

Development of Tenacity 4FL for a fairway renovation program to eliminate *Poa annua* (post-emergence) in Kentucky bluegrass

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A study was conducted at the WSU Palouse Ridge Golf Club (PRGC) in Pullman, WA to determine the efficacy of Tenacity applied alone or combined with other grass weed herbicides for post-emergence control of *Poa annua* in a Kentucky bluegrass/*P. annua* fairway. Each treatment was applied to the same plots on 18 May, 8 June, and 29 June 2009 with a bicycle-wheeled CO₂ pressurized sprayer using 11002 flat fan spray nozzles at 40 psi. Individual plot size was 6' x 10'. The experimental design was a randomized complete-block with 3 replications. Initial percentage of *P. annua* within each plot was determined at the beginning and at the end of the study (10 WAIT). One week following the first application of herbicides, phytotoxicity on *P. annua* and Kentucky bluegrass was rated every week or two up to 10 weeks after initial treatment (WAIT). Phytotoxicity was rated from 0 to 10; with 0 = no phytotoxicity and 10 = dead turf.

Tenacity alone did not cause any significant phytotoxicity to *P. annua* until 7 WAIT and 1 week following the third and final application (Table 1). However, Tenacity with Velocity or Velocity alone did result in moderate phytotoxicity to *P. annua* for most of the study up to 8 WAIT. Surprisingly, Tenacity with Prograss and Prograss alone showed little phytotoxicity to *P. annua* throughout the 10 weeks of the study.

Velocity alone or in combination with Tenacity resulted in phytotoxicity above acceptable levels up to 3 weeks after the second and third application dates (Table 2). However, following the first application date the Kentucky bluegrass did not recover from the phytotoxicity by the time the second application was made. Tenacity or Prograss alone, or combined together, resulted in little or no phytotoxicity throughout the 10 weeks of the study. Fig. 1 shows the phytotoxicity of each treatment in Rep 1 at 7 WAIT (6 July 2009).

The percentage of *P. annua* present in each treatment at the beginning compared to the end of the study increased for all treatments (Table 3). This obviously was not what was anticipated. A reason for this may be that the percentage of *P. annua* was underestimated in the spring, since it was hard to tell the difference between Kentucky bluegrass and *P. annua* in the fairway at that time.

Overall, Velocity at the 15 g ai/A rate resulted in phytotoxicity on Kentucky bluegrass above acceptable levels for most of the 10 weeks of the study. Tenacity or Prograss alone, or the combined treatment of the two, caused little or no phytotoxicity to Kentucky bluegrass. No treatment resulted in the elimination of *P. annua* from the Kentucky bluegrass/*P. annua* fairway.

Table 1. Phytotoxicity of Tenacity alone or mixed with grass weed herbicides on *Poa annua* in a Kentucky bluegrass/*Poa annua* golf course fairway.

Trt No.	Treatment	Chemical name	Rate		App. date	<i>Poa annua</i> phytotoxicity (rated 0 - 10)*									
			(lbs or g ai/A)	NIS** (% V/V)		5/25/09	6/1/09	6/8/09	6/15/09	6/29/09	7/6/09	7/13/09	7/28/09		
						1 WAIT	2 WAIT	3 WAIT	4 WAIT	6 WAIT	7 WAIT	8 WAIT	10 WAIT		
1	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09	0.0	0.7 c***	0.0 c	0.0 c	0.0	2.0 b	0.0 c	0.0		
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09										
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/29/09										
2	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09	0.0	4.0 a	3.7 a	3.7 a	0.0	3.0 a	1.7 b	0.0		
	+ Velocity	Bispyribac-sodium	15 g												
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09										
	+ Velocity	Bispyribac-sodium	15 g												
3	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/29/09										
	+ Velocity	Bispyribac-sodium	15 g												
	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	5/18/09	0.0	2.7 b	2.7 b	2.7 b	0.0	3.3 a	2.7 a	0.0		
4	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	6/8/09										
	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	6/29/09										
	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	6/29/09										
4	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09	0.0	0.0 c	0.0 c	0.0 c	0.0	1.0 c	0.0 c	0.0		
	+ Prograss	Ethofumesate	0.38 lb												
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09										
	+ Prograss	Ethofumesate	0.38 lb												
5	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/29/09										
	+ Prograss	Ethofumesate	0.38 lb												
	+ Prograss	Ethofumesate	0.38 lb												
5	Prograss	Ethofumesate	0.38		5/18/09	0.0	0.3 c	0.3 c	0.3 c	0.0	0.3 d	0.0 c	0.0		
	Prograss	Ethofumesate	0.38		6/8/09										
	Prograss	Ethofumesate	0.38		6/29/09										
6	Check					0.0	0.0 c	0.0 c	0.0 c	0.0	0.0 d	0.0 c	0.0		

*Phytotoxicity was rated on a scale from 0 to 10; with 0 = no visible phytotoxicity. Acceptable level of phytotoxicity ≤ 2.

**NIS = non-ionic surfactant. (Activator 90).

***Means within a column followed by the same letter are not significantly different. LSD P = 0.05.

Table 2. Phytotoxicity of Tenacity alone or mixed with grass weed herbicides on Kentucky bluegrass in a Kentucky bluegrass/*Poa annua* golf course fairway.

Trt No.	Treatment	Chemical name	Rate		App. date	Kentucky bluegrass phytotoxicity (rated 0 - 10)*									
			(lbs or g ai/A)	NIS** (% V/V)		5/25/09	6/1/09	6/8/09	6/15/09	6/29/09	7/6/09	7/13/09	7/28/09		
						1 WAIT	2 WAIT	3 WAIT	4 WAIT	6 WAIT	7 WAIT	8 WAIT	10 WAIT		
1	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09	0.0 c***	0.0 c	0.0 c	0.0 c	0.0	0.0 b	0.0 c	0.0		
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09										
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/29/09										
2	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09	3.0 a	3.7 a	3.0 a	3.0 a	0.0	3.0 a	3.7 b	0.0		
	+ Velocity	Bispyribac-sodium	15 g												
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09										
	+ Velocity	Bispyribac-sodium	15 g												
3	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/29/09										
	+ Velocity	Bispyribac-sodium	15 g												
	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	5/18/09	2.3 b	2.3 b	2.3 b	2.3 b	0.0	3.3 a	5.3 a	0.0		
4	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	6/8/09										
	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	6/29/09										
	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	6/29/09										
4	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09	0.0 c	0.0 c	0.0 c	0.0 c	0.0	0.0 b	0.0 c	0.0		
	+ Prograss	Ethofumesate	0.38 lb												
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09										
	+ Prograss	Ethofumesate	0.38 lb												
5	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/29/09										
	+ Prograss	Ethofumesate	0.38 lb												
	+ Prograss	Ethofumesate	0.38 lb												
5	Prograss	Ethofumesate	0.38		5/18/09	0.0 c	0.3 c	0.3 c	0.3 c	0.0	0.0 b	0.0 c	0.0		
	Prograss	Ethofumesate	0.38		6/8/09										
	Prograss	Ethofumesate	0.38		6/29/09										
6	Check					0.0 c	0.0 c	0.0 c	0.0 c	0.0	0.0 b	0.0 c	0.0		

*Phytotoxicity was rated on a scale from 0 to 10; with 0 = no visible phytotoxicity. Acceptable level of phytotoxicity ≤ 2.

**NIS = non-ionic surfactant. (Activator 90).

***Means within a column followed by the same letter are not significantly different. LSD P = 0.05.

Table 3. Percentage of *P. annua* present at the beginning and end of the study.

Trt No.	Treatment	Chemical name	Rate (lbs or g ai/A)	NIS* (% V/V)	App. date	<i>Poa annua</i> (% of plot area)	
						5/18/09 0 WAIT	7/28/09 10 WAIT
1	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09	21.7	33.3
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09		
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/29/09		
2	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09	20.0	31.7
	+ Velocity	Bispyribac-sodium	15 g				
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09		
	+ Velocity	Bispyribac-sodium	15 g				
3	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/29/09	18.3	33.3
	+ Velocity	Bispyribac-sodium	15 g				
	+ Velocity	Bispyribac-sodium	15 g				
4	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	5/18/09	17.3	21.7
	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	6/8/09		
	Velocity + NIS	Bispyribac-sodium	15 g	0.25%	6/29/09		
	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	5/18/09		
	+ Prograss	Ethofumesate	0.38 lb				
5	Tenacity 4FL + NIS	Mesotrione	0.156 lb	0.25%	6/8/09	17.3	35.0
	+ Prograss	Ethofumesate	0.38 lb				
	+ Prograss	Ethofumesate	0.38 lb				
6	Prograss	Ethofumesate	0.38		5/18/09	23.3	48.3
	Prograss	Ethofumesate	0.38		6/8/09		
	Prograss	Ethofumesate	0.38		6/29/09		
6	Check					23.3	48.3

*NIS = non-ionic surfactant. (Activator 90).

Figure 1. Rep 1 of the *Poa annua* control study on the 9th fairway at the Palouse Ridge Golf Club. Photo taken on 6 Jul 2009 (7 WAIT and 1 week after the 3rd and final application).

