

Effects of Fungicide Programs on Creeping Bentgrass Quality and Recovery from Aeration and Drought Stress



Fungicide programs were evaluated on a creeping bentgrass putting green for their effects turf quality and recovery in response to drought stress and aeration events in 2015. Riverside, CA. Photo taken on 17 Sep 2015.

Research Report Brought To You By:



Effects of Fungicide Programs on Creeping Bentgrass Quality and Recovery from Aeration and Drought Stress

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The Bottom Line: Fungicide programs from Syngenta, Bayer, and BASF were tested against minimal fungicide and no fungicide programs for their effects on drought stress tolerance and recovery after aeration on a creeping bentgrass putting green in Riverside, CA in 2015. In general, fungicides did not cause significant improvement in turf quality or hasten turf recovery in response to water deficit or aeration events. Signature Xtra Stressguard from Bayer contained the darkest green pigment among fungicides and sometimes resulted in the highest Green Cover % measured by digital image analysis (DIA). However, a similar effect was observed when the green pigment Transition HC was incorporated into the program containing no fungicides. Overall, these data support previous findings from UCR that fungicides have little or no positive impact on turfgrass quality when little or no disease pressure is present.

Introduction:

Certain fungicides can have secondary benefits on plant health in addition to providing disease control. Previous field and greenhouse research conducted by UCR has demonstrated that fungicide plant health benefits in response to water deficit stress are minimal when disease pressure is negligible or absent.

Objectives:

Evaluate fungicide program effects on the rate of recovery following core aeration and the onset of drought stress and recovery following irrigation.

Study Conditions:

Soil:	Sand
Species:	'Pure Distinction' Creeping Bentgrass
Height:	0.125 inches; 5 times/wk
Spray Information:	CO ₂ -powered backpack sprayer TeeJet 8003VS nozzles; 9-inch spacing; 2 gal/M
Design:	Randomized block (by drainage patterns/history of drought stress symptoms); 9 replications
Plot size:	4 ft x 6 ft; 2-ft alleys

Important Dates:

17 April 2015 (1st fungicide application)

1 May 2015 (2nd)

18 May 2015 (3rd)

29 May 2015 (4th)

4 June 2015 (1/2-inch tine core aeration + sand)

14 June 2015 (5th)

27 June 2015 (6th)

29 June to 6 July 2015 (water withheld)

10 July 2015 (7th)

28 July 2015 (8th)

5 August 2015 (solid tine aeration + sand)

13 August 2015 (9th)

21 August 2015 (10th)

3 September 2015 (11th)

10 September 2015 (1/2-inch tine core aeration + sand)

18 September 2015 (12th)

Treatments:**1. Syngenta Basic**

Date	Product	Rate (oz/M)
April 17	Headway	3.0
May 1	Heritage	0.4
	Qualibra	6.0
May 18	Daconil Weather Stik	3.6
	Signature	4.0
	Primo Maxx	0.125
May 29	Heritage	0.4
	Qualibra	6.0
June 4	Core Aeration	
June 14	Daconil Weather Stik	3.6
	Signature	4.0
	Primo Maxx	0.125
June 27	Heritage	0.4
	Qualibra	6.0
June 29 to July 6	Dry Down	
July 10	Daconil Weather Stik	3.6
	Signature	4.0
	Primo Maxx	0.125
July 28	Daconil Weather Stik	3.6
	Signature	4.0
	Heritage	0.4
	Primo Maxx	0.125
	Qualibra	6.0
August 5	Solid Tine Aeration	
August 13	Daconil Weather Stik	3.6
	Signature	4.0
	Primo Maxx	0.125
August 21	Daconil Weather Stik	3.6
	Signature	4.0
	Primo Maxx	0.125
September 3	Heritage	0.4
	Qualibra	6.0
September 10	Core Aeration	
September 18	Daconil Weather Stik	3.6
	Signature	4.0
	Primo Maxx	0.125

2. Syngenta Premium

Date	Product	Rate (oz/M)
April 17	Headway	3.0
	Secure	0.5
May 1	Heritage Action	0.4
	Qualibra	6.0
May 18	Daconil Action	3.5
	Appear	6.0
	Primo Maxx	0.125
May 29	Heritage Action	0.4
	Qualibra	6.0
June 4	Core Aeration	
June 14	Daconil Action	3.5
	Appear	6.0
	Velista	0.5
	Primo Maxx	0.125
June 27	Heritage Action	0.4
	Qualibra	6.0
June 29 to July 6	Dry Down	
July 10	Daconil Action	3.5
	Appear	6.0
	Velista	0.5
	Primo Maxx	0.125
July 28	Daconil Action	3.5
	Appear	6.0
	Briskway	0.72
	Primo Maxx	0.125
	Qualibra	6.0
August 5	Solid Tine Aeration	
August 13	Daconil Action	3.5
	Appear	6.0
	Velista	0.5
	Primo Maxx	0.125
August 21	Daconil Action	3.5
	Appear	6.0
	Velista	0.5
	Primo Maxx	0.125
September 3	Heritage Action	0.4
	Qualibra	6.0
September 10	Core Aeration	
September 18	Briskway	0.72
	Appear	6.0
	Primo Maxx	0.125

3. Control (minimal fungicide inputs)

Date	Product	Rate (oz/M)
April 17	Daconil Weather Stik	3.6
	Heritage	0.4
May 1		
May 18		
May 29	Daconil Weather Stik	3.6
June 4	Core Aeration	
June 14		
June 27	Heritage	0.4
June 29 to July 6	Dry Down	
July 10		
July 28	Heritage	0.4
August 5	Solid Tine Aeration	
August 13		
August 21	Daconil Weather Stik	3.6
September 3		
September 10	Core Aeration	
September 18	Heritage	0.4

4. Bayer

Date	Product	Rate (oz/M)
April 17	Tartan	2.0
May 1	Signature Xtra Stressguard	4.0
	Daconil Action	3.2
	Revolution	6.0
May 18	Tartan	2.0
May 29	Signature Xtra Stressguard	4.0
	Daconil Action	3.2
	Revolution	6.0
June 4	Core Aeration	
June 14	Signature Xtra Stressguard	4.0
	Daconil Action	3.2
June 27	Signature Xtra Stressguard	4.0
	Interface	4.0
	Revolution	6.0
June 29 to July 6	Dry Down	
July 10	Signature Xtra Stressguard	4.0
	Daconil Action	3.2
July 28	Signature Xtra Stressguard	4.0
	Honor	1.1
	Revolution	6.0
August 5	Solid Tine Aeration	
August 13	Signature Xtra Stressguard	4.0
	26GT	4.0
August 21	Signature Xtra Stressguard	4.0
	Honor	1.1
September 3	Signature Xtra Stressguard	4.0
	Interface	4.0
	Revolution	6.0
September 10	Core Aeration	
September 18	Interface	4.0

5. BASF

Date	Product	Rate (oz/M)
April 17	Encartis	0.3
May 1	Tourney Revolution	0.37 6.0
May 18	Signature Daconil Ultrex 26GT	2.0 3.2 4.0
May 29	Lexicon Intrinsic Revolution	0.34 6.0
June 4	Core Aeration	
June 14	Lexicon Intrinsic Daconil Ultrex	0.34 3.2
June 27	Lexicon Intrinsic Revolution	0.34 6.0
June 29 to July 6	Dry Down	
July 10	Signature Daconil Ultrex 26GT	2.0 3.2 4.0
July 28	Lexicon Intrinsic Revolution	0.34 6.0
August 5	Solid Tine Aeration	
August 13	Segway Tourney Daconil Ultrex	0.9 0.37 3.2
August 21	Lexicon Intrinsic	0.34
September 3	Signature Daconil Ultrex Tourney Revolution	4.0 3.2 0.37 6.0
September 10	Core Aeration	
September 18	Encartis	4.0

6. Control (no fungicides)

Date	Product	Rate (oz/M)
April 17		
May 1	Revolution	6.0
May 18	Primo Maxx	0.125
May 29	Revolution	6.0
June 4	Core Aeration	
June 14	Primo Maxx	0.125
June 27	Revolution	6.0
June 29 to July 6	Dry Down	
July 10	Primo Maxx	0.125
July 28	Primo Maxx Transition HC Revolution	0.125 3.0 6.0
August 5	Solid Tine Aeration	
August 13	Primo Maxx Transition HC	0.125 1.5
August 21	Primo Maxx Transition HC	0.125 1.5
September 3	Transition HC Revolution	3.0 6.0
September 10	Core Aeration	
September 18	Transition HC	1.5

Plot Plan (Field 12E-22):

North ↑

5	3	2	1	4
1	4	4	6	3
6	2	5	3	5
3	6	1	2	4
4	1	2	6	3
6	5	X	2	1
4	3	1	5	1
4	5	6	3	6
2	3	4	2	5
2	2	4	6	3
1	5	6	5	1

Results:

- ✓ Despite 9 replications and attempts to block accordingly, there was considerable variation in soil conditions ranging from severe drought stress/LDS (SE corner) to no turf stress (NW corner). Data shown include all 9 replications/treatment. Preliminary data analysis with outlier plots removed did not appear to resolve this dilemma.
- ✓ No significant treatment differences were found for localized dry spot (LDS), soil moisture (TDR), or turf quality throughout the study (Tables 1 and 2).
- ✓ Differences in % Green Cover were detected in late June and from mid-September until the end of the experiment only (Table 3). It appeared that the Bayer program helped to expedite turf recovery following the core aeration events. However, this and most of the other programs were not different from the controls following subsequent dry down and aeration events. Bayer Signature Xtra Stressguard contained the darkest green pigment among the fungicide treatments, which usually resulted in higher visual turf quality ratings and may have been responsible for increased green cover ratings using digital image analysis. To test this theory, Transition HC pigment was incorporated into the no fungicide control treatment (#6) beginning July 28. Subsequent Green Cover measurements, especially following applications of Transition HC, often yielded the highest values.
- ✓ Subtle but significant differences in NDVI occurred at the beginning of the dry down study in early July and from mid-September until the end of the study (Table 4). Interestingly, treatments containing darker green pigments (i.e., #4 and #6) yielded lower NDVI values, whereas NDVI is typically correlated with greener, healthier turf.
- ✓ In summary, these data support previous findings at UCR that fungicides have little or no positive impact on turf health in an environment where there is low disease pressure. However, in a separate fungicide trial conducted in northern California in 2015, the secondary benefits of fungicides on turf health were clearly evident among visible anthracnose and rapid blight disease pressure.

Table 1. Effects of fungicide programs on creeping bentgrass localized dry spot (LDS; 0-100%) and soil moisture (0-100%) measured by time domain reflectometry in 2015. Riverside, CA.

No.	Program	LDS 5/29	TDR 6/29	TDR 7/01	TDR 7/02	TDR 7/06	TDR 7/08
1	Syngenta Basic	5.0	34.0	27.0	26.6	9.7	26.3
2	Syngenta Premium	2.3	35.4	24.6	22.5	5.6	21.9
3	Control (Minimal inputs)	6.7	37.9	29.7	26.9	11.9	23.0
4	Bayer	5.0	38.0	25.0	23.6	7.0	23.4
5	BASF	2.2	36.7	27.2	26.7	10.8	27.1
6	Control (No fungicides)	5.0	34.7	25.9	25.2	8.7	25.0

Fisher's Protected Least Significant Difference (LSD) test ($\alpha = 0.05$) revealed no differences.

Table 2. Effects of fungicide programs on creeping bentgrass visual quality (1-9, 9 = best) in 2015. Riverside, CA.

No.	Program	5/22	5/29	6/13	6/27	7/06	7/10	7/13	7/19	7/28	8/02	8/13	8/21
1	Syngenta Basic	5.7	6.3	6.8	7.3	5.8	3.9	4.1	4.6	5.2	5.3	5.4	6.0
2	Syngenta Premium	6.1	6.7	6.8	7.0	5.2	3.6	3.7	4.2	4.6	4.6	5.1	5.7
3	Control (Minimal inputs)	5.1	6.2	6.7	6.9	6.1	5.0	4.9	5.4	5.3	5.3	6.0	6.7
4	Bayer	6.2	6.2	6.3	7.0	6.2	4.4	5.8	5.3	5.7	5.9	5.6	6.1
5	BASF	5.7	6.8	7.0	7.0	5.8	3.8	3.7	4.3	4.2	4.6	4.9	5.3
6	Control (No fungicides)	5.4	5.9	6.3	6.7	5.4	4.4	4.6	4.9	5.2	5.7	5.3	6.1

Fisher's Protected Least Significant Difference (LSD) test ($\alpha = 0.05$) revealed no differences.

Table 3. Effects of fungicide programs on creeping bentgrass green cover (0-100%) measured by digital image analysis (DIA) in 2015. Riverside, CA.

No.	Program	6/03	6/05	6/08	6/10	6/12	6/15	6/17	6/19	6/22	6/24	6/26	6/29	7/01	7/03	7/06
1	Syngenta Basic	100	26	82	94	94	96	98	97 BC	96.4 B	94.3 C	97	98	99	99	79
2	Syngenta Premium	100	29	80	94	96	98	99	98.1 AB	97.7 A	96.1 AB	98	99	99	99	87
3	Control (Minimal inputs)	100	37	88	96	95	98	98	97.8 AB	97.2 AB	96 AB	98	99	99	99	93
4	Bayer	100	35	82	93	92	98	99	98.4 A	97.7 A	96.4 A	98	100	100	100	97
5	BASF	100	37	90	97	97	97	99	97.3 ABC	96.2 B	95.7 AB	98	99	100	99	82
6	Control (No fungicides)	100	29	82	93	93	96	97	96.5 C	96.8 AB	94.9 BC	96	98	99	99	90

Means followed by the same letter in a column are not significantly different ($\alpha = 0.05$). Otherwise, Fisher's Protected Least Significant Difference (LSD) test ($\alpha = 0.05$) revealed no differences.

Table 3 (Cont.). Effects of fungicide programs on creeping bentgrass green cover (0-100%) measured by digital image analysis (DIA) in 2015. Riverside, CA.

No.	Program	7/08	7/10	7/17	7/24	7/31	8/07	8/14	8/21	8/28	9/04	9/09	9/11	9/14
1	Syngenta Basic	30	35	68	75	86	49	80	95	99	94	95	38	26
2	Syngenta Premium	34	34	75	82	90	58	88	94	99	94	95	36	27
3	Control (Minimal inputs)	58	56	88	92	98	63	75	100	100	96	99	44	34
4	Bayer	46	46	97	96	99	62	87	100	100	100	99	40	35
5	BASF	36	40	73	72	81	48	55	88	90	86	91	35	31
6	Control (No fungicides)	49	51	87	92	99	72	97	100	100	100	99	51	25

Fisher's Protected Least Significant Difference (LSD) test ($\alpha = 0.05$) revealed no differences.

Table 3 (Cont.). Effects of fungicide programs on creeping bentgrass green cover (0-100%) measured by digital image analysis (DIA) in 2015. Riverside, CA.

No.	Program	9/16	9/18	9/21	9/23	9/25	9/28	9/30	10/2	10/5
1	Syngenta Basic	51 ABC	49 A	72 ABC	72 AB	65 ABC	73 AB	80 AB	90 A	94 AB
2	Syngenta Premium	46 BC	45 AB	68 BC	63 BC	58 BCD	61 BC	78 ABC	86 AB	92 AB
3	Control (Minimal inputs)	57 AB	56 A	57 CD	55 C	45 D	51 C	61 D	76 BC	89 BC
4	Bayer	60 A	56 A	80 AB	80 A	78 A	85 A	91 A	95 A	98 A
5	BASF	53 ABC	46 A	46 D	54 C	48 CD	61 BC	74 BCD	78 BC	87 BC
6	Control (No fungicides)	42 C	30 B	86 A	83 A	68 AB	63 BC	67 CD	71 C	82 C

Means followed by the same letter in a column are not significantly different ($\alpha = 0.05$).

Table 4. Effects of fungicide programs on creeping bentgrass NDVI (0-1) measured by GreenSeeker instrument in 2015. Riverside, CA.

No.	Program	6/29	7/01	7/02	7/06	7/08	7/10	7/17	7/24	7/31	8/07	8/14	8/21	8/28	9/04	9/11
1	Syngenta Basic	0.80 A	0.80	0.80 B	0.67	0.52	0.58	0.58	0.65	0.68	0.57	0.70	0.78	0.75	0.74	0.31
2	Syngenta Premium	0.81 A	0.80	0.81 AB	0.67	0.50	0.60	0.60	0.67	0.67	0.57	0.70	0.77	0.73	0.74	0.31
3	Control (Minimal inputs)	0.81 A	0.81	0.82 AB	0.73	0.59	0.67	0.65	0.74	0.74	0.66	0.81	0.84	0.79	0.77	0.34
4	Bayer	0.78 B	0.79	0.79 C	0.67	0.55	0.62	0.63	0.68	0.72	0.63	0.77	0.81	0.75	0.71	0.32
5	BASF	0.82 A	0.81	0.83 A	0.68	0.52	0.59	0.58	0.64	0.65	0.58	0.69	0.76	0.73	0.69	0.30
6	Control (No fungicides)	0.81 A	0.81	0.81 AB	0.70	0.57	0.63	0.65	0.70	0.68	0.61	0.77	0.81	0.76	0.70	0.32

Means followed by the same letter in a column are not significantly different ($\alpha = 0.05$). Otherwise, Fisher's Protected Least Significant Difference (LSD) test ($\alpha = 0.05$) revealed no differences.

Table 4 (Cont.). Effects of fungicide programs on creeping bentgrass NDVI (0-1) measured by GreenSeeker instrument in 2015. Riverside, CA.

No.	Program	9/14	9/16	9/18	9/21	9/23	9/25	9/28	9/30	10/2	10/5
1	Syngenta Basic	0.46 B	0.51 BC	0.49 B	0.53 B	0.59 BC	0.54 AB	0.63 AB	0.69 A	0.73 AB	0.78 A
2	Syngenta Premium	0.46 B	0.50 BC	0.48 B	0.52 BC	0.57 CD	0.52 B	0.61 B	0.67 A	0.71 B	0.76 A
3	Control (Minimal inputs)	0.54 A	0.58 A	0.58 A	0.61 A	0.66 A	0.55 AB	0.62 AB	0.68 A	0.72 B	0.77 A
4	Bayer	0.51 AB	0.54 AB	0.54 AB	0.56 AB	0.63 AB	0.61 A	0.67 A	0.71 A	0.76 A	0.79 A
5	BASF	0.48 B	0.54 AB	0.49 B	0.54 B	0.59 BC	0.55 AB	0.52 C	0.69 A	0.73 AB	0.76 A
6	Control (No fungicides)	0.46 B	0.47 C	0.42 C	0.47 C	0.52 D	0.43 C	0.52 C	0.57 B	0.63 C	0.65 B

Means followed by the same letter in a column are not significantly different ($\alpha = 0.05$).