Baker, the mowing height was maintained at ½" throughout the evaluation period, but otherwise all mowing procedures were the same. For both locations, clippings from each plot were collected in a zip-lok plastic bag and were weighed off-site in PACE Consulting's laboratory. The entire plot area was mowed following individual plot mowing to ensure uniform heights throughout the plot area for subsequent mowings.

Turf quality was determined on a visual basis using a 0 – 7 scale, where 0 = poorest turf quality possible and 7 = best quality turf possible. Quality was a function of color, density and evenness. Differences in turf quality were apparent on only one rating date (3/29/99) at CCRB, and there were not statistically significant differences in turf quality at ABGC.

Presence of poa seedheads was rated visually by examining the poa plants in each plots and visually determining what percentage of plants had produced seedheads. Poa seedheads were present in high enough numbers to rate only on certain sampling dates.

Data analysis: Data was subjected to analysis of variance, and treatment means were separated using Fisher's LSD, where $p<0.05$. Percent poa seedhead data was transformed prior to statistical analysis using the arcsine (square root of the proportion).

Results and Discussion

Turf quality: No phytotoxicity was caused by any of the products tested. However, the use of Primo caused a slightly thinned, dark colored cast to appear on treated plots. This appears to be the result of significant growth inhibition of the bermudagrass, which was further stressed by cool temperatures. This effect is not surprising, given the sensitivity of bermudagrass to Primo (the recommended rate for use on bermudagrass is 0.20 – 0.25 oz/1000 sq ft, and the rate used in the trial was the ryegrass rate of 0.5 oz/1000 sq ft). At one location, a small but significant improvement in turf quality was observed in plots treated with Proxy at both the 5 oz and 10 oz rate on one rating date (Table 5). The observed improvement appeared to be related to the decrease in poa seedheads in the Proxy treated plots. There were no significant differences in turf quality on any other rating dates at either location, however.

Clipping reduction (Country Club at Rancho Bernardo) (Table 3): The effect of Proxy on clipping weights did not follow the pattern that was expected, based on previous experiences with the current commercial standard (Primo) for turf growth regulation. In the case of Primo, a significant reduction in turf growth is typically seen within 1-2 weeks of application (see Table 3). This effect is usually sustained for at least four weeks; in the case of this trial, a single Primo application produced significant reductions in turf growth for the full seven weeks of the trial. In contrast to the performance of Primo, Proxy applications did not result in any decrease in turf growth during the first 2-3 weeks after application. However, by the 3rd week after application, there were some signs ($P<0.10$) that the 5-oz/1000 square foot rate of Proxy was retarding the growth of the overseeded turf. By the 5th week after treatment, the 5-oz rate of Proxy produced a significant reduction in turf growth, of similar magnitude to that produced by Primo, which was sustained for the remaining weeks of the trial. Surprisingly, the higher rate of Proxy (10 oz/1000 square feet) did not perform as well as the 5 oz rate, and in fact produced a significant increase in turf growth rate on the first evaluation date (1 week after treatment). On subsequent evaluation dates, this effect was not sustained, but the 10 oz Proxy treatment didn't differ from the check on any of the remaining evaluation dates. This suggests that the rate response for this product is not linear, but instead may have peaks (5 oz /1000 square feet rate) and valleys (10 oz/1000 square feet rate) of activity.

Clipping reduction (Admiral Baker Golf Course) (Table 4): The general trends exhibited at Rancho Bernardo were roughly mirrored at Admiral Baker, though some of the observed effects were more exaggerated at this location. Here, the significant growth stimulant effect of the 10 oz rate of Proxy was observed on the initial two rating dates (rather than on one date at Rancho Bernardo). And the decrease in clipping weights that was seen at Rancho Bernardo with the 5 oz rate of Proxy was not seen during the 4 week period in which clippings weights were taken at Admiral Baker. Primo also did not show the expected reduction in clipping weights for the first two weeks of the test, with significant decreases only appearing on the 1/28 (3 weeks after treatment) and 2/4/99 (4 weeks after treatment) evaluation dates. Some of these effects can be explained by the cool temperatures that were experienced in early January, which was probably responsible for reduced growth and the low clipping weights observed on 1/3 and 1/19 in all treatments, including the non-treated check. In addition, soil fertility was low during the first few weeks of the trial due to a delay in scheduling golf course-wide fertilizer applications. Because growth was already reduced by low

temperatures and low fertility, the effectiveness of growth regulators such as Primo or Proxy would have been more difficult to measure. As temperatures warmed up in late January/early February, higher clipping weights were observed in the check plots (see 1/28 and 2/4 data) and it became possible to observe growth regulation, at least in the Primo treated areas.

Clipping reduction (summary): Overall, Proxy applications performed inconsistently in the regulation of cool season turf growth on overseeded bermudagrass fairways. While the 5-oz rate produced significant clipping weight reductions at one location, it took several weeks for the effect to appear; the effect was not observed at the second location. In addition, the possibility that the product, under the right conditions, could actually produce increased turf growth is cause for concern. The fact that this growth stimulation effect was observed at both locations further suggests that the commercial potential for use of Proxy as a turf growth regulator needs to be seriously assessed. However, as will be seen below, the product's activity as an inhibitor of *Poa annua* seedheads was much more consistent, and much more promising.

Table 3. Clipping weights (grams per 33.33 square feet) of turf following growth regulator application on February 15, 1999, Country Club at Rancho Bernardo. Treatments with significantly ($p<0.05$) lower clippings than the control are highlighted in green. Treatments with significantly more ($p>0.05$) clippings than the control are highlighted in red. WAT = weeks after treatment.

Treatment (Rate/1000 sq ft)	2/22/99 1 WAT	3/1/99 2 WAT	3/8/99 3 WAT	3/22/99 5 WAT	3/29/99 6 WAT	4/5/99 7 WAT
1) Control	85.0 b	53.0 b	214 b	105.0 c	156.0 b	130.0 b
2) Proxy (5 oz)	94.3 bc	51.7 b	164.3 b*	69.0 ab	82.7 a	91.7 a
3) Proxy (10 oz)	120.7 c	62.0 b	185.0 b	81.7 bc	85.3 a	112.3 ab
4) Primo L (0.5 oz)	49.0 a	24.0 a	89.7 a	53.7 a	79.7 a	86.3 a

*this value was significantly lower than the check, but only at the $p<0.10$ level.

Table 4. Clipping weights (grams per 33.33 square feet) of turf following growth regulator application on January 6, 1999, Admiral Baker Golf Course. Treatments with significantly ($p<0.05$) lower clippings than the control are highlighted in green. Treatments with significantly more ($p>0.05$) clippings than the control are highlighted in red. WAFT = weeks after first treatment.

Treatment (Rate/1000 sq ft)	1/13/99 1 WAFT	1/19/99 2 WAFT	1/28/99 3 WAFT	2/4/99 4 WAFT
1) Control	73.0 a	57.0 ab	124.7 b	125.7 bc
2) Proxy (5 oz)	83.0 a	71.7 b	122.0 b	113.7 b
3) Proxy (10 oz)	138.0 b	101.7 c	170.0 b	158.0 c
4) Primo L (0.5 oz)	62.7 a	33.3 a	44.3 a	73.3 a

Seedhead reduction: Country Club at Rancho Bernardo (Table 5): Both rates of Proxy gave consistent poa seedhead reduction. This effect was observed for the full seven week period of the trial, though there was an indication on the 7 weeks after treatment rating date that the effectiveness of Proxy was beginning to wane slightly. There were no significant differences in performance between the 5-oz and 10 oz rates of Proxy. Although Primo provided some reduction in poa seedheads present, it did not perform as well as either rate of Proxy.

Seedhead reduction, Admiral Baker Golf Course (Table 6): Both rates of Proxy gave significant seedhead reduction (Figure 1) compared to the non-treated check, but at this location, the rate response between the 5 oz and 10 oz rate of Proxy was obvious, with the higher rate resulting in significantly fewer *Poa annua* seedheads than the 5 oz rate. Primo applications also resulted in significantly reduced poa seedhead densities on some dates, but it did not perform as consistently or as strongly as Proxy did at either the 5-oz or 10 oz rate (Figure 2).

Figure 1. The 10-oz rate of Proxy (treatment 3: background) provided good control of poa seedheads compared to the non-treated check (treatment 1: foreground). Admiral Baker Golf Course, March 10, 1999.

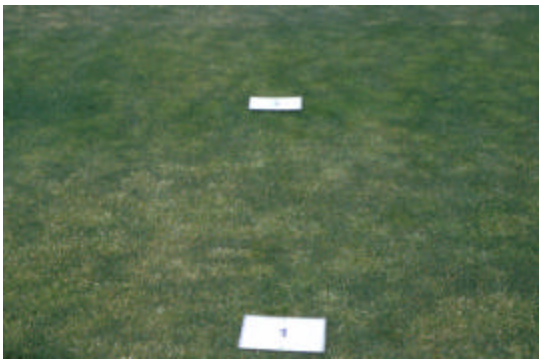
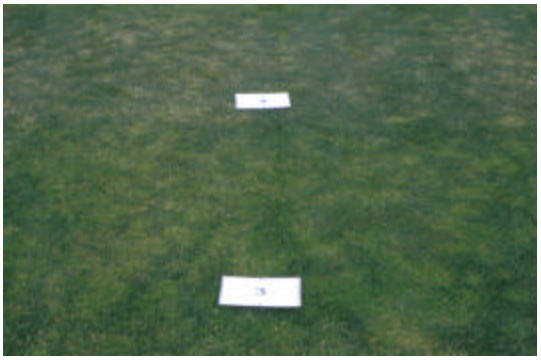


Figure 2. The 10-oz rate of Proxy (treatment 3: foreground) provided significantly better control of poa seedheads than Primo L applied at 0.5 oz (treatment 4: background). Admiral Baker Golf Course, March 10, 1999.



Seedhead reduction (summary): At both rates tested, Proxy provided significant and consistent reductions in poa seedhead densities that lasted for up to seven weeks after a single application. At one location, a rate response with Proxy was observed, with the higher rate producing a stronger reduction in poa seedhead density. However at our second location, there was no significant difference between the good performance of the 5-oz and 10 oz rates in terms of poa seedhead density reductions. Primo L also resulted in decreased poa seedhead densities, but this effect was neither as strong nor as consistent as that for Proxy.

The ability of Proxy to significantly reduce poa seedhead densities on a consistent basis, without any related damage to warm or cool season turfgrass has important commercial significance for use on fairways, but even more so on *Poa annua* greens. In the Western U.S., poa greens are the standards on many golf courses, and fulfill many of the needs of superintendents and golfers alike. However, the presence of poa seedheads is not only a cosmetic problem on greens, but also interferes with ball roll. Because there are few products available than can manage poa seedheads without causing some injury to turf, Proxy may have an important role to play here. On fairways, the presence of poa is less problematic, although it can be a serious cosmetic issue. In addition, it is possible that reduction of poa seedhead densities on fairways (through the use of Proxy) may help decrease the inoculum of poa seed in the soil to the point that future poa infestations can be more easily managed. This concept would need to further investigated to confirm it, however.

For these reasons, the development of Proxy as a poa seedhead regulator should be further investigated for use on greens as well as on fairways.

Table 5. Percent Poa annua seedheads present and turf quality rating, Country Club at Rancho Bernardo. Treatments with the lowest ($p<0.05$) poa seedhead densities or significantly higher turf quality ($p<0.05$) than the control are highlighted in green. Percent poa seedhead data was transformed prior to statistical analysis using the arcsine (square root of the proportion).

	Percent Poa seedheads present			**Turf quality**
Treatment (Rate/1000 sq ft)	**3/22/99 5 WAT**	**3/29/99 6 WAT**	**4/5/99 7 WAT**	**3/29/99 6 WAT**
1) Control	100.0 c	86.7 b	100.0 b	6.5 b
2) Proxy (5 oz)	46.7 a	26.7 a	86.7 a	7.0 a
3) Proxy (10 oz)	43.3 a	20.0 a	68.3 a	7.0 a
4) Primo L (0.5 oz)	76.7 b	46.7 a	100.0 b	6.5 b

Table 6. Percent Poa annua seedheads present, Admiral Baker Golf Course. Treatments with the lowest ($p<0.05$) poa seedhead densities are highlighted in green. Treatments were made on 1/6/99 and 2/17/99. Percent poa seedhead data was transformed prior to statistical analysis using the arcsine (square root of the proportion).

Treatment (Rate/1000 sq ft)	**1/28/99 3 WAFT**	**2/4/99 4 WAFT**	**2/17/99 6 WAFT**	**3/10/99 9 WAFT**	**4/16/99 14 WAFT**
1) Control	15.0 b	83.3 c	98.3 d	100.0 c	73.3 b
2) Proxy (5 oz)	2.0 a	18.3 b	13.3 b	60.0 b	51.7 a
3) Proxy (10 oz)	2.0 a	6.7 a	1.7 a	20.0 a	48.3 a
4) Primo L (0.5 oz)	2.0 a	16.7 ab	58.3 c	100.0 c	66.7 ab