



# For successful control, know your *Poa annua*

Superintendents in the South continue to battle *Poa annua*, a tenacious winter annual weed.

*Poa annua* (annual bluegrass) continues to be the most prolific winter annual grass weed superintendents fight, especially when trying to control it in another cool-season grass such as overseeded perennial ryegrass or *Poa trivialis* (roughstalk bluegrass). Although I would rate *P. annua* pressure in the southeastern U.S. in 2007 as rather normal, the extensive dry fall (for most), very bright days in winter (which encourages germination) and extremely late spring allowed *P. annua* seedheads to remain visible into early summer. In a “normal” year, seedheads in this area would have stopped being noticeable by late mid-spring (for example, from early April along the Gulf Coast to late-April in the transition zone). This is a prime example of “what happens in one year may or may not happen equally in another year (or location).”

## *Poa annua* biology

The annual biotype of *Poa annua* begins to germinate when daytime temperatures consistently drop into the mid-70s F (-24 C) and nighttime temperatures are in the mid-50s F (-13 C) for several consecutive days in late summer and early fall (Table 1). Another flush of germination typically occurs in early winter when daytime temperatures are warm and nighttime temperatures are cold. This alternating warm/cold temperature scarifies additional seed, thus encouraging another flush of germination. Typically, it has been observed in the southeastern U.S. that about 75% of the yearly germination of *P. annua* occurs in mid-fall, with the remaining 25% germinating throughout the winter and early spring.

After germination, annual bluegrass grows and then tillers (mostly unnoticeable) throughout the fall and early winter months. Once late winter arrives, annual bluegrass begins to shift from vegetative toward reproductive growth by forming numerous seedheads that can literally turn a turf

stand snow-white in color. The annual biotype reduces its growth in late spring as daytime temperatures approach the lower to mid-80s F (-28 C) and dies following flowering or when daytime temperatures reach the lower to mid-90s F (-32 C) for several consecutive days. Seed can remain viable in the soil for more than six years, ensuring a continued supply.

## *Poa annua* control strategies

### *Bermudagrass greens*

For bermudagrass greens overseeded with *Poa trivialis*, the Rubigan 1AS (fenarimol, Gowan Co.) program is still best. Control is most consistent with a total of 12 ounces of product applied per 1,000 square feet (38 liters/hectare) split in two or three applications 20 to 30 days apart, with the last being 30 days before overseeding. In heavy *P. annua* populations, the manufacturer recommends a “kicker” application of 2 ounces/1,000 square feet (6.4 liters/hectare) in early winter (for exam-



Bert McCarty, Ph.D.

## *Poa annua* growth response

<i>Poa annua</i> growth response	Temperature	
	Fahrenheit	Celsius
Germination	daytime: mid-70s nighttime: mid-50s	mid-20s 12-14
Maximum growth	60-70	15.6-21.1
Maximum root growth (soil temperatures)	65-70	18.3-21.1
Seedhead development	70-80	21.1-26.7
Maximum heat tolerance	85-95	29.4-35
Minimum shoot growth (soil temperatures)	50	10
Lethal cold temperature	~5	-15

Table 1. Growth responses of annual bluegrass to varying environmental parameters.



Extensive annual bluegrass (*Poa annua*) can turn a ryegrass fairway overseeded with perennial ryegrass snow white. Photos by B. McCarty



Part of this area just off the green was treated with Rubigan 1AS and the approach was not.

ple, from the winter solstice in the transition zone until the first week in January in coastal areas). This program provides reasonable *P. annua* control (~80%) with no long-term damage to the bermudagrass or overseeding. Rubigan also provides spring dead spot disease (*Ophiosphaerella* species) control. Other products are not consistently effective and/or damage the overseeding or the bermudagrass to the point of being unacceptable.

#### *Bermudagrass fairways*

Tables 2 and 3 list three *P. annua* control trials with and without sequential herbicide applications in Tifway bermudagrass overseeded with

perennial ryegrass. Perennial ryegrass was seeded between Sept. 20 and Oct. 1, 2007, with approximately 350 pounds seed/acre (392 kilograms/hectare).

From Table 2, dramatic differences in control were noted from site 1 vs. site 2. At site 1, a dinitroaniline-type herbicide was used on and off for more than 20 years, whereas this type of herbicide had never been used at site 2. Correspondingly, at site 1, treatments with two dinitroaniline herbicides, Barricade (proflam, Syngenta) and Pendulum (pendimethalin, BASF), averaged only 57% *P. annua* control, whereas at site 2, the same treatments averaged 91% control. Most other products provided good to excellent control at one of the two sites, but not both.

*Poa annua* is unlike many summer annual grass weeds in that a full-rate application of herbicide applied once seems to work as well or even better than two half-rate split applications. This is especially true with proflam or the combination product Regal Star II (Regal Chemical Co.), which contains proflam plus oxadiazon. If split applications are chosen, it is advisable to use a full upfront rate followed by a one-half rate approximately three months later.

The sites also differed in *P. annua* control following applications of Revolver (foramsulfuron, Bayer), Monument (trifloxysulfuron, Syngenta) or TranXit (rimsulfuron, DuPont) just before overseeding. These herbicides control any emerged *P. annua* plants before overseeding. At site 2, which was not overseeded until Oct. 15, this strategy worked reasonably well. However, at site 1, which was overseeded Sept. 20, few *P. annua* plants had germinated when these herbicides were applied and, therefore, less long-term control was achieved.

Prograss (ethofumesate, Bayer) achieved the most consistent control and ranked among the highest control products at both sites. Timing with Prograss is extremely important. If it is applied too early, Prograss immediately causes any green bermudagrass to go dormant (turns brown). Although long-term problems to the bermudagrass are rare, the brown turf may be objectionable until the perennial ryegrass has matured sufficiently to mask it. If Prograss is applied too late, *P. annua* plants become more mature (develop a mature cuticle), and Prograss becomes much less effective. Previous research by notable weed scientists such as Euel Coats, Ray Dickens, B.J. Johnson, Bill Lewis and Wayne Bingham worked out a schedule of two Prograss applications at 0.66 to 1 gallon of product applied per acre (6.2 to 9.4 liters/hectare) with each application. In the south-



eastern U.S., the first application is timed for late November with a repeat application in mid-to-late December. Continued research still supports these timings, as indicated in Table 2. At each site, Prograss provided control as good as any other product.

Prograss, unfortunately, is not for everyone. It should be applied only on golf courses located where the bermudagrass goes completely dormant. In the southeastern U.S., this typically excludes all of Florida, southern Georgia, lower Alabama, Mississippi, Louisiana and south Texas. As a rule of thumb, if glyphosate (for example, Roundup Pro, Monsanto) can be used safely in non-overseeded bermudagrass, then Prograss should be safe. Prograss also should be used with caution in late winter. Although Prograss does not damage treated bermudagrass going into dormancy, treating bermudagrass with Prograss as it comes out of dormancy is another story. Because most problems with Prograss have been reported when the bermudagrass was coming out of dormancy, a rule of thumb is not to apply it after mid-January, when *P. annua* control drops dramatically and treatment is generally pointless anyway.

### Plant growth regulators

Since the main objection to *Poa annua* is the profusion of seedheads in spring, an alternative means of control is suppressing seedheads with plant growth regulators (PGRs). Table 4 lists typical results from using various PGRs for *P. annua* seedhead control in bermudagrass overseeded with perennial ryegrass. The effectiveness of PGRs in controlling *P. annua* seedheads can vary between years and locations. In the first year (2006), excellent (>90%) control was achieved with Cutless (flurprimidol, SePro) alone or in combination with Proxy (ethephon, Bayer Environmental Science), Trimmit (paclobutrazol, Syngenta Professional Products) or Embark Lite (mefluidide, PBI/Gordon Corp.). Excellent results also followed the use of Primo (trinexapac-ethyl, Syngenta Professional Products) plus Trimmit or Trimmit plus Embark Lite. In year 2 (2007), good to excellent control was achieved using Proxy alone or Embark Lite alone or mixed with Proxy or Primo.

Perennial ryegrass density can also vary following PGR use. When first treated with PGRs, perennial ryegrass typically is still immature and can appear less dense. Treatments containing Cutless or Embark Lite can reduce the density appearance following initial applications, although this does not always occur. (Table 4). These trends, however, were not observed the second year. Density reduction was very transient and after repeat

### *Poa annua* control in overseeded bermudagrass

Herbicide	Rate (per acre)	Timing	Site 1*	Site 2*
			% control	
Barricade 4L	0.5 pound ai	60 DBO	60 a-c	92 a
Barricade	0.75 pound ai	60 DBO	63 ab	95 a
Barricade	0.38 pound ai	60 DBO fb Jan	38 a-d	93 a
Pendulum 3.8CS	3 pounds ai fb 1.5 pounds ai	45 DBO fb Jan	65 ab	82 ab
Dimension G	0.5 pound ai	45 DBO fb Jan	75 a	23 d
Regal Star II G	3 pounds ai	60 DBO	78 a	85 ab
Regal Star II	1.5 pounds ai	60 DBO fb Jan	67 ab	58 c
Ronstar 2G	1.5 pounds ai	60 DBO fb Jan	67 ab	22 d
Prograss 1.5L	1 pound ai	Nov fb Dec	73 a	95 a
Revolver 0.19L	17 fluid ounces	7 DBO	13 d	52 c
Monument 75 DF + NIS	0.3 ounce	7 DBO	7 d	92 a
TranXit 25DG + NIS	1.0 ounce	7 DBO	20 cd	92 a
Velocity 17.6 WDG	6 ounces	Feb fb 21 DL	32 b-d	93 a
Ronstar 2G	1.5 pounds ai	60 DBO fb Jan	67 ab	22 d

Abbreviations: NIS, nonionic surfactant added at 0.5% v/v; fb, followed by; DBO, days before overseeding; DAO, days after overseeding; DL, days later.

\*Site 1 was near Clemson, S.C., on a golf course that had used a dinitroaniline pre-emergence herbicide on and off for the past 20 years. Site 2 was near Hilton Head, S.C., on a golf course with no previous dinitroaniline pre-emergence herbicide use.

**Table 2.** Percent *Poa annua* control in Tifway bermudagrass overseeded with perennial ryegrass in April 2007 and 2008 at two sites in South Carolina.

### *Poa annua* control in overseeded bermudagrass at three sites

Herbicide	Rate (per acre)	Timing	Site 1*	Site 2*	Site 3*
			% control		
Barricade 4L	0.75 pound ai	60 DBO	68 ab	33 e	92 cd
Monument 75DF + NIS	0.3 ounce	7 DBO	23 cde	68 bcd	97 abc
Prograss 1.5L	1 pound ai	Nov fb Dec	87 a	92 ab	93 bc
Velocity 17.6 WDG	6 ounces	Feb fb Mar	45 bcd	83 abc	87 d
Barricade fb Monument	0.75 pound ai fb 0.3 ounce	60 DBO fb 7 DBO	67 ab	60 cde	93 bc
Barricade fb Prograss	0.75 pound fb 1 pound ai	60 DBO fb Dec	92 a	90 ab	97 abc
Barricade fb Velocity	0.75 pound ai fb 6 ounces	60 DBO fb Feb	72 ab	47 de	92 cd
Monument fb Prograss	0.3 ounce fb 1 pound ai	7 DBO fb Dec	72 ab	95 ab	97 abc
Monument fb Velocity	0.3 ounce fb 6 ounces	7 DBO fb Feb	20 de	70 a-d	98 ab
Prograss fb Velocity	1 pound ai fb 6 ounces	Dec fb Feb	53 bc	97 a	93 bc
Barricade fb	0.75 pound ai fb	60 DBO fb 7 DBO	90 a	88 ab	97 abc
Monument fb Prograss	0.3 ounce fb 1 pound ai	fb Dec			
Barricade fb Prograss fb Velocity	0.75 pound ai fb 1 pound ai fb 6 ounces	60 DBO fb Dec fb Feb	95 a	88 ab	97 abc
Monument fb Prograss fb Velocity	0.3 ounce fb 1 pound ai fb 6 ounces	7 DBO fb Dec fb Feb	55 b	87 abc	97 abc
Barricade fb Monument fb	0.75 pound ai fb				
Prograss fb Velocity	0.3 ounce fb 1 pound ai fb 6 ounces	60 DBO fb 7 DBO fb Dec fb Feb	93 a	85 abc	100 a

Abbreviations: NIS, nonionic surfactant added at 0.5% v/v; fb, followed by; DBO, days before overseeding; DAO, days after overseeding.

\*Site 1 was near Clemson, S.C., on a golf course that had used a dinitroaniline pre-emergence herbicide on and off for the past 20 years. Site 2 was near Charleston, S.C., on a golf course that had used a dinitroaniline pre-emergence herbicide for at least 20 continuous years. Site 3 was near Hilton Head, S.C., on a golf course with no previous dinitroaniline pre-emergence herbicide use.

**Table 3.** Percent *Poa annua* control at three sites in April in overseeded Tifway bermudagrass, 2007-2008.



*Poa annua* seedhead control with PGRs

Trade name	Rate/acre	Perennial ryegrass		
		density	<i>Poa annua</i> seedhead control	
		March 2006	April 2006	April 2007
			%	
Proxy 2L	3.4 gallons	93 a	27 cd	88 a
Primo MAXX 1L	11 ounces	83 a-e	22 cd	8 e
Cutless 50WP	3 pounds	75 d-f	93 a	8 e
Trimmit 2SC	16 ounces	83 a-e	83 ab	5 e
Proxy + Primo	1.7 gallons + 5.5 ounces	87 a-d	53 a-c	75 a-c
Proxy + Cutless	1.7 gallons + 1.5 pounds	75 d-f	92 a	63 b-d
Proxy + Trimmit	1.7 gallons + 8 ounces	85 a-d	50 a-c	54 d
Primo + Cutless	5.5 ounces + 1.5 pounds	82 a-f	57a-c	13 e
Primo + Trimmit	5.5 ounces + 8 ounces	92 ab	92 a	8 e
Cutless + Trimmit	1.5 pounds + 8 ounces	72 ef	93 a	7 e
Embark Lite 0.2L	0.6 gallon	80 b-f	40 b-d	90 a
Embark Lite + Proxy	0.3 gallon + 1.7 gallons	78 c-f	43 b-d	83 ab
Embark Lite + Primo	0.3 gallon + 5.5 ounces	82 a-f	28 cd	83 ab
Embark Lite + Cutless	0.3 gallon + 1.5 pounds	70 f	92 a	67 b-d
Embark Lite + Trimmit	0.3 gallon + 8 ounces	88 a-c	87 ab	55 cd

Note: All treatments were applied at 20 gallons/acre (187 liters/hectare) on Feb. 11 and March 11, 2006 or 2007.

Table 4. *Poa annua* seedhead control following applications of various plant growth regulators (PGRs).

applications and/or several warm spring days, perennial ryegrass tillering initiated and PGR-based reductions were negated.

Success when using PGRs to suppress *P. annua* seedheads depends on timing and repeat applications. PGRs do not control emerged seedheads and, therefore, must be applied before seedhead initiation. Typical applications should begin in early winter and be repeated every three to four weeks until seedhead production ceases. This typically translates to monthly application from December through April in the southeastern U.S. If applications are made after seedhead expression or if repeat applications are not religiously made, results are usually disappointing.

***Poa annua* control program**

Most researchers involved in *Poa annua* control research agree that no single product will work perfectly under all conditions, especially when *P. annua* pressure is as heavy as it was in our research sites. Therefore, we have aggressively been developing *P. annua* control programs that require several products, depending on the financial resources available. In Table 3, three separate

and distinct sites were used in 2007-2008, with different results at each site. Barricade provided excellent control at one site, but at the sites where dinitroaniline herbicides had been used for years, control was not as consistent. Again, herbicides used alone had varying results, often providing good to excellent control at one or two, but not all three sites. The exception, again, would be Prograss. By itself or in combination with other products, Prograss was part of most consistent control programs. This indicates that a program combining pre-emergence and post-emergence herbicides is necessary for best results.

Because no single product provides 100% control in overseeded fairways containing moderate to heavy *P. annua* populations, courses should consider following a program. The program components listed below have provided the most consistent *P. annua* control, with Table 3 providing typical results from several programs. Of course, each option in the program adds expense, and no herbicide or combination of herbicides will provide 100% control at all locations.

*Option A.* Apply 0.75 pound a.i./acre (0.84 kilogram a.i./hectare) Barricade 60 days before overseeding. Because this product is relatively inexpensive, it should be considered a base product in most programs. Alone, this treatment provides about 75% control, unless it has been used for more than 10 consecutive years. To boost the percentage of control, consider additional options (below).

*Option B.* Apply either 0.5 ounce/acre (35 grams/hectare) TranXit 25DG, 0.3 ounce/acre (21 grams/hectare) Monument 75DF or 9 ounces/acre (0.66 liter/hectare) Revolver 0.19L before overseeding, as indicated on the labels. This assumes overseeding takes place after Oct. 1 (preferably after Oct. 15), which allows as much *P. annua* as possible to germinate before overseeding. Because these are post-emergence herbicides, any *P. annua* that germinates after application will not be satisfactorily controlled. If overseeding earlier than Oct. 1 in the Northern Hemisphere, option B will have diminishing effects.

*Option C.* Apply 1 gallon/acre (9.4 liters/hectare) Prograss 1.5L in early to mid-December for early post-emergence control. Additionally, superintendents could forgo options A and B and make two applications of Prograss at 1 gallon/acre each in late November, followed by another in late December. Note the earlier timing restrictions. Prograss applied earlier will cause green bermudagrass to turn dormant (no long-term problems, though). However, do not apply Prograss after mid-January in the U.S.



*Option D.* In mid- to late February, apply Velocity 17.6 WDG (bispiribac-sodium, Valent) at 6 ounces/acre (0.42 kilogram/hectare) when day/night air temperatures are at least 70/50 F (21/10 C). Note that some yellowing to the perennial ryegrass may occur for about five days after application, but this does not always happen. The appropriate temperatures at the time of application are critical to ensure maximum control. If Velocity is applied when temperatures are lower, the *P. annua* is not growing as actively and the herbicidal effects are reduced.

*Option E.* Use of plant growth regulators. This option can work. However, timing before seedhead initiation and repeat monthly applications are necessary. If the golf course cannot make the repeat applications, this option will be disappointing.

Courses that have not overseeded in several years may just need option A, C or D. If step C were used alone, I would recommend two applications, one in late November followed by another in late December, as discussed earlier.

As *P. annua* pressure increases, however, more of the options are necessary. At a minimum, I would recommend options A and B in heavier *P. annua* populations. Superintendents should scout their fairways in November and early February to determine whether options C and/or D are necessary.

**Acknowledgments**

We conduct numerous *Poa annua* research trials yearly. This would be impossible without the cheerful assistance provided by Alan Estes, Rex Blanton, Jack Harrell III, Jeff Marvin, Jeff Atkinson and Raymond McCauley at Clemson University. The willingness of superintendents to allow us to speckle their courses with studies is also much appreciated. Thanks to Matt Davis and Dave Fonesworth, Boscobel Golf Club, Pendleton, S.C.; Don Garrett, CGCS, The Walker Golf Course, Clemson University, Clemson, S.C.; Jay Gratton, Bill Kennedy, CGCS, and Seth Zeigler, Spring Island Co., Okatie, S.C.; and Scott Ferguson, CGCS, and Karsten McElfresh, Wild Dunes Resort, Isle of Palms, S.C.

Additional mini-field days on *Poa annua* control will be held this spring, so plan on attending to compare and contrast your results with ours.

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Successful *Poa annua* control often requires a program approach. If a step is omitted or not applied at the proper timing, results may be disappointing.

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Bert McCarty (bmcrry@clemson.edu) is a professor of turfgrass science in the horticulture department, Clemson University, Clemson, S.C.



**The research says**

→ For bermudagrass greens overseeded with *Poa trivialis*, the Rubigan 1AS program currently provides the best *P. annua* control.

→ For bermudagrass fairways that go completely dormant in winter and are overseeded with perennial ryegrass, Prograss achieves the most consistent control, but application timing is critical to avoid damage to the bermudagrass.

→ To avoid reduction in effectiveness of dinitroaniline herbicides, do not apply them in the same location for a number of consecutive years.

→ Successful use of PGRs for *P. annua* control depends on timing (they must be applied before seedhead initiation) and repeat applications.

→ A program approach combining both pre- and post-emergence herbicides is most effective.