Annual Bluegrass Control in Fairway Height Creeping Bentgrass

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Introduction

This study was conducted on a mature, mixed stand of 'Penneagle II' creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) at the Valentine Turfgrass Research Center, Penn State University, University Park, PA. The objective of the study was to determine if selected materials could reduce the annual bluegrass population after applications in two consecutive growing seasons under simulated golf course fairway conditions.

Methods and Materials

This study was a randomized complete block design with three replications. Treatments were applied on May 25 (POA), June 2 (7 DAT), June 13 (14 DAT), June 17 (21 DAT), July 7 (42 DAT), July 27, 2011 (63 DAT), and again on May 31 (POA), June 7 (7 DAT), June 13 (14 DAT), June 22 (21 DAT), July 25 (42 DAT), and August 13, 2012 (63 DAT) using a three foot CO_2 powered boom sprayer (Figure 1) calibrated to deliver 87.12gpa using one, flat fan, TP9508EVS nozzle at 40 psi. The test area was maintained at 0.5 inch using a five-plex John Deere reel mower. Additionally, turfgrass was irrigated on an as needed basis to prevent moisture stress. The test area (Figure 2) received maintenance fungicide applications to control disease.

The test site consisted of approximately 40 percent creeping bentgrass and 60 percent annual bluegrass at the initiation of the study in 2011 and contained approximately 70 percent creeping bentgrass and 30 percent annual bluegrass at the resumption of the study in 2012.

Results and Discussion from 2011

Creeping bentgrass phytotoxicity was rated four times during the study (Table 1). On every rating date there was at least one instance of unacceptable phytotoxicity observed. It should be noted that turfgrass treated with Xonerate at 3 oz/A plus Agridex at 0.25% v/v revealed unacceptable phytotoxicity on every rating date. It appears there may be a trend that earlier applications at lower rates have no unacceptable phytotoxicity.

Annual bluegrass phytotoxicity was rated four times during the study (Table 3). All treated annual bluegrass revealed some level of phytotoxicity. This would be expected as the objective of the study was to eliminate the weed.

Turfgrass color was rated once on July 6, 2011 (Table 5). All turfgrass revealed acceptable color (higher than 7.0).

A turfgrass quality rating was taken on August 2, 2011 (Table 6). The quality rating included the following factors; turfgrass color, turfgrass density, and uniformity of the turfgrass stand. Turfgrass treated with Xonerate at 3 oz/A plus Agridex at 0.25% v/v applied four times during the study was rated with less than acceptable quality.

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Results and Discussion from 2012 and 2013

Creeping bentgrass and annual bluegrass and phytotoxicity were rated during the study (Tables 2 and 4) No phytotoxicity was observed.

Turfgrass quality was rated six times during the study (Table 7). The quality rating included the following factors, turfgrass density, and uniformity of the turfgrass stand. All turfgrass had acceptable quality for the duration of the study. .

Annual bluegrass control was evaluated once in 2011 and once in 2012 (Table 8). The amount of control was variable during this study. These ratings give some insight to the populations of annual bluegrass. In the spring of 2013 the final populations of annual bluegrass were rated (Table 9). The percent control was calculated for the populations found on the last rating date in 2012. There was no additional annual bluegrass control found in 2013 of significance. Therefore, all treated turfgrass in 2012 held the annual bluegrass in check not allowing additional population increases in spring of 2013.

Table 1. 'Penneagle II' creeping bentgrass phytotoxicity from 0-10, where 0 = dead turf, 7 = acceptable, and 10 = no phytotoxicity in 2011.

Treatment	Form	Rate	Timing	(----------Bentgrass Phytotoxicity----------)			
		oz/A		6/1/11	6/22/11	7/18/11	8/2/11
XONERATE	70WDG	1	POA/7/14/21 DAT	8.2	9.0	10.0	10.0
AGRIDEX	L	0.25% v/v	POA/7/14/21 DAT				
XONERATE	70WDG	2	POA	7.5	10.0	10.0	10.0
AGRIDEX	L	0.25% v/v	POA				
XONERATE	70WDG	3	POA	7.0	10.0	10.0	10.0
AGRIDEX	L	0.25% v/v	POA				
XONERATE	70WDG	4	POA	6.3	9.2	10.0	10.0
AGRIDEX	L	0.25% v/v	POA				
CHECK				10.0	10.0	10.0	10.0
XONERATE	70WDG	2	POA/21/42/63 DAT	7.8	10.0	6.7	6.3
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
TRIMMIT	2SC	0.25 lb ai/A	POA	8.7	7.7	8.0	7.3
XONERATE	70WDG	0.5	POA/21/42/63 DAT	9.3	10.0	10.0	8.3
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
XONERATE	70WDG	1.0	POA/21/42/63 DAT	8.5	10.0	9.5	8.3
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
XONERATE	70WDG	3.0	POA/21/42/63 DAT	6.8	6.8	6.3	6.0
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
XONERATE	70WDG	1	POA	7.7	10.0	10.0	10.0
AGRIDEX	L	0.25% v/v	POA				
TRIMMIT	2SC	0.125 lb ai/A	POA				
XONERATE	70WDG	1.0	POA/21/42/63 DAT	7.8	7.0	7.8	7.5
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT				

Table 2. 'Penneagle II' creeping bentgrass phytotoxicity on a scale of 0-10, where 0 = dead turf, 7 = acceptable, and 10 = no phytotoxicity in 2012.

Treatment	Form	Rate	Timing	(----------Bentgrass Phytotoxicity----------)					
		oz/A		6/29/12	7/6/12	7/20/12	8/3/12	8/17/12	8/31/12
XONERATE	70WDG	1	POA/7/14/21 DAT	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	2	POA	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	3	POA	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	4	POA	10.0	10.0	10.0	10.0	10.0	10.0
CHECK				10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	2	POA/21/42/63 DAT	10.0	10.0	10.0	10.0	10.0	10.0
TRIMMIT	2SC	0.25 lb ai/A	POA	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	0.5	POA/21/42/63 DAT	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	1.0	POA/21/42/63 DAT	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	1	POA	10.0	10.0	10.0	10.0	10.0	10.0
TRIMMIT	2SC	0.125 lb ai/A	POA						
XONERATE	70WDG	1.0	POA/21/42/63 DAT	10.0	10.0	10.0	10.0	10.0	10.0
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT						

Table 3 Annual bluegrass phytotoxicity on a scale of 0-10, where 0 = dead turf, 7 = acceptable, and 10 = no phytotoxicity in 2011.

Treatment	Form	Rate	Timing	(------Annual Bluegrass Phytotoxicity------)			
		oz/A		6/1/11	6/22/11	7/18/11	8/2/11
XONERATE	70WDG	1	POA/7/14/21 DAT	7.5	9.0	10.0	10.0
AGRIDEX	L	0.25% v/v	POA/7/14/21 DAT				
XONERATE	70WDG	2	POA	7.0	10.0	10.0	10.0
AGRIDEX	L	0.25% v/v	POA				
XONERATE	70WDG	3	POA	6.7	10.0	10.0	10.0
AGRIDEX	L	0.25% v/v	POA				
XONERATE	70WDG	4	POA	5.8	9.2	10.0	10.0
AGRIDEX	L	0.25% v/v	POA				
CHECK				10.0	10.0	10.0	10.0
XONERATE	70WDG	2	POA/21/42/63 DAT	6.7	10.0	6.7	7.0
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
TRIMMIT	2SC	0.25 lb ai/A	POA	8.3	7.0	7.2	7.0
XONERATE	70WDG	0.5	POA/21/42/63 DAT	9.0	10.0	10.0	7.3
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
XONERATE	70WDG	1.0	POA/21/42/63 DAT	7.5	10.0	9.3	7.5
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
XONERATE	70WDG	3.0	POA/21/42/63 DAT	6.7	7.0	5.7	6.7
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
XONERATE	70WDG	1	POA	7.0	10.0	10.0	10.0
AGRIDEX	L	0.25% v/v	POA				
TRIMMIT	2SC	0.125 lb ai/A	POA				
XONERATE	70WDG	1.0	POA/21/42/63 DAT	6.8	7.0	6.8	7.0
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT				
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT				

Table 4. Annual bluegrass phytotoxicity on a scale of 0-10, where 0 = dead turf, 7 = acceptable, and 10 = no phytotoxicity in 2012.

Treatment	Form	Rate	Timing	(----------Annual Bluegrass Phytotoxicity----------)						
		oz/A		6/22/12	6/29/12	7/6/12	7/20/12	8/3/12	8/17/12	8/31/12
XONERATE	70WDG	1	POA/7/14/21 DAT	10.0	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	2	POA	10.0	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	3	POA	10.0	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	4	POA	10.0	10.0	10.0	10.0	10.0	10.0	10.0
CHECK				10.0	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	2	POA/21/42/63 DAT	10.0	10.0	10.0	10.0	10.0	10.0	10.0
TRIMMIT	2SC	0.25 lb ai/A	POA	10.0	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	0.5	POA/21/42/63 DAT	10.0	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	1.0	POA/21/42/63 DAT	10.0	10.0	10.0	10.0	10.0	10.0	10.0
XONERATE	70WDG	1	POA	10.0	10.0	10.0	10.0	10.0	10.0	10.0
TRIMMIT	2SC	0.125 lb ai/A	POA							
XONERATE	70WDG	1.0	POA/21/42/63 DAT	10.0	10.0	10.0	10.0	10.0	10.0	10.0
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT							

Table 5. Turfgrass color on a scale of 0-10, where 0 = brown turf, 7 = acceptable, and 10 = dark green turf in 2011.

Treatment	Form	Rate oz/A	Timing	(---Color---) 7/6/11
XONERATE	70WDG	1	POA/7/14/21 DAT	8.0
AGRIDEX	L	0.25% v/v	POA/7/14/21 DAT	
XONERATE	70WDG	2	POA	8.5
AGRIDEX	L	0.25% v/v	POA	
XONERATE	70WDG	3	POA	8.5
AGRIDEX	L	0.25% v/v	POA	
XONERATE	70WDG	4	POA	8.5
AGRIDEX	L	0.25% v/v	POA	
CHECK				8.3
XONERATE	70WDG	2	POA/21/42/63 DAT	8.3
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
TRIMMIT	2SC	0.25 lb ai/A	POA	8.3
XONERATE	70WDG	0.5	POA/21/42/63 DAT	8.5
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	1.0	POA/21/42/63 DAT	8.5
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	3.0	POA/21/42/63 DAT	8.0
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	1	POA	8.5
AGRIDEX	L	0.25% v/v	POA	
TRIMMIT	2SC	0.125 lb ai/A	POA	
XONERATE	70WDG	1.0	POA/21/42/63 DAT	8.2
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT	

Table 6. Turfgrass quality on a scale of 0-10, where 0 = poor quality, 7 = acceptable, and 10 = excellent quality in 2011.

Treatment	Form	Rate oz/A	Timing	(--Quality--) 8/2/11
XONERATE	70WDG	1	POA/7/14/21 DAT	9.0
AGRIDEX	L	0.25% v/v	POA/7/14/21 DAT	
XONERATE	70WDG	2	POA	9.0
AGRIDEX	L	0.25% v/v	POA	
XONERATE	70WDG	3	POA	9.0
AGRIDEX	L	0.25% v/v	POA	
XONERATE	70WDG	4	POA	9.0
AGRIDEX	L	0.25% v/v	POA	
CHECK				9.0
XONERATE	70WDG	2	POA/21/42/63 DAT	8.0
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
TRIMMIT	2SC	0.25 lb ai/A	POA	8.3
XONERATE	70WDG	0.5	POA/21/42/63 DAT	8.8
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	1.0	POA/21/42/63 DAT	8.7
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	3.0	POA/21/42/63 DAT	6.0
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	1	POA	9.0
AGRIDEX	L	0.25% v/v	POA	
TRIMMIT	2SC	0.125 lb ai/A	POA	
XONERATE	70WDG	1.0	POA/21/42/63 DAT	8.5
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT	

Table 7. Turfgrass quality on a scale of 0-10, where 0 = poor quality, 7 = acceptable, and 10 = excellent quality in 2012.

Treatment	Form	Rate	Timing	(-------Quality------)	
		oz/A		7/6/12	8/31/12
XONERATE	70WDG	1	POA/7/14/21 DAT	9.0	9.5
XONERATE	70WDG	2	POA	9.0	9.5
XONERATE	70WDG	3	POA	9.0	9.5
XONERATE	70WDG	4	POA	9.0	9.5
CHECK				9.0	9.5
XONERATE	70WDG	2	POA/21/42/63 DAT	9.0	9.5
TRIMMIT	2SC	0.25 lb ai/A	POA	9.0	9.5
XONERATE	70WDG	0.5	POA/21/42/63 DAT	9.0	9.5
XONERATE	70WDG	1.0	POA/21/42/63 DAT	9.0	9.5
XONERATE	70WDG	1	POA	9.0	9.5
TRIMMIT	2SC	0.125 lb ai/A	POA		
XONERATE	70WDG	1.0	POA/21/42/63 DAT	9.0	9.5
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT		

Table 8. Percent control of annual bluegrass in a mixed fairway height sward with 'Penneagle II' creeping bentgrass in 2011 and 2012.

Treatment	Form	Rate	Timing	(----% Control[1]----)	
		oz/A		11/2/11	4/12/12
XONERATE	70WDG	1.0	POA/7/14/21 DAT	76.5b	65.3bc
AGRIDEX	L	0.25% v/v	POA/7/14/21 DAT		
XONERATE	70WDG	2.0	POA	28.9e	35.0e
AGRIDEX	L	0.25% v/v	POA		
XONERATE	70WDG	3.0	POA	59.4c	56.9cd
AGRIDEX	L	0.25% v/v	POA		
XONERATE	70WDG	4.0	POA	42.6d	54.1d
AGRIDEX	L	0.25% v/v	POA		
CHECK				0.0f	0.0f
XONERATE	70WDG	2.0	POA/21/42/63 DAT	61.9c	67.4b
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT		
TRIMMIT	2SC	0.25 lb ai/A	POA	86.7a	80.0a
XONERATE	70WDG	0.5	POA/21/42/63 DAT	56.1c	53.0d
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT		
XONERATE	70WDG	1.0	POA/21/42/63 DAT	38.3d	41.1e
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT		
XONERATE	70WDG	3.0	POA/21/42/63 DAT	91.3a	76.5a
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT		
XONERATE	70WDG	1.0	POA	58.8c	58.8cd
AGRIDEX	L	0.25% v/v	POA		
TRIMMIT	2SC	0.125 lb ai/A	POA		
XONERATE	70WDG	1.0	POA/21/42/63 DAT	82.3ab	79.3a
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT		
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT		

1 - Means followed by same letter do not significantly differ (P=0.05, Duncan's New MRT)

Table 9. Percent control of annual bluegrass in a mixed fairway height sward with 'Penneagle II' creeping bentgrass in 2013.

Treatment	Form	Rate oz/A	Timing	(% Control[1]) 5/6/13
XONERATE	70WDG	1.0	POA/7/14/21 DAT	0.0 a
AGRIDEX	L	0.25% v/v	POA/7/14/21 DAT	
XONERATE	70WDG	2.0	POA	0.0 a
AGRIDEX	L	0.25% v/v	POA	
XONERATE	70WDG	3.0	POA	0.0 a
AGRIDEX	L	0.25% v/v	POA	
XONERATE	70WDG	4.0	POA	0.0 a
AGRIDEX	L	0.25% v/v	POA	
CHECK				0.0 a
XONERATE	70WDG	2.0	POA/21/42/63 DAT	0.0 a
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
TRIMMIT	2SC	0.25 lb ai/A	POA	0.0 a
XONERATE	70WDG	0.5	POA/21/42/63 DAT	6.7 a
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	1.0	POA/21/42/63 DAT	0.0 a
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	3.0	POA/21/42/63 DAT	0.0 a
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
XONERATE	70WDG	1.0	POA	6.7 a
AGRIDEX	L	0.25% v/v	POA	
TRIMMIT	2SC	0.125 lb ai/A	POA	
XONERATE	70WDG	1.0	POA/21/42/63 DAT	0.0 a
AGRIDEX	L	0.25% v/v	POA/21/42/63 DAT	
TRIMMIT	2SC	0.125 lb ai/A	POA/21/42/63 DAT	

1 - Means followed by same letter do not significantly differ (P=0.05, Duncan's New MRT)

Figure 1: CO_2 powered boom sprayer used for application of liquid materials.

Figure 2: 2011 overview of the test area showing phytotoxicity one week after application. This level of phytotoxicity was not observed after treatments in the 2012 growing season.