IMPACT OF VARIOUS SYNGENTA PRODUCTS ON TURFGRASS QUALITY ON A RESEARCH PUTTING GREEN DURING HEAT STRESS AND RESTRICTED IRRIGATION

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INTRODUCTION

Putting greens are the most critical playing surface on golf courses. In addition to many physical stresses, putting green turfgrass is also subjected to abiotic stresses such as heat and periods of reduced available moisture. The objective of this study was to evaluate various Syngenta products' ability to improve plant health and subsequent recovery during/after a period of stressful environmental conditions.

MATERIALS & METHODS

This one-year field study was initiated at the Valentine Turfgrass Research Center located in University Park, PA. The study area consisted of a stand of 50/50 'Penn A-4' creeping bentgrass (*Agrostis stolonifera*) annual bluegrass (*Poa annua L.*) *on* a USGA style rootzone with a pH of 7.4 and 1.3% organic matter. The area was maintained as a golf course putting green and mowed five times per week to a height of 0.110 inch prior to trial initiation. All treatments were applied with a CO_2 pressurized (45 psi) sprayer equipped with an air-induction flat fan nozzle (TeeJet, AI9508EVS) calibrated to deliver 2.0 gal of water 1000 ft^{-2}. Application were initiated on 30 Jun and applied according to the application schedule. All treatments and application dates are listed in the data tables. From 25 Jul to 9 Aug the trial was not irrigated.

Plots measured 3 ft x 6 ft and were arranged as a randomized complete block design with four replications. Turfgrass quality and/or color were visually rated on a 1 to 9 scale where 1 = entire plot brown or dead and 9 = optimum greenness and/or density. Soil volumetric water content (VWC) was collected using a Field Scout TDR 300. All data were subjected to analysis of variance and means were separated at $P \leq 0.05$ according to Fisher's Protected least significant difference test.

Figure1. Syngenta dry-down study at the Valentine Turfgrass Research Center, 2016.

RESULTS & DISCUSSION

At the initiation of the trial, all plots had acceptable quality and color (≥ 6) (Tables 1 & 2). As irrigation was withheld from the trial, reductions in both the quality and color of the plots were observed. The negative impact of stress on quality and color peaked 14 days (8 Aug) after irrigation began being withheld. All plots had recovered to acceptable levels of color and quality by 15 Aug (7 days after irrigatrion operations were restored).

Quality: With few exceptions, turfgrass quality within all plots had acceptable quality for the duration of the study. On one rating date (8 Aug) plots treated with Daconil Action + Appear, Heritage Action + Appear, Daconil Weatherstik Heritage Action + Appear + Primo, or the

untreated control had unacceptable quality, (Table 1). On the same rating date, plots treated with Daconil Action, Heritage Action, Heritage, Daconil Action + Primo, or Heritage Action + Primo were observed to have the highest levels of turfgrass quality (6.3 to 7.0) when compared to the nontreated controls (5.3 to 5.5) (Table 1). On the final rating date (22 Aug), plots treated with Daconil Action, Daconil Action + Appear, Daconil WeatherStik + Heritage Action + Primo, or Daconil WeatherStik + Heritage Action + Appear + Primo were observed to have the highest turfgrass quality (7.3 to 7.3) when compared to the nontreated control (6.5) (Table 1).

Color: On 8 Aug all treatments were observed to have unacceptable color ratings (<6), however, no statistical differences in color ratings among treatments were observed during this study (Table 2).

VWC: Volumetric water content steadily decreased upon the withholding of irrigation. On 8 Aug, all plots were near the permanent wilting point of the sand rootzone (approximately 10%), however, as with color ratings, no statistical differences in VWC were observed among treatments during the study (Table 3).

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Table 1. Quality on a research putting green following the application of various commercially available fungicides, 2016.

	Treatment and rate per 1000 sq ft[y]	Application code[y]	Quality[z]				
			25 Jul	1 Aug	8 Aug	15 Aug	22 Aug
1	Daconil Action 3.5 fl oz	ABCD	7.0 a[x]	6.8 a	6.8 ab	7.0 a	7.3 a
2	Daconil WeatherStik 3.6 fl oz	ABCD	7.0 a	6.8 a	6.0 b-e	6.8 ab	7.0 ab
3	Heritage Action 0.2 oz	ABCD	7.0 a	7.0 a	6.5 abc	6.8 ab	7.0 ab
4	Heritage 0.2 oz	ABCD	7.0 a	6.5 a	6.8 ab	7.0 a	7.0 ab
5	Daconil Action 3.5 fl oz	ABCD	7.0 a	7.0 a	7.0 a	7.0 a	7.0 ab
	Primo Maxx 0.125 fl oz	ABCD					
6	Heritage Action 0.2 oz	ABCD	7.0 a	6.3 a	6.3 a-d	6.3 bc	7.0 ab
	Primo Maxx 0.125 fl oz	ABCD					
7	Daconil Action 3.5 fl oz	ABCD	7.0 a	6.5 a	5.5 de	6.3 bc	7.3 a
	Appear 6 fl oz	ABCD					
8	Heritage Action 0.2 oz	ABCD	7.0 a	6.3 a	5.3 e	6.3 bc	7.0 ab
	Appear 6 fl oz	ABCD					
9	Daconil WeatherStik 3.6 fl oz	ABCD	7.0 a	6.8 a	5.8 cde	6.5 abc	7.5 a
	Heritage Action 0.2 oz	ABCD					
	Primo Maxx 0.125 fl oz	ABCD					
10	Daconil WeatherStik 3.6 fl oz	ABCD	7.0 a	6.5 a	6.0 b-e	6.0 c	7.5 a
	Heritage Action 0.2 oz	ABCD					
	Appear 6 fl oz	ABCD					
	Primo Maxx 0.125 fl oz	ABCD					
11	Nontreated	-	7.0 a	6.5 a	5.5 de	6.5 abc	6.5 b
12	Nontreated	-	7.0 a	6.5 a	5.3 e	6.3 bc	6.5 b

[z] Quality was visually assessed on a 1 to 9 scale where 1 = entire thinned/bare and 9 = optimum uniformity and density.

[y] Treatments were applied on the following dates: A = 24 Jun, B = 8 Jul, C = 22 Jul, D = 5 Aug.

[x] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to the Fisher's Protected least significant difference test.

Table 2. Color on a research putting green following the application of various commercially available fungicides, 2016.

	Treatment and rate per 1000 sq ft[y]	Application code[y]	Color[z]				
			25 Jul	1 Aug	8 Aug	15 Aug	22 Aug
1	Daconil Action 3.5 fl oz	ABCD	8.0 a[x]	6.3 a	5.3 a	6.0 a	7.0 a
2	Daconil WeatherStik 3.6 fl oz	ABCD	8.0 a	6.5 a	5.5 a	6.5 a	7.3 a
3	Heritage Action 0.2 oz	ABCD	8.0 a	6.5 a	5.3 a	6.3 a	6.8 a
4	Heritage 0.2 oz	ABCD	8.0 a	6.3 a	5.8 a	6.5 a	7.0 a
5	Daconil Action 3.5 fl oz	ABCD	8.0 a	6.3 a	5.8 a	6.3 a	7.0 a
	Primo Maxx 0.125 fl oz	ABCD					
6	Heritage Action 0.2 oz	ABCD	8.0 a	6.5 a	5.3 a	6.0 a	6.8 a
	Primo Maxx 0.125 fl oz	ABCD					
7	Daconil Action 3.5 fl oz	ABCD	8.0 a	6.0 a	5.5 a	6.0 a	6.8 a
	Appear 6 fl oz	ABCD					
8	Heritage Action 0.2 oz	ABCD	8.0 a	6.5 a	5.3 a	6.0 a	6.8 a
	Appear 6 fl oz	ABCD					
9	Daconil WeatherStik 3.6 fl oz	ABCD	8.0 a	6.5 a	5.5 a	6.0 a	7.0 a
	Heritage Action 0.2 oz	ABCD					
	Primo Maxx 0.125 fl oz	ABCD					
10	Daconil WeatherStik 3.6 fl oz	ABCD	8.0 a	6.3 a	5.5 a	6.0 a	7.0 a
	Heritage Action 0.2 oz	ABCD					
	Appear 6 fl oz	ABCD					
	Primo Maxx 0.125 fl oz	ABCD					
11	Nontreated	-	8.0 a	6.0 a	4.8 a	5.8 a	7.3 a
12	Nontreated	-	8.0 a	6.3 a	4.8 a	6.0 a	6.8 a

[z] Quality was visually assessed on a 1 to 9 scale where 1 = entire plot brown and 9 = optimum greenness.

[y] Treatments were applied on the following dates: A = 24 Jun, B = 8 Jul, C = 22 Jul, D = 5 Aug.

[x] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to the Fisher's Protected least significant difference test.

Table 3. Volumetric water content on research putting green following the application of various commercially available fungicides, 2016.

		Application	VWC[z]				
	Treatment and rate per 1000 sq ft[y]	code[y]	25 Jul	27 Jul	29 Jul	1 Aug	3 Aug
1	Daconil Action 3.5 fl oz	ABCD	26.7 a[x]	17.9 a	20.0 a	18.7 a	17.4 a
2	Daconil WeatherStik 3.6 fl oz	ABCD	28.9 a	18.5 a	19.7 a	19.6 a	17.6 a
3	Heritage Action 0.2 oz	ABCD	27.6 a	19.0 a	19.6 a	18.9 a	16.5 a
4	Heritage 0.2 oz	ABCD	27.4 a	18.9 a	20.8 a	20.0 a	17.8 a
5	Daconil Action 3.5 fl oz	ABCD	27.7 a	18.4 a	20.0 a	19.0 a	17.5 a
	Primo Maxx 0.125 fl oz	ABCD					
6	Heritage Action 0.2 oz	ABCD	27.2 a	18.8 a	19.8 a	19.1 a	17.0 a
	Primo Maxx 0.125 fl oz	ABCD					
7	Daconil Action 3.5 fl oz	ABCD	28.7 a	19.0 a	18.8 a	18.5 a	15.5 a
	Appear 6 fl oz	ABCD					
8	Heritage Action 0.2 oz	ABCD	25.9 a	17.7 a	20.4 a	17.9 a	16.9 a
	Appear 6 fl oz	ABCD					
9	Daconil WeatherStik 3.6 fl oz	ABCD	26.3 a	18.2 a	18.7 a	18.8 a	16.2 a
	Heritage Action 0.2 oz	ABCD					
	Primo Maxx 0.125 fl oz	ABCD					
10	Daconil WeatherStik 3.6 fl oz	ABCD	27.5 a	19.2 a	18.7 a	18.8 a	15.6 a
	Heritage Action 0.2 oz	ABCD					
	Appear 6 fl oz	ABCD					
	Primo Maxx 0.125 fl oz	ABCD					
11	Nontreated	-	26.6 a	17.8 a	19.3 a	18.6 a	16.2 a
12	Nontreated	-	27.3 a	17.8 a	20.5 a	18.5 a	17.4 a

[z] Soil volumetric water content was collected using a Field Scout TDR 300.

[y] Treatments were applied on the following dates: A = 24 Jun, B = 8 Jul, C = 22 Jul, D = 5 Aug.

[x] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to the Fisher's Protected least significant difference test.

Table 3 (Cont). Volumetric water content on research putting green following the application of various commercially available fungicides, 2016.

	Treatment and rate per 1000 sq ft[y]	Application code[y]	VWC[z]			
			5 Aug	8 Aug	10 Aug	12 Aug
1	Daconil Action 3.5 fl oz	ABCD	15.7 a[x]	10.7 a	18.2 a	19.2 a
2	Daconil WeatherStik 3.6 fl oz	ABCD	15.1 a	10.2 a	16.6 a	18.1 a
3	Heritage Action 0.2 oz	ABCD	15.4 a	11.5 a	18.4 a	19.0 a
4	Heritage 0.2 oz	ABCD	15.9 a	11.6 a	17.6 a	19.8 a
5	Daconil Action 3.5 fl oz	ABCD	15.5 a	11.2 a	18.1 a	19.3 a
	Primo Maxx 0.125 fl oz	ABCD				
6	Heritage Action 0.2 oz	ABCD	15.3 a	11.2 a	17.9 a	19.9 a
	Primo Maxx 0.125 fl oz	ABCD				
7	Daconil Action 3.5 fl oz	ABCD	14.3 a	9.7 a	17.3 a	18.6 a
	Appear 6 fl oz	ABCD				
8	Heritage Action 0.2 oz	ABCD	15.5 a	12.1 a	18.3 a	19.2 a
	Appear 6 fl oz	ABCD				
9	Daconil WeatherStik 3.6 fl oz	ABCD	15.0 a	11.1 a	18.4 a	19.0 a
	Heritage Action 0.2 oz	ABCD				
	Primo Maxx 0.125 fl oz	ABCD				
10	Daconil WeatherStik 3.6 fl oz	ABCD	14.4 a	10.8 a	17.7 a	19.5 a
	Heritage Action 0.2 oz	ABCD				
	Appear 6 fl oz	ABCD				
	Primo Maxx 0.125 fl oz	ABCD				
11	Nontreated	-	14.6 a	11.0 a	17.1 a	17.4 a
12	Nontreated	-	14.9 a	10.2 a	17.1 a	19.2 a

[z] Soil volumetric water content was collected using a Field Scout TDR 300.

[y] Treatments were applied on the following dates: A = 24 Jun, B = 8 Jul, C = 22 Jul, D = 5 Aug.

[x] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to the Fisher's Protected least significant difference test.