Advances in *Poa* Seedhead Management

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Bottom line: Despite some well-known weaknesses, *Poa annua* (annual bluegrass) is a resilient turf that is cultivated with great success on golf courses around the world. Effective seedhead management, via a combination of cultural practices and growth regulator (mefluidide) applications, is one of the reasons that *Poa* is accepted by both golfers and superintendents. Although positive results are achieved with this approach, there are also problems: optimal application timing is difficult to determine; frequent applications of growth regulator are required; and turf discoloration is common. Some of these problems may be overcome by use of the growth regulator ethephon, which was recently discovered to suppress *Poa* seedheads on greens and higher mown turf for 6 weeks or more, with no apparent damage to either warm or cool season turf. The addition of ethephon to seedhead management programs can provide superintendents with another good tool for managing *Poa* – the grass you love to hate.

From many standpoints, *Poa annua* is an ideal turf for use on golf courses. It's upright growth habit and high shoot density results in dense and velvety turf. It's aggressive growth and ability to germinate from a natural seed bank allows it to recover from stressful conditions more rapidly than other cool season turf varieties. And its tolerance to shade and compaction makes it useful in a wide variety of situations.

Of course, we all know that this is only one side of the story. Because *Poa* is also more susceptible to disease, salinity, heat and drought than other turf varieties. And then, there are those pesky seedheads.

While many of *Poa's* pitfalls are not easily addressed, the occurrence of seedheads can be significantly reduced through a combination of cultural practices and plant growth regulator applications. In this issue of *PACE Insights,* we will review current practices for seedhead suppression, and will present new data on the use of growth regulators for improved results.

The (not-so-secret) sex-life of *Poa*

The formation of seedheads is the final step in the relatively brief, but very prolific sex life of *Poa.* Since *Poa* has both male and female flowers on each plant, they are capable of either self-pollinating, or of cross-fertilizing nearby plants. Once the female flowers have been pollinated, the seed begins to develop. Each small plant can produce several hundred viable seeds. From the time the *Poa* seed germinates in the soil, it can take anywhere from 44 to 149 days before seedheads form (Peel, 1982; Cattani, 1999). The timing of seedhead formation is influenced by many factors, but weather, geography and the biotypes of *Poa* present at your location are probably the most important.

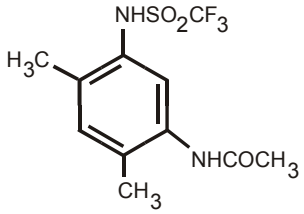
Weather: When air temperatures are optimal for *Poa* growth and development (air temperatures roughly 50ºF to 70ºF [Beard, 1969; Peel, 1982]), seedheads will develop most rapidly. If temperatures are either warmer or colder than this, seedheads will be slower to appear. This is the reason behind our frequently frustrated efforts to predict when seedheads will show up each year. In a cool year, it may be quite late in the season before seedheads emerge, while a winter or spring with temperatures in the 60's and 70's can result in their premature appearance. This problem is even more dramatic when we look at the differences between northern and southern locations. In most northern states, *Poa* is dormant for part of the year and therefore incapable of growth and seedhead production during the winter months. In these areas, *Poa* seedheads typically begin to form sometime between March and May (depending on the weather, and depending on the location) and continue to be produced for as long as 8 weeks. In contrast, the southern states experience moderate winters and see *Poa* seedhead formation almost every month of the year. In these areas, seedheads begin to form in January or February, reach their peak in April or May, and then fall to their lowest numbers during the autumn and early winter.

Poa biotypes: We all tend to talk about "*Poa*" as though it were one, uniform variety, but this is not accurate at all. Instead, the thing that we call "*Poa*" is actually a large number of distinct turf sub-varieties, or biotypes. These range from annual types that die each spring following a period of intense seedhead formation, to biotypes that live for several years, and that flower later in the season, for longer periods of time. And it is impossible to predict which biotypes will occur on a given golf course, or even on a given green. Cook (1996) estimates that there are 5 to 20 different *Poa* biotypes on any given putting green!

Seedhead management: current state of the art

Cultural practices: No one method provides 100% seedhead control. For this reason, all strategies – cultural, chemical and otherwise – should be employed for optimal results. A cultural program of brushing (daily during peak seedhead periods) and/or periodic vertical mowing is typically used to pull *Poa* seedheads upwards, making it easier to remove them via mowing.

Mefluidide: The plant growth regulator mefluidide (Embark, Chek-Turf II, Gro-Tard, Slow It) has been used for suppression of turf growth and seedheads on greens, tees and fairways for many years. The product acts by interfering with mitosis (cell division) and cell elongation after it is absorbed by the foliage.



mefluidide

Under optimal conditions, applications of mefluidide can result in 85 – 90% seedhead suppression, which has made this the product of choice on many golf courses.

San Diego Country Club, CA, Gary Dalton superintendent. *Poa* green. 3/20/00 (3 weeks after application). Note the darker turf and lack of poa seedheads in the plot treated with Embark.

No treatment Embark 2S (0.14 oz/1000)

Despite its good performance, there are some drawbacks associated with the use of mefluidide:

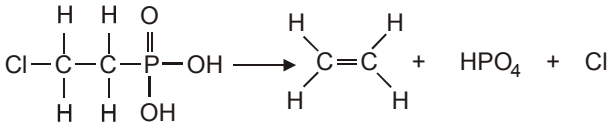
1. Turf discoloration: Mefluidide is generally not recommended for use on greens or other highly trafficked areas of turf. This is because the amount of product required for optimum seedhead suppression is also high enough to cause severe growth regulation of turf. The temporary yellowing of turf (a dark green color usually develops 1 – 2 weeks after application) that follows a mefluidide application is testament to this fact. Some superintendents have had luck in decreasing the discoloration by applying iron at the same time as the mefluidide, but some degree of yellowing appears to be unavoidable.
2. Varying turf response: The duration of seedhead suppression with mefluidide varies from 3 to 6 weeks, and in many cases, the turf becomes less responsive to mefluidide with successive applications. To keep seedhead populations consistently low, many superintendents must therefore gradually increase the rate with each successive application For example, on greens, many superintendents start out at the relatively low rate of 4 oz Embark 2S per acre (= 0.9 oz/1000 square ft, or roughly 1 oz of active ingredient per acre), but will increase up to 6 or even 8 oz per acre as the season progresses.
3. Timing the first application: This is where the real art of using mefluidide kicks in. Since the product will have no effect on seedheads that already exist, the first application should ideally be made 1 - 2 weeks BEFORE the first flush of seedheads appears. Later applications have diminishing returns. But given the difficulties we've described above of predicting this date each year, that's easier said than done. Trial, error and ingenuity have allowed some superintendents to develop methods for timing their first mefluidide application. For example, in the upper mid-West, a few successive days of average soil temperatures (at a 2" depth) above 45ºF appear to be a good indication that seedheads will appear soon. In the northeast, the start of forsythia bloom provides a similar trigger. And in coastal southern California, the first appearance of *Poa* seedheads (usually in January) is a good trigger for beginning mefluidide applications. Remember though – these systems were developed locally, and are therefore dependent on the climate of the specific region where they are used. For this reason, a model that works well in Chicago, IL probably won't work at all in Arizona or Florida (due to their lack of a cold winter), or even in Maine (due to their much longer and colder winters).

Ethephon for seedhead management

Ethylene has been used in agriculture since the time of the ancient Egyptians, who would place cut figs next to unripe figs in order to stimulate fruit ripening. We now know that by cutting the fruit, they were releasing ethylene gas – a naturally occurring plant hormone that has many functions in the plant, including fruit ripening. Present day applications include the use of ethylene to ripen green tomatoes immediately prior to their placement on supermarket shelves. Ethylene also causes abscission (dropping) of flowers, a phenomenon that ethylene-based products such as Proxy, Florel and Ethrel capitalize on.

Ethephon is the active ingredient in most ethylene-based plant growth regulator products, but it converts to ethylene gas when it is exposed to pHs above 4 (as occurs when it is mixed with water). When applied to

crop plants, the ethephon penetrates plant tissue, moves throughout the plant, and slowly (over a period of several hours) decomposes to ethylene, phosphate and chloride.



ethephon ethylene phosphate chloride

Seedhead management research results from PTRI

During 1998, the PACE Turfgrass Research Institute (PTRI) began to look at Proxy (21.7% ethephon) for turf growth management on overseeded bermudagrass fairways in Southern California. Although we didn't observe the reductions in clipping weights that we had hoped for, we saw something even better -- dramatic and statistically significant suppression of *Poa* seedheads, as seen in the photo to the right. Better yet, there was no turf discoloration associated with applications of Proxy at the recommended rate (5 oz/1000 square feet) and even at twice the recommended rate (10 oz/1000 square feet), and seedhead suppression appeared to last 7 weeks or more after application. When we saw this effect repeated in several locations, the next step was to test Proxy on bent/poa greens. Key findings (summarized in the table below) include:

Admiral Baker Golf Course, CA. Alan Andreasen, CGCS, superintendent. Overseeded (perennial ryegrass) bermudagrass fairway. 3/10/99. Note the high number of poa seedheads in the non-treated (bottom) plot, and the lack of seedheads in the upper plot treated with Proxy.

Seedhead suppression on *Poa*/bent greens at three different California locations (Del Mar CC: David Major CGCS superintendent; Oak Valley GC: John Harkness, superintendent; San Diego CC: Gary Dalton, superintendent.

			Percent seedhead suppression averaged over a period of 6 weeks		
Product	**Active Ingredient**	**Rate oz/1000 sq ft**	**Del Mar CC**	**Oak Valley GC**	**San Diego CC**
No treatment	---	---	**0**	**0**	**0**
Chipco Proxy	21.7% Ethephon	3.0	**30**	**53**	**48**
Chipco Proxy	"	5.0	**72**	**65**	**61**
Chipco Proxy	"	10.0	**90**	**77**	**87**
Primo	12% Trinexepac-ethyl	0.5	**10**	**17**	**2**
Embark 2S	28% mefluidide	0.14	**Not tested**	**Not tested**	**58**

75 – 90% seedhead suppression: When tested at three different locations on either bent/poa or all poa greens, Proxy performed significantly better than the non-treated check on all evaluation dates. A single Proxy application (5 oz/1000 square ft) resulted in 75% suppression of *Poa* seedheads, while the 10 oz/1000 square ft rate resulted in greater than 90% seedhead suppression. Primo (0.5 oz/1000 square ft) provided less than 20% seedhead suppression.

Performance vs. Embark: When compared to the commercial standard, Embark (0.14 oz/1000 square feet), Proxy at 5 oz/1000 square ft provided statistically equivalent control, but for longer periods of time.

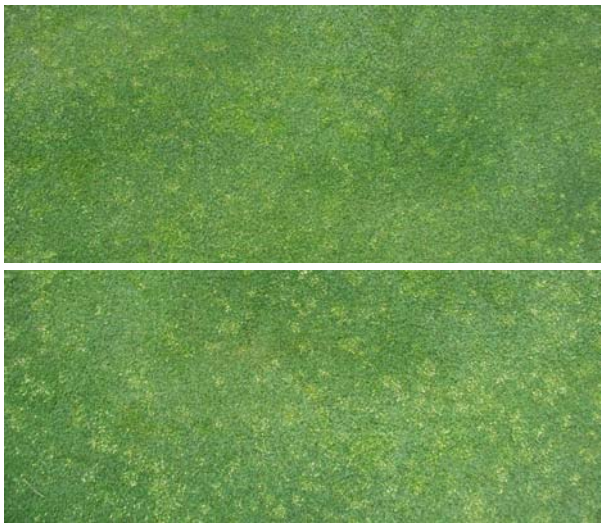
Turf discoloration: No damage to bentgrass or *Poa* was observed when Proxy was applied at 5 oz or 10 oz/1000 square feet. Turf discoloration due to Embark was observed for approximately 2 weeks, but good turf color was restored by 3 weeks after application.

Need for re-application: High levels of seedhead suppression were observed with Proxy for up to 6 weeks after application. Efficacy began to gradually decline by 6 weeks after application, indicating that treatments should be made every 6 – 7 weeks.

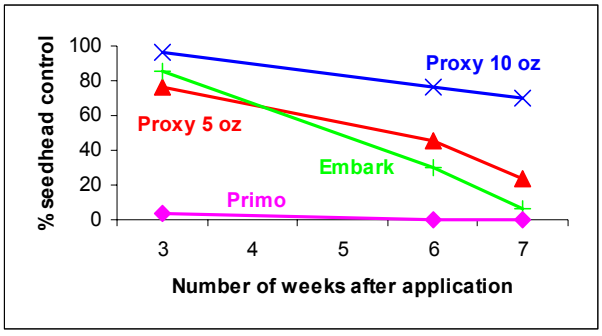
Combinations with Primo (trinexepac-ethyl): What happens when Proxy is tank mixed with the growth regulator Primo? This is an important question, since many superintendents are regularly using Primo on

their cool season greens to obtain denser growth, darker color and reduced clippings. Fortunately, there is only good news to report. We have looked at combinations of Proxy (5 oz/1000 square ft) plus Primo (0.125 oz/1000 square ft) on 3 different bent/poa greens, and in each case, seedhead suppression and turf quality was very high. For this reason, it is not only safe to mix these two products together, but it appears to be beneficial.

Del Mar Country Club, CA. David Major, CGCS superintendent. On 3/20/00 (4 weeks after treatment), bent/*Poa* greens treated with Proxy at 5 oz/1000 sq ft (top photo) had 75% seedhead suppression, compared to the non-treated check (bottom photo).



San Diego Country Club, San Diego, CA. Gary Dalton, superintendent. All products were applied on 2/28/00, to predominantly poa greens. Embark provided excellent control for 3 – 4 weeks, while Proxy activity lasted as long as 7 weeks. Primo provided minimal seedhead control.



Timing of first application: Applications made in the early stages of seedhead production (February, in Southern California) were more successful than applications made later in the season. It therefore appears that greatest efficacy will be achieved for either Embark or Proxy if the first application is made at the very beginning of seedhead production.

Del Mar Country Club, CA. David Major, CGCS, superintendent. Tank mix combinations of Proxy (5 oz/1000) plus Primo (0.125 oz/1000) applied to a bent/*Poa* green resulted in high quality turf with 90% fewer seedheads than the non-treated check.

Non-treated Proxy + Primo

Although questions remain regarding optimal application timing and combinations with other products, Proxy's ability to suppress seedheads and lack of phytotoxicity indicate that it will be another useful tool in seedhead suppression strategies.

Can seedhead suppression lead to less *Poa?*

Imagine this. After several years of aggressive cultural and plant growth regulator programs to suppress *Poa* seedheads, you have finally reduced the *Poa* population to such low numbers that there are no longer any *Poa* seeds in the soil. And you can now grow bentgrass or other desirable turf without fear of *Poa* invasion. Are you dreaming? Well…probably. If your golf course is near an area that is infested with *Poa,* your course will continue to be infested by windborne seed, even if you are able to reduce the *Poa* seedbank on the course. And there is some preliminary research that suggests that seedhead suppression can actually help strengthen the *Poa* plant, by allowing it to devote more energy to growing strong foliage and roots. It is therefore unlikely that *Poa* seedhead suppression programs – even the most effective ones -- will have the added advantage of resulting in permanent reductions in *Poa.* But these programs ***can*** make *Poa* an easier turf for you to manage, and a more desirable turf for golfers to play on.

References

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