

# Annual Bluegrass (*Poa annua* L.) Control In Creeping Bentgrass (*Agrostis stolonifera* L.) Putting Greens with Various Combinations of Amicarbazone and Paclobutrazol

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## Introduction

Annual bluegrass (*Poa annua* L.) is a problematic weed in creeping bentgrass (*Agrostis stolonifera* L.) putting greens due to inadequate control options from pre- and postemergent herbicides. Annual bluegrass is capable of producing seedheads at very low mowing heights, creating an uneven putting surface. This weed species is also highly susceptible to many disease-causing pathogens that can inoculate creeping bentgrass (Teuton et al., 2007). To date, annual bluegrass control on creeping bentgrass greens is best achieved through repeat applications of plant growth regulators (PGRs) (Woosley et al., 2003). Paclobutrazol, a gibberellin biosynthesis inhibitor, is currently the most effective PGR labeled for annual bluegrass suppression in creeping bentgrass putting greens. Although paclobutrazol is an effective management tool for suppression of annual bluegrass growth and seedhead production, it does not provide complete annual bluegrass control. Amicarbazone (70WG, Arysta LifeScience) is a photosystem II inhibiting herbicide belonging to the triazolinone family (Dayan et al. 2009). Amicarbazone has shown potential for postemergent annual bluegrass control in cool-season turf, including creeping bentgrass putting greens (Hart, 2010).

## Objective

To determine the effects of various amicarbazone and paclobutrazol treatment regimes on annual bluegrass control and creeping bentgrass quality.

## Materials and Methods

Creeping bentgrass field tolerance trials were conducted on 'A1', 'A4', 'Crenshaw', and 'L-93' cultivars at the North Carolina State University Turf Field Laboratory (Raleigh, NC). Annual bluegrass control trials were conducted on 'Crenshaw' (Governors Club, Chapel Hill, NC) and 'Penncross' (Sandhills Turfgrass Field Laboratory, Jackson Springs, NC) creeping bentgrass putting greens. All trials were initiated on March 8, 2010 and arranged in a randomized complete block design with plots measuring 1 x 2 m. Chemical applications were applied with a CO<sub>2</sub> pressurized sprayer calibrated at 304 L/ha. Treatments included amicarbazone (49, 65, and 92 g ai ha<sup>-1</sup>) and paclobutrazol (70, 140, and 280 g ai ha<sup>-1</sup>) as standalone treatments, tank-mixtures, and the usage of both chemicals at varying rates and sequential timings (Table 1). All amicarbazone treatments included a non-ionic surfactant (0.25% v/v). Visual creeping bentgrass quality was evaluated weekly on a 1 (complete plant death) to 9 (ideal plant growth) scale. Five normalized difference vegetation index (NDVI) readings were taken monthly from each plot at tolerance trial locations. Data were averaged over plots and converted to a grass index to allow for comparisons with visual quality estimations. To determine population decline, annual bluegrass percent cover ratings were rated weekly at control sites. Plot ratings were converted to percent cover reduction using the formula:  $\frac{((\text{nontreated plot cover} - \text{treated plot cover}) / \text{nontreated plot cover}) \times 100}{100}$ . Analysis of variance was conducted using MIXED model methodology (SAS, 2003) and means are reported using Fisher's Protected LSD ( $P < 0.05$ ).

**Table 1.** Herbicide treatments applied for postemergent annual bluegrass control in creeping bentgrass greens.

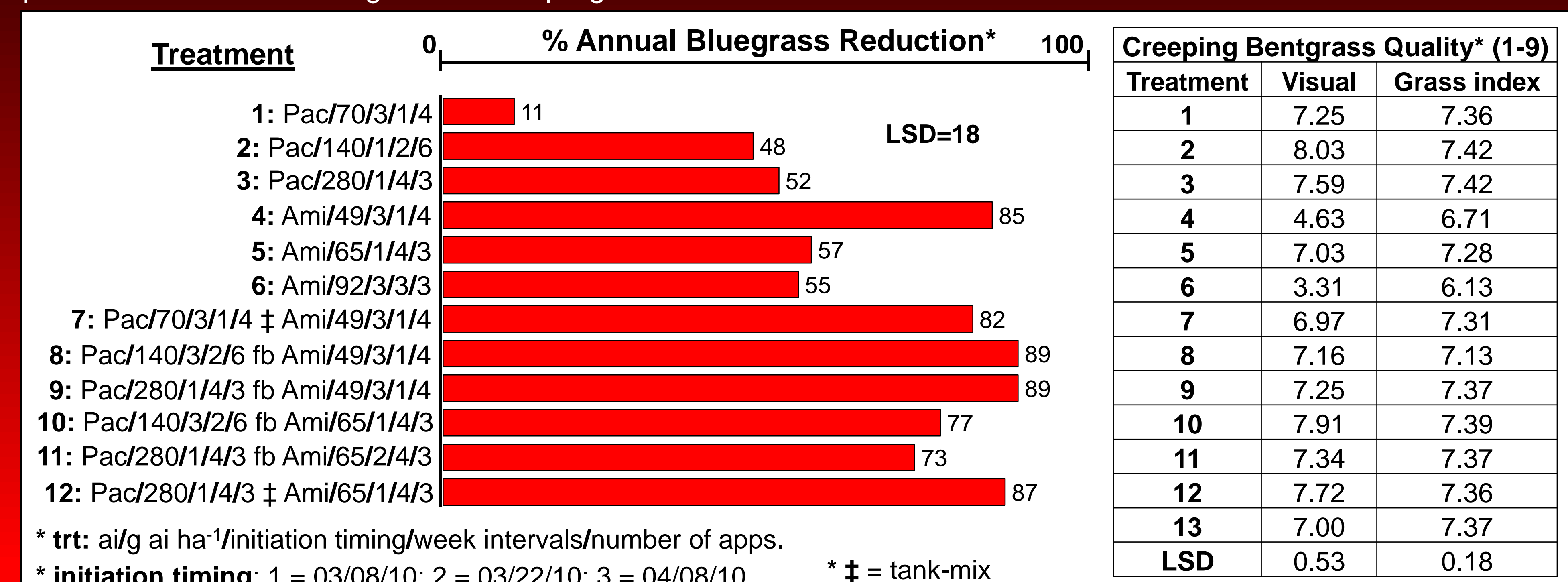
Treatment	Amicarbazone				Paclobutrazol			
	(g ai ha <sup>-1</sup> )	Initiation Timing	Sequential interval (weeks)	Number of applications	(g ai ha <sup>-1</sup> )	Initiation Timing	Sequential interval (weeks)	Number of applications
1	--	--	--	--	70	04/08/10	1	4
2	--	--	--	--	140	03/08/10	2	6
3	--	--	--	--	280	03/08/10	4	3
4	49	04/08/10	1	4	--	--	--	--
5	65	03/08/10	4	3	--	--	--	--
6	92	04/08/10	3	3	--	--	--	--
7 (‡)	49	04/08/10	1	4	70	04/08/10	1	4
8	49	04/08/10	1	4	140	03/08/10	2	6
9	49	04/08/10	1	4	280	03/08/10	4	3
10	65	03/08/10	4	3	140	03/08/10	2	6
11	65	03/22/10	4	3	280	03/08/10	4	3
12 (‡)	65	03/08/10	4	3	280	03/08/10	4	3
13	Nontreated							

\* All amicarbazone treatments included a non-ionic surfactant (0.25% v/v)

\* ‡ = tank-mix

## Results and Discussion

All treatments including amicarbazone on one or three week sequential intervals reduced creeping bentgrass quality six to eight weeks after initial treatment (WAIT) (data not shown). Compared to amicarbazone applied alone (49 g ai ha<sup>-1</sup>), tank-mixtures of paclobutrazol (70 g ai ha<sup>-1</sup>) with amicarbazone (49 g ai ha<sup>-1</sup>) applied on weekly intervals significantly increased creeping bentgrass quality without a significant decrease in annual bluegrass cover reduction 12 WAIT (Figure 1). Three monthly applications of amicarbazone (65 g ai ha<sup>-1</sup>) and paclobutrazol (280 g ai ha<sup>-1</sup>) provided poor annual bluegrass cover reduction ( $\leq 57\%$ ); however, tank-mixing both treatments significantly increased annual bluegrass cover reduction (87%). Aside from this treatments activity on annual bluegrass, visual ratings and NDVI readings at no point over the duration of tolerance trials indicated unacceptable bentgrass quality (data not shown). Compared to paclobutrazol standalone treatments, all treatments utilizing amicarbazone and paclobutrazol significantly decreased annual bluegrass cover. Finally, tolerance trials indicate there is not a reduction in creeping bentgrass quality with the addition of amicarbazone applied on four week intervals in a paclobutrazol annual bluegrass control program.



**Figure 1.** Annual bluegrass percent cover reduction and creeping bentgrass quality 12 WAIT (05/31/10). \*Annual bluegrass cover reduction pooled over two cultivars; Creeping bentgrass quality pooled over four cultivars.

## Conclusions

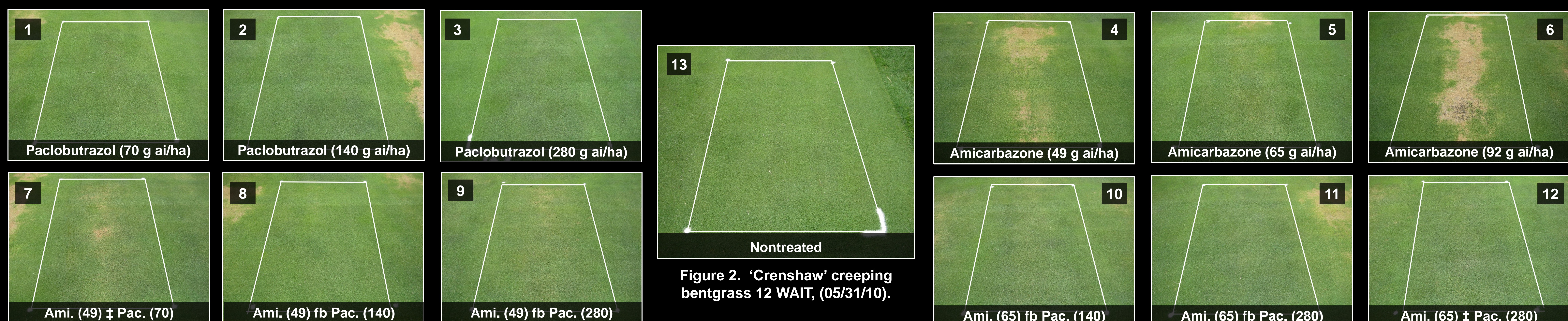
- Annual bluegrass control programs utilizing paclobutrazol treatments may be improved with the addition of amicarbazone.
- Amicarbazone applied on less than four week sequential intervals caused unacceptable creeping bentgrass quality.
- Tank-mixtures of amicarbazone and paclobutrazol reduced annual bluegrass cover while maintaining acceptable creeping bentgrass quality, compared to both applied alone.

## Future Research

- Determine the amount of foliar vs. root absorption of amicarbazone in annual bluegrass and creeping bentgrass.
- Explore creeping bentgrass growth response to amicarbazone applications under various environmental conditions
- Establish management practices to encourage creeping bentgrass canopy closure following annual bluegrass control

## Literature Cited

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**Figure 2.** 'Crenshaw' creeping bentgrass 12 WAIT, (05/31/10).