

Fungicides for Control of Anthracnose and Summer Patch Diseases on Annual Bluegrass Putting Greens 2018 Report

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The Bottom Line: Thirty-two commercial and experimental fungicide treatments were tested alone or in combination against an untreated control for their ability to control foliar and basal rot anthracnose (*Colletotrichum cereale*) and summer patch (*Magnaporthe poae*) diseases preventatively on annual bluegrass (*Poa annua*) turf maintained as a golf course putting green. Study was conducted at the Turfgrass Research Facility in Riverside. Treatments were applied every 2 wks, starting from June 2018 for a total of 8 applications. Both anthracnose and summer patch diseases symptoms were observed during the study. However, anthracnose was the primary disease that caused turf damage. Despite some initial injury observed within plots treated with the fungicide rotation programs developed by Bayer (Programs No. 1, 2 and 5 in particular), Bayer Programs Nos. 1-3 and No. 5 (containing Mirage Stressgard at 1.0 oz/M, Chipco Signature at 4.0 oz/M or Signature XTRA Stressgard at 5.3 oz/M, Daconil Weatherstik at 3.5 oz/M, Insignia SC Intrinsic at 0.7 oz/M (with or without addition of Affirm WDG at 1.0 oz/M or Exteris Stressgard at 4.0 oz/M) and Primo Maxx at 0.1 oz/M) were generally the best performing treatments in the 2018 study. Among the aforementioned treatments, Bayer Program No. 3 (containing Chipco Signature at 4.0 oz/M and the addition of Affirm WDG at 1.0 oz/M) caused no phytotoxicity effect and was the only treatment maintaining disease incidence below 5% throughout the study, including during peaks of pathogenic activity – September 10 and October 9. Results of this study are also in line with previous reports, showing that whenever high disease pressure is forecasted, a programmatic approach ensures higher chances of success regarding anthracnose disease control and maintaining high quality turf.

Acknowledgments

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Introduction

Anthracnose disease caused by *Colletotrichum cereale* is a common and destructive problem in golf course putting greens - especially when established with annual bluegrass. The disease can infect foliage or can be developed as a basal rot, which attacks the leaf sheaths, crowns, and stolons of the plant. Anthracnose symptoms are highly variable, appearing yellow to orange in color and in an irregular pattern, in small freckle-like spots, or in circular patches up to 1 foot in diameter. On diseased leaves, elongated reddish-brown lesions and numerous black spiny fruiting bodies (acervuli) appear and are important diagnostic features. Symptoms are typically most severe in areas that are stressed from low mowing, excessive traffic,

or inadequate irrigation or fertilization. In annual bluegrass turfgrass death usually occurs during prolonged, hot weather conditions when the plants are weakened and under stress.

Summer patch, caused by *Magnaporthe poae*, is a warm-weather disease that appears as crescent-shaped or circular patches with green centers (frog eyes). Turf within these patches is initially off-colored, prone to wilt, growing poorly, or sunken in the turf stand. Over time, the turf continues to decline, turning yellow or straw brown and eventually collapsing to the soil surface. The outer edges of the patch are usually orange or bronze when the disease is actively developing. The subterranean portions of infected plants are seriously rotted and appear brown to black in color. The pathogen forms dark, surface inhabiting mycelia on infected roots and stems. Symptom development for this disease appears to require stressful conditions (high temperatures and light) and possibly subsequent infection by facultative parasites, including *Fusarium* species.

Objectives

This study was conducted to evaluate ability of 33 different fungicide treatments to control foliar and basal rot anthracnose (*Colletotrichum cereale*) and summer patch (*Magnaporthe poae*) diseases preventatively on annual bluegrass (*Poa annua*) maintained as a golf course putting green.

Materials and Methods

The study was conducted on mature annual bluegrass (*Poa annua*) 'Peterson's Creeping' turf on a Hanford fine sandy loam amended with sand. Green was established in 2007 from seed and plots were originally inoculated with *Colletotrichum* spores grown in the laboratory. In later years, inoculation was achieved through core aeration and dragging in order to spread the existing inoculum.

Turf was mowed 5 days/wk at 0.125 inches and received 0.125 lbs N/1000 ft² in liquid form every 14 days. Fungicide treatments were applied every 14 days beginning on June 6, 2018 (before disease symptoms were present) for a total of 8 applications. Treatments were applied using a CO₂-powered backpack sprayer equipped with TeeJet 8004VS nozzles calibrated to deliver 2 gallons/1000 ft². Experimental design was a complete randomized block with 5 replications. Plot size was 4 ft × 6 ft with 1-ft alleys.

Starting from June 17, plots were evaluated bi-weekly for visual turf quality and visual turf green color intensity (both 1-9; 9=best), injury caused by treatments (phytotoxicity; 0-10; 10=highest), anthracnose and summer patch disease cover (0-100%), disease symptom severity within the affected area (0-10; 10=highest), disease pressure calculated from the two previously mentioned parameters, and normalized difference vegetation index (NDVI) using GreenSeeker. Dark green color index (DGCI) using Digital Image Analysis (DIA) was also evaluated. Data collected throughout the study were analyzed using analysis of variance for each evaluated trait separately and the means were compared using the Fisher's protected least significant difference (LSD) test at the 0.05 probability level ($P \leq 0.05$).

Results

Some severe scalping occurred at the beginning of the study on plots located in replications nos. 1 and 4 due to excessive soil moisture, which resulted in exclusion of those data in statistical analysis performed for the purpose of this report.

Colletotrichum cereale acervuli (Fig. 2) were first noticed in the beginning of July, but significant anthracnose pressure in untreated control plots started in a first half of August and increased over time. Before that, starting on July 17, severe disease pressure (even greater than when compared to control)

started showing within all UCR 001 to 003 treatments and escalated, in most cases until the September 10 (Table 2). Addition of Daconil Weatherstik and Medallion SC to the UCR experimental materials reduced disease symptoms (ca. 20% in average), but there were no significant differences between those treatments and untreated control in terms of disease cover, disease symptom severity and disease pressure by September 10 when the pathogenic activity within those treatments was at its highest level (Table 2). Summer Patch was difficult to distinguish in the 2019 study, because once both pathogens started to become active disease symptoms were indistinguishable. Starting on August 27, both diseases were evaluated together (and referred to as ‘anthracnose disease’) but until then treatment efficacy against summer patch mirrored that of anthracnose (data not shown).

Two peaks of disease pressure were observed throughout this study – September 10 and October 9 (final rating event). Only 4 treatments (Bayer Programs Nos. 1-3 and 5) maintained disease cover at the level below 5% on September 10. Data analysis showed that 12 other treatments were statistically comparable to the aforementioned ‘best performers’. However, only 3 treatments (Intelligro Program No. 2 and Syngenta Programs No. 2 and 3) kept the average disease cover under the level of 15%, therefore, despite the lack of significant differences, remaining treatments were not considered successful (Table 2). Furthermore, on October 9, only Bayer Program No. 3 consistently maintained disease cover below 5%, whereas, in other previously discussed treatments, disease pressure increased. On the same date, coverage equal or below 15% was provided, with Bayer Programs No. 1, 2, 4 and 5, tank-mix of Daconil Weatherstik, Medallion SC and UCR 002 (treatment 15) as well as Intelligro Program No. 3 (Table 2), although, the last two did not provide satisfactory disease control throughout the study (data not shown).

On September 10, the highest turfgrass visual quality was shown with Bayer Programs Nos. 1-3 and 5. Among other treatments resulting in satisfactory quality of turf (equal or above average score of 6), Intelligro Program No. 2, Nivales T and Echo Dyad ETQ tank-mix, Syngenta Programs No. 2 and 3, UCR 004, Maxtima were not statistically different from the highest treatments (Table 2). Furthermore, on October 9, all Bayer Programs demonstrated remarkable (highest) turfgrass visual quality. Tank-mixes of Daconil Action with Medallion SC, UCR 001, UCR 002 and UCR 003 (treatments 14, 15, 18 only) were not statistically different from Bayer Programs on this date, nevertheless those treatments did not demonstrate satisfactory turfgrass visual quality throughout the period of greatest pathogenic activity (Table 2; data not shown).

Bayer Programs Nos. 1-3 and 5 improved color on both dates of highest anthracnose activity (September 10 and October 9). On September 10 they were not statistically different from all Syngenta Programs and UCR 004 treatment, while on October 9, they were no different from Intelligro Program No. 3, tank-mix of Nivales T with Echo Dyad ETQ and all Daconil Weatherstik tank-mixes with Medallion SC and UCR 001-003 treatments (Table 3). However, none of the above-mentioned treatments, apart from Bayer Programs Nos. 1-3 and 5, provided consistent turf color improvement throughout the study (data not shown). Furthermore, visual observations for Bayer Programs Nos. 1-3 and 5 corresponded to NDVI and DGCI measurements on both dates, while data for remaining treatments were not consistent (Tables 3 and 4).

Lastly, it should be emphasized that Bayer Program Nos. 1, 2 and 5 together with UCR 004 resulted in some slight initial injury, likely caused by DMI fungicides (Table 3), from which turf recovered rapidly. No other phytotoxicity was noticed throughout the study with treatments containing Primo Maxx at various rates, although damage caused by UCR 004 persisted at the unacceptable level until August 27 (data not shown).

Tables and Figures

Table 1. Fungicide treatments tested in the preventative foliar and basal rot anthracnose and summer patch diseases control study in Riverside, CA. 2018.

No.	Treatments	Active ingredient(s)	Company	Rate (oz/1000 ft ²)	Timing
1	Untreated Control	-	-	-	-
	<i>Bayer Program No. 1</i>				
	Mirage Stressgard	tebuconazole	Bayer	1.00	ACEG
2	Chipco Signature	aluminium-tris	Bayer	4.00	BDFH
	Daconil Weatherstik	chlorothalonil	Syngenta	3.50	BDFH
	Insignia SC Intrinsic	pyraclostrobin	BASF	0.70	CE
	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
	<i>Bayer Program No. 2</i>				
	Mirage Stressgard	tebuconazole	Bayer	1.00	ACEG
3	Signature XTRA Stressgard	aluminium-tris	Bayer	5.30	BDFH
	Daconil Weatherstik	chlorothalonil	Syngenta	3.50	BDFH
	Insignia SC Intrinsic	pyraclostrobin	BASF	0.70	CE
	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
	<i>Bayer Program No. 3</i>				
	Mirage Stressgard	tebuconazole	Bayer	1.00	AG
4	Chipco Signature	aluminium-tris	Bayer	4.00	BDFGH
	Daconil Weatherstik	chlorothalonil	Syngenta	3.50	BDFH
	Insignia SC Intrinsic	pyraclostrobin	BASF	0.70	CE
	Affirm WDG	polyoxin D zinc salt	Cleary / NuFarm	1.00	CE
	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
	<i>Bayer Program No. 4</i>				
	Mirage Stressgard	tebuconazole	Bayer	1.00	AG
	Chipco Signature	aluminium-tris	Bayer	4.00	BDFGH
5	Daconil Weatherstik	chlorothalonil	Syngenta	3.50	BDFH
	Insignia SC Intrinsic	pyraclostrobin	BASF	0.70	CE
	Exteris Stressgard	fluopyram, trifloxystrobin	Bayer	4.00	CE
	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
	<i>Bayer Program No. 5</i>				
	Mirage Stressgard	tebuconazole	Bayer	1.00	ACEG
6	Chipco Signature	aluminium-tris	Bayer	4.00	ABDFGH
	Daconil Weatherstik	chlorothalonil	Syngenta	3.50	BDFH
	Insignia SC Intrinsic	pyraclostrobin	BASF	0.70	CE
	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
7	UCR 001	<i>classified</i>	-	-	A-H
8	UCR 001	<i>classified</i>	-	-	A-H
9	UCR 002	<i>classified</i>	-	-	A-H
10	UCR 002	<i>classified</i>	-	-	A-H
11	UCR 003	<i>classified</i>	-	-	A-H

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12	UCR 003	<i>classified</i>	-	-	A-H
	Daconil Weatherstik	chlorothalonil	Syngenta	3.60	
13	Medallion SC	fludioxonil	Syngenta	1.00	A-H
	UCR 001	<i>classified</i>	-	-	
	Daconil Weatherstik	chlorothalonil	Syngenta	3.60	
14	Medallion SC	fludioxonil	Syngenta	1.00	A-H
	UCR 001	<i>classified</i>	-	-	
	Daconil Weatherstik	chlorothalonil	Syngenta	3.60	
15	Medallion SC	fludioxonil	Syngenta	1.00	A-H
	UCR 002	<i>classified</i>	-	-	
	Daconil Weatherstik	chlorothalonil	Syngenta	3.60	
16	Medallion SC	fludioxonil	Syngenta	1.00	A-H
	UCR 002	<i>classified</i>	-	-	
	Daconil Weatherstik	chlorothalonil	Syngenta	3.60	
17	Medallion SC	fludioxonil	Syngenta	1.00	A-H
	UCR 003	<i>classified</i>	-	-	
	Daconil Weatherstik	chlorothalonil	Syngenta	3.60	
18	Medallion SC	fludioxonil	Syngenta	1.00	A-H
	UCR 003	<i>classified</i>	-	-	
	Daconil Weatherstik	chlorothalonil	Syngenta	3.60	
19	Medallion SC	fludioxonil	Syngenta	1.00	A-H
	<i>Intelligro Program No. 1</i>				
	CIVITAS TURF DEFENSE Pre-M1xed	mineral oil	Intelligro	8.50	A-H
	LINK Quality Plus	NPK 5-20-20	Willbur-Ellis	4.00	AB
	Alude	mono- and dibasic sodium, potassium, and ammonium phosphites	NuFarm	5.50	C-H
20	Banner Maxx II	propiconazole	Syngenta	1.00	A
	Medallion SC	fludioxonil	Syngenta	1.00	BF
	Velista	penthiopyrad	Syngenta	0.30	CG
	Heritage	azoxystrobin	Syngenta	0.20	D
	Affirm WDG	polyoxin D zinc salt	Cleary / NuFarm	0.88	E
	Insignia SC Intrinsic	pyraclostrobin	BASF	0.50	H

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<i>Intelligro Program No. 2</i>					
	LINK Quality Plus	NPK 5-20-20	Willbur-Ellis	4.00	AB
	Alude	mono- and dibasic sodium, potassium, and ammonium phosphites	NuFarm	5.50	C-H
21	Banner Maxx II	propiconazole	Syngenta	1.00	A
	Medallion SC	fludioxonil	Syngenta	1.00	BF
	Velista	penthiopyrad	Syngenta	0.30	CG
	Heritage	azoxystrobin	Syngenta	0.20	D
	Affirm WDG	polyoxin D zinc salt	Cleary / NuFarm	0.88	E
	Insignia SC Intrinsic	pyraclostrobin	BASF	0.50	H
	<i>Intelligro Program No. 3</i>				
	Daconil Ultrex	chlorothalonil	Intelligro	8.50	A-H
	LINK Quality Plus	NPK 5-20-20	Willbur-Ellis	4.00	AB
	Alude	mono- and dibasic sodium, potassium, and ammonium phosphites	NuFarm	5.50	C-H
22	Banner Maxx II	propiconazole	Syngenta	1.00	A
	Medallion SC	fludioxonil	Syngenta	1.00	BF
	Velista	penthiopyrad	Syngenta	0.30	CG
	Heritage	azoxystrobin	Syngenta	0.20	D
	Affirm WDG	polyoxin D zinc salt	Cleary / NuFarm	0.88	E
	Insignia SC Intrinsic	pyraclostrobin	BASF	0.50	H
	23	Nivales T	fludioxonil	Sipcam Agro	1.00
Echo Dyad ETQ		chlorothalonil	Sipcam Agro	4.90	
<i>Syngenta Program No. 1</i>					
24	Heritage Action	azoxystrobin, acibenzolar-S-methyl	Syngenta	0.40	ACEG
	Daconil Action	chlorothalonil, acibenzolar-S-methyl	Syngenta	3.50	BDFH
	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
<i>Syngenta Program No. 2</i>					
25	Secure Action	fluazinam, acibenzolar-S-methyl	Syngenta	0.50	A-H
	Appear II	potassium phosphite	Syngenta	6.00	ACEG
	Daconil Action	chlorothalonil, acibenzolar-S-methyl	Syngenta	3.50	BDFH
	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
26	Daconil Action	chlorothalonil, acibenzolar-S-methyl	Syngenta	3.50	A-H
	Appear II	potassium phosphite	Syngenta	6.00	
27	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
	UCR 004	<i>classified</i>	-	-	
28	UCR 005	<i>classified</i>	-	-	A-H
	Medallion SC	fludioxonil	Syngenta	1.00	

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Syngenta Program No. 3					
	Velista	penthiopyrad	Syngenta	0.50	ADG
29	Daconil Action	chlorothalonil, acibenzolar-S-methyl	Syngenta	3.50	BEH
	Heritage Action	azoxystrobin, acibenzolar-S-methyl	Syngenta	0.40	CF
	Primo Maxx	trinexapac-ethyl	Syngenta	0.10	A-H
30	UCR 006	<i>classified</i>	-	-	A-H
	Medallion SC	fludioxonil	Syngenta	1.00	A-H
31	Maxtima	mefentrifluconazole	BASF	0.80	A-H
32	Navicon Intrinsic	mefentrifluconazole, pyraclostrobin	BASF	0.85	A-H
33	Velista	penthiopyrad	Syngenta	0.30	A-H

Application codes (timing):

- A – 06/06/2018
- B – 06/20/2018
- C – 07/06/2018
- D – 07/18/2018
- E – 08/02/2018
- F – 08/15/2018
- G – 08/30/2018
- H – 09/12/2018



Figure 1. Comparison of untreated plot (left) to plot treated with Bayer Program No. 3 (right). Photos taken by P. Petelewicz on September 13, 2018. Riverside, CA.

Table 2. Effect of fungicide treatments on anthracnose disease cover (0-100%) and visual turfgrass quality (1-9; 9=best) evaluated on annual bluegrass turf. Riverside, CA, 2018.

No.	Treatment	Anthracnose Cover		Visual Quality	
		Sep. 10	Oct. 9	Sep. 10	Oct. 9
1	Untreated Control	60.0 AB*	61.7 AB*	2.7 F-H*	3.7 F-H*
2	Bayer Program No. 1	0.0 G	13.3 H-J	7.7 A	7.0 AB
3	Bayer Program No. 2	0.0 G	11.7 IJ	7.7 A	8.0 A
4	Bayer Program No. 3	0.0 G	3.3 J	7.7 A	8.0 A
5	Bayer Program No. 4	23.3 D-G	11.7 IJ	5.7 A-E	7.0 AB
6	Bayer Program No. 5	3.3 G	13.3 H-J	7.7 A	6.7 A-C
7	UCR 001	51.7 A-E	20.3 G-J	3.7 D-H	3.7 F-H
8	UCR 001	70.0 A	50.0 A-F	2.3 GH	3.0 GH
9	UCR 002	68.3 A	70.0 A	2.3 GH	2.7 H
10	UCR 002	55.0 A-D	51.7 A-E	2.7 F-H	3.0 GH
11	UCR 003	58.3 A-C	50.0 A-F	2.3 GH	3.0 GH
12	UCR 003	70.0 A	60.0 A-C	1.7 H	2.7 H
13	Daconil Weatherstik + Medallion SC + UCR 001	33.3 B-G	20.0 G-J	4.7 B-G	6.0 B-E
14	Daconil Weatherstik + Medallion SC + UCR 001	53.3 A-D	26.7 D-J	3.0 F-H	6.3 A-D
15	Daconil Weatherstik + Medallion SC + UCR 002	41.7 A-F	11.7 IJ	4.7 B-G	6.7 A-C
16	Daconil Weatherstik + Medallion SC + UCR 002	45.0 A-F	20.0 G-J	3.3 E-H	5.3 B-F
17	Daconil Weatherstik + Medallion SC + UCR 003	38.3 A-F	23.3 F-J	5.0 B-F	5.3 B-F
18	Daconil Weatherstik + Medallion SC + UCR 003	50.0 A-E	25.0 E-J	3.7 D-H	6.3 A-D
19	Daconil Weatherstik + Medallion SC	55.0 A-D	30.0 D-J	4.0 C-H	5.3 B-F
20	Intelligro Program No. 1	25.0 C-G	40.0 B-H	4.7 B-G	5.7 B-E
21	Intelligro Program No. 2	11.7 FG	33.3 C-I	6.3 A-C	6.0 B-E
22	Intelligro Program No. 3	45.0 A-F	15.0 H-J	4.7 B-G	6.0 B-E
23	Nivales T + Echo Dyad ETQ	23.3 D-G	21.7 G-J	6.0 A-D	6.0 B-E
24	Syngenta Program No. 1	30.0 B-G	36.7 B-I	5.7 A-E	5.0 C-F
25	Syngenta Program No. 2	13.3 FG	25.0 E-J	7.0 AB	4.7 D-G
26	Daconil Action + Appear II + Primo Maxx	25.0 C-G	30.0 D-J	5.0 B-F	4.3 E-H
27	UCR 004	18.3 E-G	46.7 A-G	6.3 A-C	5.0 C-F
28	UCR 005 +Medallion SC	33.3 B-G	30.0 D-J	4.7 B-G	6.0 B-E
29	Syngenta Program No. 3	13.3 FG	31.7 D-I	7.0 AB	4.3 E-H
30	UCR 006 + Medallion SC	60.0 AB	53.3 A-D	4.0 C-H	4.3 E-H
31	Maxtima	23.3 D-G	35.0 B-I	6.0 A-D	5.3 B-F
32	Navicon Intrinsic	28.3 B-G	28.3 D-J	5.7 A-E	5.3 B-F
33	Velista	56.7 A-D	71.7 A	3.3 E-H	4.3 E-H

*Means followed by the same letter or not followed by any letter in a column are not significantly different (P=0.05).

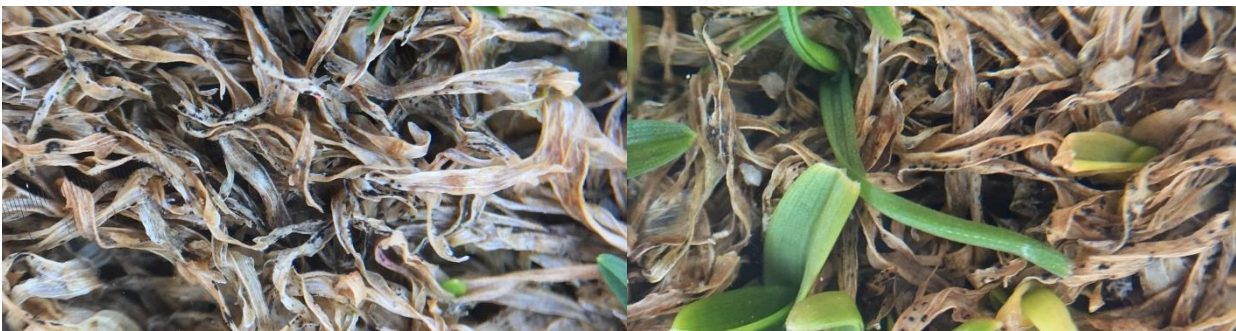


Figure 2. Close-ups on anthracnose (*Colletotrichum cereale*) acervuli occurring on dead annual bluegrass (*Poa annua*) foliage. Photos taken by P. Petelewicz on September 26, 2018. Riverside, CA.

Table 3. Effect of fungicide treatments on visually estimated turfgrass green color intensity (1-9; 9=best) and normalized difference vegetation index (-1-1) evaluated on annual bluegrass turf. Riverside, CA, 2018.

No.	Treatment	Visual Color		NDVI	
		Sep. 10	Oct. 9	Sep. 10	Oct. 9
1	Untreated Control	3.7 G-K*	3.7 G-I*	0.71 F-H*	0.79 FG*
2	Bayer Program No. 1	7.3 A-D	6.3 A-E	0.80 A-C	0.84 A-C
3	Bayer Program No. 2	7.7 A-C	7.3 AB	0.80 A-C	0.85 A-C
4	Bayer Program No. 3	8.0 AB	7.7 A	0.81 AB	0.87 A
5	Bayer Program No. 4	5.7 B-H	6.3 A-E	0.78 A-D	0.86 AB
6	Bayer Program No. 5	8.3 A	6.7 A-D	0.80 A-C	0.85 A-C
7	UCR 001	4.0 F-K	4.3 E-I	0.72 E-H	0.80 D-G
8	UCR 001	3.0 I-K	3.0 HI	0.71 F-H	0.80 E-G
9	UCR 002	2.7 JK	2.7 I	0.68 H	0.77 GH
10	UCR 002	3.3 H-K	3.0 HI	0.70 GH	0.79 F-H
11	UCR 003	3.3 H-K	3.3 G-I	0.71 F-H	0.80 D-G
12	UCR 003	2.0 K	3.0 HI	0.67 H	0.76 H
13	Daconil Weatherstik + Medallion SC + UCR 001	5.7 B-H	7.0 A-C	0.80 A-C	0.85 A-C
14	Daconil Weatherstik + Medallion SC + UCR 001	4.0 F-K	6.0 A-F	0.76 B-F	0.83 B-D
15	Daconil Weatherstik + Medallion SC + UCR 002	5.7 B-H	7.0 A-C	0.78 A-D	0.85 A-C
16	Daconil Weatherstik + Medallion SC + UCR 002	4.3 E-K	6.7 A-D	0.74 D-G	0.84 A-C
17	Daconil Weatherstik + Medallion SC + UCR 003	5.7 B-H	6.0 A-F	0.77 A-E	0.85 A-C
18	Daconil Weatherstik + Medallion SC + UCR 003	5.3 C-I	7.0 A-C	0.78 A-D	0.84 B-D
19	Daconil Weatherstik + Medallion SC	4.0 F-K	4.7 D-I	0.76 B-F	0.84 A-C
20	Intelligro Program No. 1	5.0 D-J	5.3 B-G	0.79 A-D	0.82 B-F
21	Intelligro Program No. 2	6.3 A-F	5.3 B-G	0.81 AB	0.83 B-E
22	Intelligro Program No. 3	5.0 D-J	6.3 A-E	0.79 A-D	0.84 A-C
23	Nivales T + Echo Dyad ETQ	5.7 B-H	6.0 A-F	0.79 A-D	0.83 B-D
24	Syngenta Program No. 1	6.0 A-G	4.7 D-I	0.79 A-C	0.84 B-D
25	Syngenta Program No. 2	8.0 AB	5.0 C-H	0.79 A-C	0.83 B-D
26	Daconil Action + Appeal II + Primo Maxx	5.3 C-I	5.3 B-G	0.75 C-G	0.83 B-E
27	UCR 004	6.7 A-E	4.7 D-I	0.81 AB	0.83 B-E
28	UCR 005 + Medallion SC	4.7 E-J	5.3 B-G	0.80 A-C	0.84 A-C
29	Syngenta Program No. 3	7.3 A-D	4.3 E-I	0.79 A-C	0.82 B-F
30	UCR 006 + Medallion SC	3.3 H-K	4.0 F-I	0.79 A-C	0.84 B-D
31	Maxtima	5.7 B-H	5.0 C-H	0.78 A-D	0.84 A-C
32	Navicon Intrinsic	5.7 B-H	5.0 C-H	0.82 A	0.85 A-C
33	Velista	3.3 H-K	3.3 G-I	0.76 B-F	0.82 C-F

*Means followed by the same letter or not followed by any letter in a column are not significantly different (P=0.05).

Table 4. Effect of fungicide treatments on dark green color index (DGCI) and turfgrass injury caused by treatments (phytotoxicity; 0-10; 10=highest) evaluated on annual bluegrass turf. Riverside, CA, 2018.

No.	Treatment	DGCI		Turfgrass Injury
		Sep. 10	Oct. 9	Jun. 17
1	Untreated Control	0.37 E-I*	0.43 IJ*	0.7 C-E*
2	Bayer Program No. 1	0.43 A-C	0.47 A-H	2.7 AB
3	Bayer Program No. 2	0.43 A-C	0.48 A-C	3.0 A
4	Bayer Program No. 3	0.45 A	0.50 A	0.0 E
5	Bayer Program No. 4	0.42 A-E	0.46 A-I	0.3 DE
6	Bayer Program No. 5	0.45 AB	0.49 AB	3.3 A
7	UCR 001	0.40 C-H	0.45 C-J	1.3 CD
8	UCR 001	0.35 I	0.44 D-J	1.0 C-E
9	UCR 002	0.36 HI	0.43 J	0.0 E
10	UCR 002	0.36 HI	0.43 H-J	0.7 C-E
11	UCR 003	0.38 D-I	0.44 F-J	1.7 BC
12	UCR 003	0.37 F-I	0.44 F-J	0.7 C-E
13	Daconil Weatherstik + Medallion SC + UCR 001	0.41 A-E	0.48 A-E	0.3 DE
14	Daconil Weatherstik + Medallion SC + UCR 001	0.40 C-H	0.47 A-I	0.7 C-E
15	Daconil Weatherstik + Medallion SC + UCR 002	0.41 B-G	0.48 A-D	0.3 DE
16	Daconil Weatherstik + Medallion SC + UCR 002	0.39 C-H	0.47 A-G	1.0 C-E
17	Daconil Weatherstik + Medallion SC + UCR 003	0.41 B-F	0.47 A-F	0.0 E
18	Daconil Weatherstik + Medallion SC + UCR 003	0.39 C-I	0.46 A-J	0.0 E
19	Daconil Weatherstik + Medallion SC	0.39 C-H	0.46 A-J	0.0 E
20	Intelligro Program No. 1	0.39 C-I	0.43 H-J	0.3 DE
21	Intelligro Program No. 2	0.41 B-F	0.44 F-J	0.3 DE
22	Intelligro Program No. 3	0.39 C-H	0.46 A-I	0.0 E
23	Nivales T + Echo Dyad ETQ	0.41 A-E	0.45 B-J	0.0 E
24	Syngenta Program No. 1	0.40 C-H	0.45 B-J	0.0 E
25	Syngenta Program No. 2	0.42 A-C	0.44 G-J	0.0 E
26	Daconil Action + Apear II + Primo Maxx	0.41 B-F	0.46 A-J	0.0 E
27	UCR 004	0.41 A-E	0.46 A-J	2.7 AB
28	UCR 005 + Medallion SC	0.40 C-H	0.45 B-J	0.3 DE
29	Syngenta Program No. 3	0.41 B-F	0.44 E-J	0.3 DE
30	UCR 006 + Medallion SC	0.36 HI	0.44 D-J	0.0 E
31	Maxtima	0.42 A-E	0.45 B-J	0.3 DE
32	Navicon Intrinsic	0.42 A-D	0.47 A-H	0.0 E
33	Velista	0.36 G-I	0.44 G-J	0.0 E

*Means followed by the same letter or not followed by any letter in a column are not significantly different (P=0.05).



Figure 3. General view of the study area. Photo taken by P. Petelewicz on August 29, 2018. Riverside, CA.