

**Project Title: Rolling and Resistance: A Means to Reduced Fungicide Usage on Golf Course Greens**

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**Dr. Joseph Vargas, Nancy Dykema, & Ryan Bearss**

**Michigan State University**

**Executive Summary**

In this dollar spot study, the combined use of cultural, genetic, and chemical management strategies were tested to determine if they would result in acceptable disease control, lower fungicide usage, and acceptable turfgrass quality. Preliminary results indicate that a combination of these practices achieves the stated goals. In this research trial, two cultivars of creeping bentgrass including a commonly used dollar spot-susceptible cultivar, Penn A1, and a new dollar spot-resistant cultivar, Flagstick, were compared. For each cultivar, lightweight rolling conducted once or twice daily for five days weekly combined with reduced rate fungicide (boscalid, trade name Emerald) applications at 25% of the label rate was evaluated for dollar spot incidence and turfgrass quality. Preliminary data suggests that the use of a reduced fungicide (boscalid) rate combined with the use of a dollar spot resistant cultivar (Flagstick) results in dollar spot incidence similar to that achieved with full rates of the fungicide. Additionally, the use of rolling and reduced fungicide (boscalid) rates with a susceptible cultivar (Penn A1) often yielded dollar spot incidence similar to levels provided with a full rate of fungicide. By combining cultural, genetic and chemical practices, reduced chemical rates yield dollar spot control similar to full fungicide rates alone.

**Introduction**

Management of golf course turfgrass and surrounding areas often requires expensive and potentially harmful chemical inputs. The most commonly encountered summer disease on Canadian golf courses is dollar spot (*Sclerotinia homoeocarpa* FT Bennet). On average, golf course superintendents may make 10-15 fungicide applications in one growing season to manage dollar spot on putting greens alone, making this disease one of the most costly turfgrass diseases to manage. There are numerous fungicides on the market to treat dollar spot, although new IPM regulations in Ontario and Quebec require a reduction in pesticide usage over time. These regulations will force the industry to focus on more sustainable approaches for managing turfgrass pests, including diseases such as dollar spot.

A recent trend among golf courses in Canada is the conversion of annual bluegrass (*Poa annua* L.) putting greens to creeping bentgrass (*Agrostis stolonifera* L.) due to recurring problems associated with ice damage and summer disease complexes on annual bluegrass. Development of disease resistant cultivars has allowed for less devastating outbreaks of diseases like dollar spot on established creeping bentgrass putting greens; however, fungicides are still needed to maintain an acceptable level of quality and playability. Recent research has shown the benefits of lightweight rolling which reduces dollar spot in creeping bentgrass

putting greens. By coupling rolling with a new, highly dollar spot-resistant creeping bentgrass cultivar developed by MSU researchers, there is the realistic possibility that this costly disease may now be managed under a pesticide-free regimen or with reduced fungicide rates, while still providing the high-quality turfgrass golfers have come to expect.

### **Project Objectives**

The objectives of this project are to: (1) test and establish a combination of methods for management of creeping bentgrass putting greens by using reduced fungicide rates, disease-resistant cultivars, and optimizing lightweight rolling practices, and (2) determine whether acceptable levels of disease, turfgrass quality, and playability are obtainable using the methods described in objective 1.

### **Materials and Methods**

#### **Study parameters.**

A field trial was initiated in 2016 on plots established at the Hancock Turfgrass Research Center on the campus of Michigan State University, East Lansing, MI. The site was seeded in 2012 in 3 alternating 40 x 15 m replicates of Penn A1 and Flagstick creeping bentgrasses on native soil which has been sand topdressed weekly to bi-weekly since establishment. Penn A1 is a commonly used creeping bentgrass cultivar that is susceptible to dollar spot, and Flagstick is a newly released cultivar with strong dollar spot resistance. The study was set in a 2 x 7 split-plot design with 3 replicates of 1 x 5 m plots and 0.3 m untreated alleys per split-plot (cultivar). The study site was maintained using standard golf course methods for mowing, fertility, non-target disease, weed and insect management. Inoculation of the study site using a sand-cornmeal topdressing mixture infested with the fungal pathogen, *Sclerotinia homoeocarpa*, occurred on 7/13/16 and 7/28/16.

Fungicide applications were made monthly (every 28 days) using boscalid at 0.055 g m<sup>-2</sup> (full rate) or 0.014 g m<sup>-2</sup> (25% rate) on 6/30/16, 7/27/16, and 8/26/16. Rolling treatments were applied 5 days each week beginning on 5/11/16 using a Tru-Turf R52-11T lightweight roller with a 1.3 m width. A single pass (1x) was made rolling in one direction lengthwise across a plot. A double pass (2x) was made by rolling lengthwise in one direction and then immediately back in the opposite direction within each plot. Rolling treatments were applied between 7:00 and 9:00 am each day immediately following morning mowing. Within each split-plot, the following treatments were randomly located and applied:

1. Rolling once daily (single pass, 1x rolling)
2. Rolling twice daily (double pass, 2x rolling)
3. Rolling once daily (1x rolling) with boscalid 0.014 g m<sup>-2</sup> (25% rate) monthly
4. Rolling twice daily (2x rolling) with boscalid 0.014 g m<sup>-2</sup> (25% rate) monthly
5. Boscalid 0.014 g m<sup>-2</sup> (25% rate) monthly
6. Boscalid 0.055 g m<sup>-2</sup> (full rate) monthly
7. Untreated control

### Data collection.

Assessments for dollar spot disease were made on a 0-100% scale by visually estimating the percentage of each plot exhibiting dollar spot symptoms. Turfgrass quality ratings were taken visually using a 1-9 scale where 1=poor or dead turf, 6= acceptable and 9=excellent or the highest turfgrass quality. Turfgrass color (“greenness”) of the plots was rated using a FieldScout TCM 500 Normalized Difference Vegetative Index (NDVI) Turf Color Meter (Spectrum Technologies, Inc.) NDVI indicates “greenness,” or photosynthetic activity, of the turf and is reported on a 0.000 to 1.000 scale with a higher number representing “greener” turf. Chlorophyll ratings were taken using a FieldScout CM 1000 Chlorophyll Meter (Spectrum Technologies, Inc.) This device calculates the relative chlorophyll index by measuring reflected light. The scale ranges from 0-999, where 0 = no green and 999 = most green vegetation. For both NDVI and chlorophyll meters, recorded data was the mean of six measurements from each plot. Green speed, or ball roll distance, was assessed using a Pelz meter. The average of 6 ball roll distances, three in opposite directions on each plot, was recorded in meters. NDVI, chlorophyll, and Pelz meter data were collected regularly throughout the trial period.

## **Results and Discussion**

### **Dollar spot incidence.**

Dollar spot developed in the study site beginning in late July. Disease pressure increased greatly from 8/1/16 through 9/1/16 when the untreated Penn A1 control plots averaged 17% and 75% dollar spot, respectively (Table 1, Figure 1). This extremely heavy disease pressure by early September was likely due to the inoculations that were applied in July.

### **Boscalid alone.**

Flagstick. No significant differences occurred between the full rate boscalid treatments and the 25% boscalid treatment alone and with rolling on all dates.

Penn A1. All treatments containing boscalid performed similarly on 8/15 while on 8/1, 8/24, and 9/1, 25% boscalid exhibited significantly more dollar spot than the full label rate (Figure 5).

### **Rolling alone.**

Flagstick. When considering rolling treatments without boscalid in the Flagstick plots, at lower disease pressure on 8/1 and 8/15, the rolling treatments yielded no significant differences compared to the untreated control (Figure 3). However, with higher disease pressure on 8/24 and 9/1, the 2x rolling treatment had significantly less disease than the untreated control.

Penn A1. On the Penn A1 plots, the 1x and 2x rolling plots exhibited significantly less dollar spot than the untreated control on all rating dates except on 8/15 when the 1x rolling was not significantly different from the untreated control.

### **Boscalid with rolling.**

Flagstick. When comparing boscalid treatments at full and 25% rates, 25% boscalid with 1x rolling and 25% boscalid with 2x rolling, no significant differences were seen indicating that

similar control was achieved using the full (0.055 g m<sup>-2</sup>) label rate of boscalid as well as the 25% (0.014 g m<sup>-2</sup>) rate with or without rolling (Figure 4).

Penn A1. On 8/1 and 8/24, no significant differences were seen among 25% boscalid with rolling and full rate boscalid treatments. By adding rolling to the 25% boscalid plots on Penn A1, results similar to using a full rate of boscalid were achieved.

### **Preliminary Conclusions for Dollar Spot Incidence**

In summary, this preliminary data suggests:

1. The use of reduced fungicide (boscalid) rates provided disease control similar to using full fungicide rates when combined with a resistant cultivar (Flagstick). This should result in less fungicide being applied to the environment as well as reduced costs to turfgrass managers for disease control.
2. When using a dollar spot susceptible cultivar (Penn A1), adding rolling to a reduced fungicide (boscalid) rate provided disease control levels achieved with full fungicide rates.
3. In the absence of fungicide (boscalid), the use of a resistant cultivar (Flagstick) resulted in less dollar spot than using a susceptible cultivar (Penn A1).

### Turfgrass quality and playability.

Significant differences in turfgrass quality were observed among treatments, and these trends followed disease levels. Those treatments with higher dollar spot levels had lower turfgrass quality ratings. In general, treatments containing boscalid exhibited better turfgrass quality than those without the fungicide, presumably due to the occurrence of less disease (Table 2, Figure 6.) Rolling and fungicide treatments on Flagstick yielded few differences with all Flagstick treatments providing acceptable turfgrass quality on 8/1 and 8/16, and then quality differences as seen in Table 2 appearing as dollar spot incidence increased on 8/24 and 9/1. Due to the level of disease in this trial, few Penn A1 treatments resulted in acceptable turfgrass quality.

In comparing NDVI readings, differences among treatments became more apparent when dollar spot pressure was highest on 9/1 as seen in Figure 7 (Table 3.) Chlorophyll measurements are presented in Table 4 and depicted graphically in Figure 8. No significant trend among treatments could be elucidated regarding chlorophyll content. When dollar spot was abundant, greenness as indicated by NDVI, decreased. All plots that were not rolled exhibited no difference in greenspeed regardless of cultivar or the presence or absence of fungicide (Table 5, Figure 9.) As expected, in general, plots that were rolled 2x had the fastest greenspeeds and did not significantly differ based on cultivar or fungicide presence or rate.

### **Preliminary Conclusions for Turfgrass Quality and Playability**

In summary, this preliminary data suggests:

4. Acceptable turfgrass quality was achieved when using rolling, disease-resistant creeping bentgrass, and reduced fungicide rates.

Preliminary findings suggest that acceptable dollar spot control and turfgrass quality can be attained using less fungicide when combined with the use of dollar spot resistant creeping bentgrass and daily rolling. Further research including 1-2 years more data will verify preliminary results and help form recommendations for golf course managers.

### **Future research**

Field trials will continue during the 2017 field season following the protocols and timeline used in 2016. Data will be collected in a similar manner, as well. Research is proceeding on schedule.

Table 1. 2016 Rolling and creeping bentgrass host dollar spot study disease incidence.

Rating Type: Dollar spot incidence.

Rating Scale: Mean percent dollar spot.

Trt No.	Treatment Name	Boscalid Rate <sup>c</sup>	Creeping Bentgrass Cultivar	8/1/2016		8/15/2016		8/24/2016		9/1/2016	
				Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>
8	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	0.0	d	0.7	c	2.0	g	0.0	h
6	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	0.0	d	0.0	c	1.7	g	1.3	h
12	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Flagstick	0.0	d	1.0	c	5.0	fg	1.7	h
10	Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	0.0	d	0.3	c	1.3	g	2.7	h
11	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Penn A1	0.3	d	0.3	c	2.0	g	3.3	h
7	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	1.3	cd	1.7	c	5.0	fg	8.0	g
5	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	1.7	cd	4.3	c	6.7	fg	12.3	fg
9	Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	3.0	c	2.0	c	8.3	ef	14.0	f
4	Roll daily 2x		Flagstick	0.0	d	2.3	c	8.3	ef	28.3	e
2	Roll daily 1x		Flagstick	0.0	d	3.3	c	13.3	de	38.3	d
14	Untreated Control		Flagstick	0.0	d	3.3	c	16.7	cd	40.0	d
3	Roll daily 2x		Penn A1	2.7	c	14.0	b	21.7	bc	60.0	c
1	Roll daily 1x		Penn A1	8.7	b	20.0	ab	26.7	b	70.0	b
13	Untreated Control		Penn A1	17.0	a	26.7	a	33.3	a	75.0	a

<sup>a</sup> Represents the average of 3 replications.

<sup>b</sup> Means followed by the same letter are not significantly different (LSD, p=0.05.)

<sup>c</sup> All boscalid applications made on a 28 day interval on 6/30/16, 7/27/16, and 8/26/16.

Figure 1. 2016 Average of percent dollar spot incidence ratings.

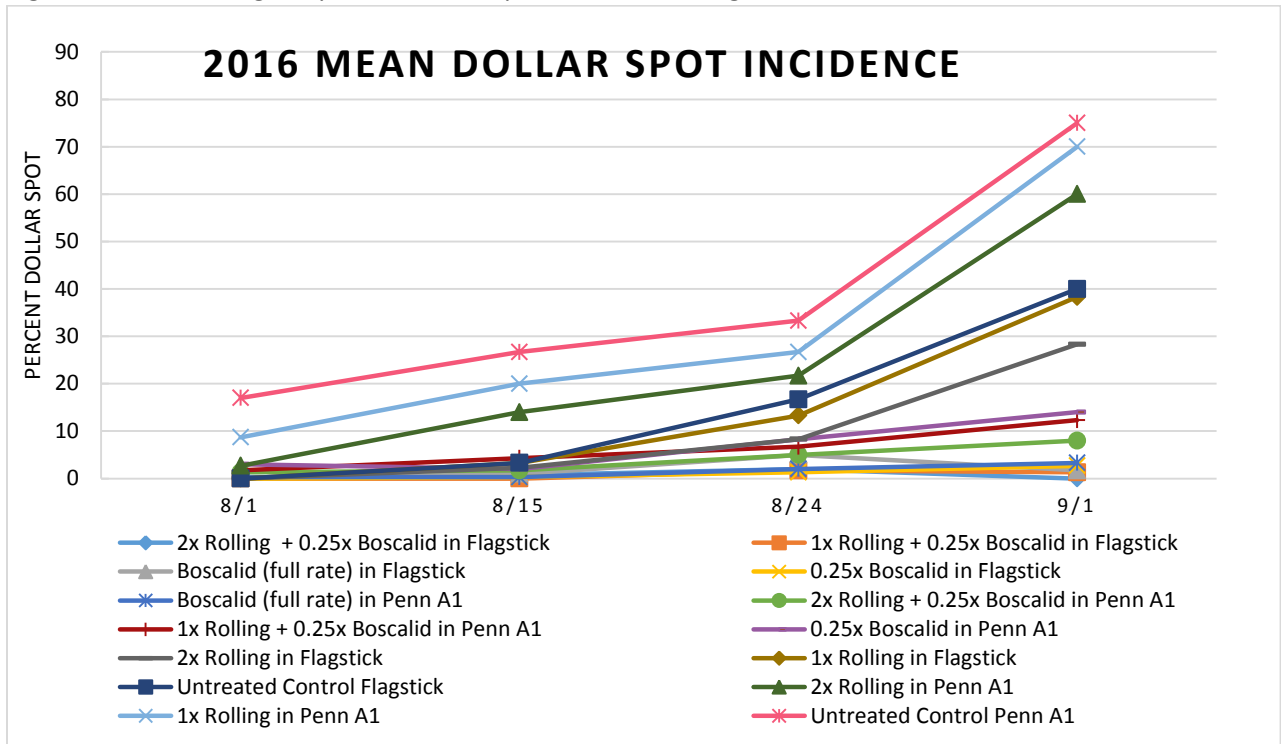


Figure 2. 2016 Average percent dollar spot incidence for treatments containing boscalid only.

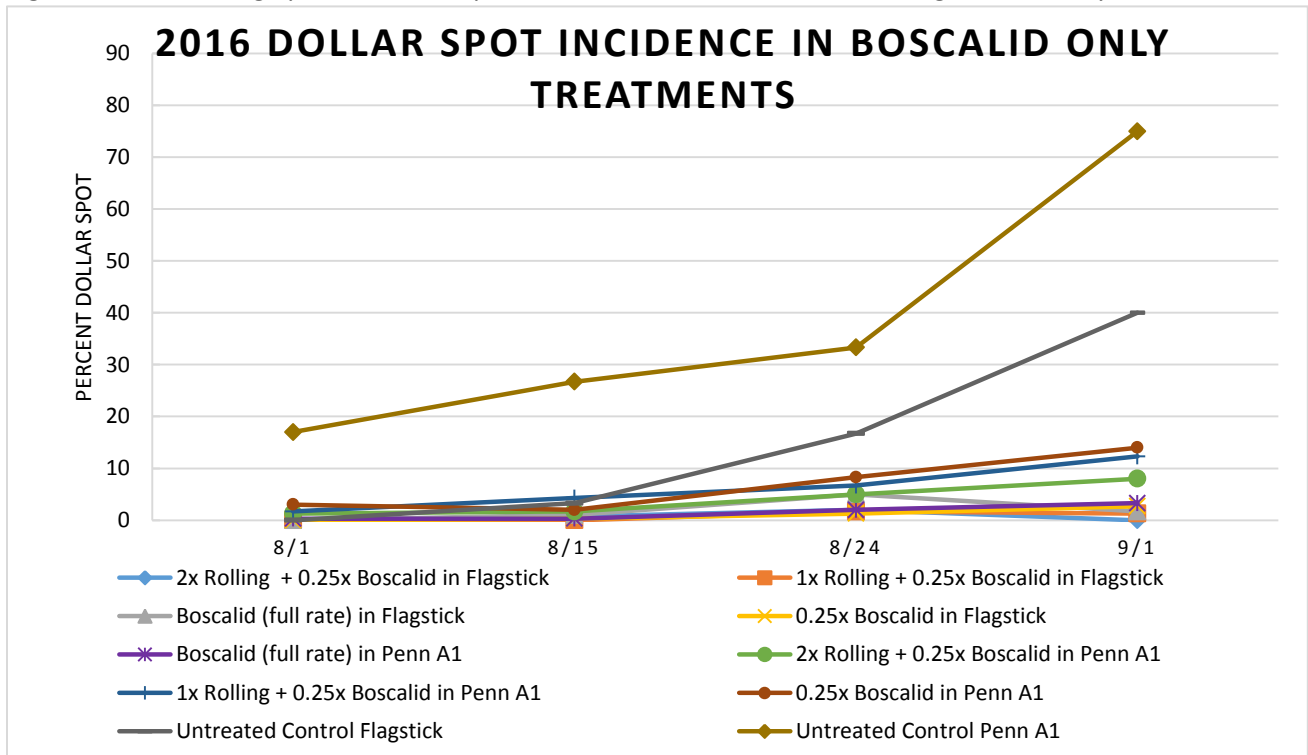


Figure 3. Average percent dollar spot incidence among rolling only treatments.

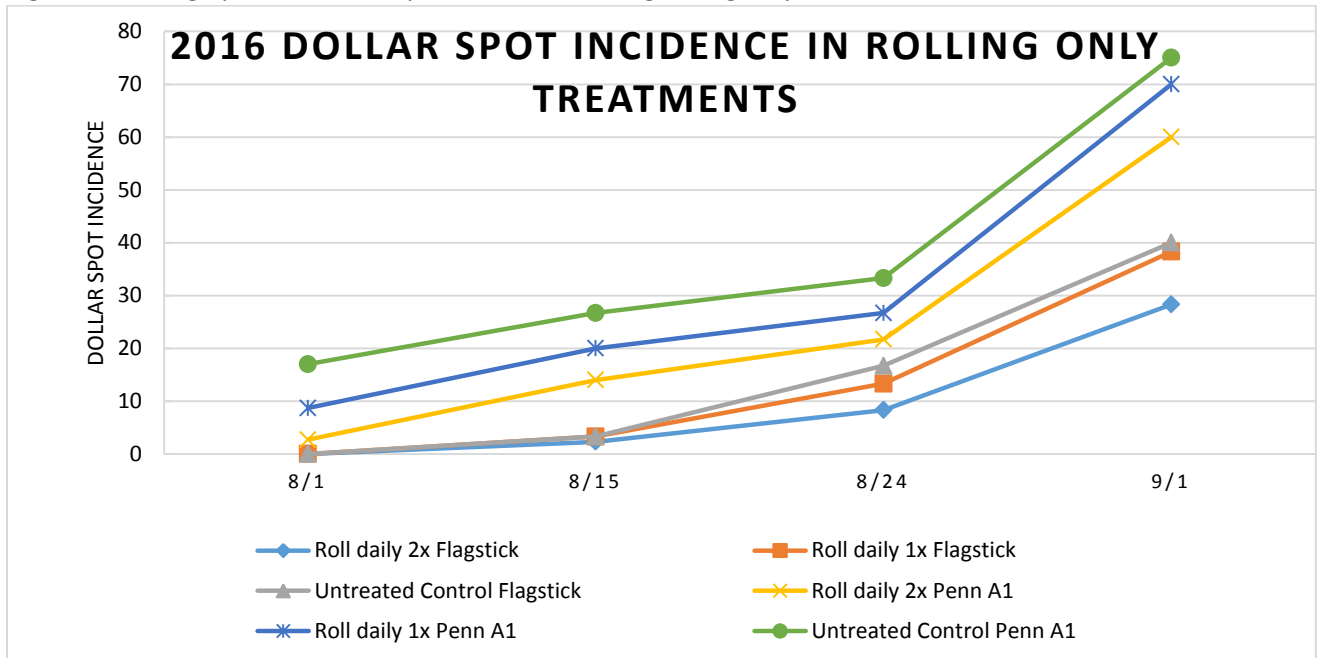


Figure 4. Flagstick average percent dollar spot incidence.

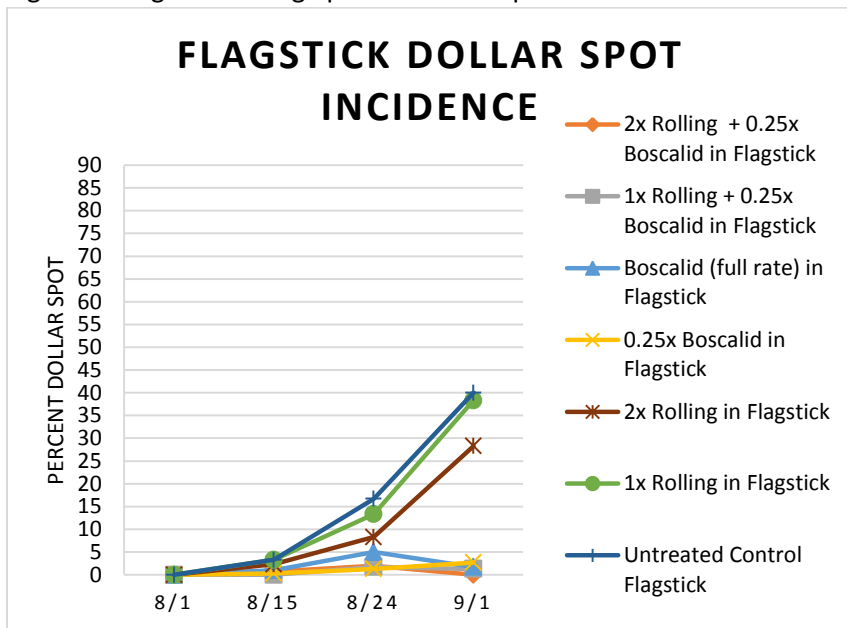


Figure 5. Penn A1 average percent dollar spot incidence.

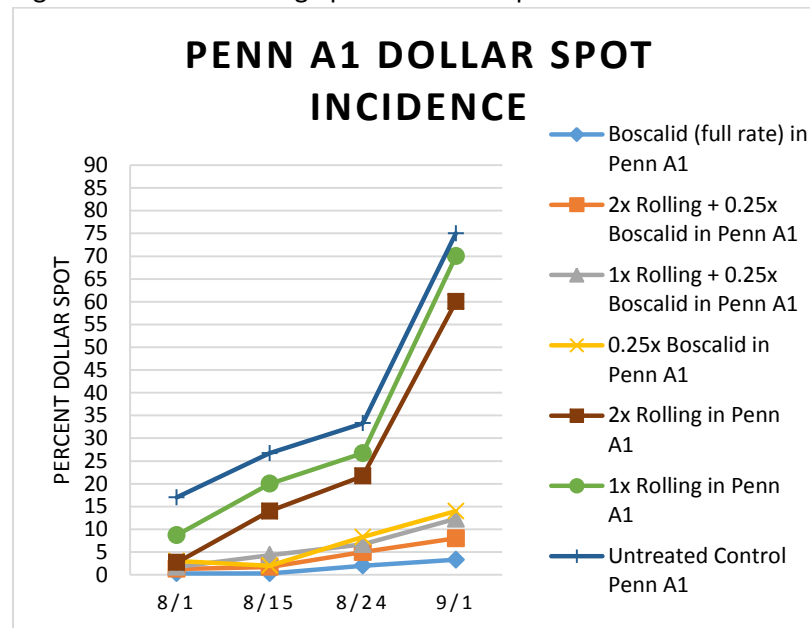




Table 2. Rolling and creeping bentgrass host dollar spot study quality results.  
 Rating Type: Turfgrass quality.  
 Rating Scale: 1-9, where 1 = poor, 6 = acceptable, and 9 = excellent.

Trt No.	Treatment Name	Boscalid Rate <sup>c</sup>	Creeping Bentgrass Cultivar	8/1/2016		8/16/2016		8/24/2016		9/1/2016	
				Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>
1	Roll daily 1x		Penn A1	5.7	de	5.7	d-g	4.3	e	2.7	i
2	Roll daily 1x		Flagstick	6.5	bc	6.5	abc	5.7	cd	3.7	gh
3	Roll daily 2x		Penn A1	5.2	e	5.2	fg	4.2	e	3.0	hi
4	Roll daily 2x		Flagstick	6.0	cd	6.2	b-e	5.5	cd	4.2	fg
5	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	6.0	cd	5.5	efg	5.3	d	4.8	def
6	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	6.2	cd	6.3	bcd	6.8	a	6.5	abc
7	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	5.7	de	5.7	d-g	5.3	d	5.2	de
8	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	6.0	cd	6.0	b-e	6.2	abc	6.8	ab
9	Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	6.5	bc	5.8	c-f	5.5	cd	4.7	ef
10	Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	7.5	a	7.2	a	6.7	ab	6.2	bc
11	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Penn A1	6.5	bc	5.5	efg	6.0	bcd	5.7	cd
12	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Flagstick	7.0	ab	6.7	ab	6.7	ab	7.2	a
13	Untreated Control		Penn A1	5.8	cde	5.0	g	4.0	e	2.3	i
14	Untreated Control		Flagstick	7.2	ab	6.5	abc	6.0	bcd	3.7	gh

<sup>a</sup> Represents the average of 3 replications.

<sup>b</sup> Means followed by the same letter are not significantly different (LSD, p=0.05.)

<sup>c</sup> All boscalid applications made on a 28 day interval on 6/30/16, 7/27/16, and 8/26/16.

Figure 6. 2016 mean turfgrass quality ratings. Ratings are based on a 1-9 scale where 1=poor, 6=acceptable, and 9=excellent.

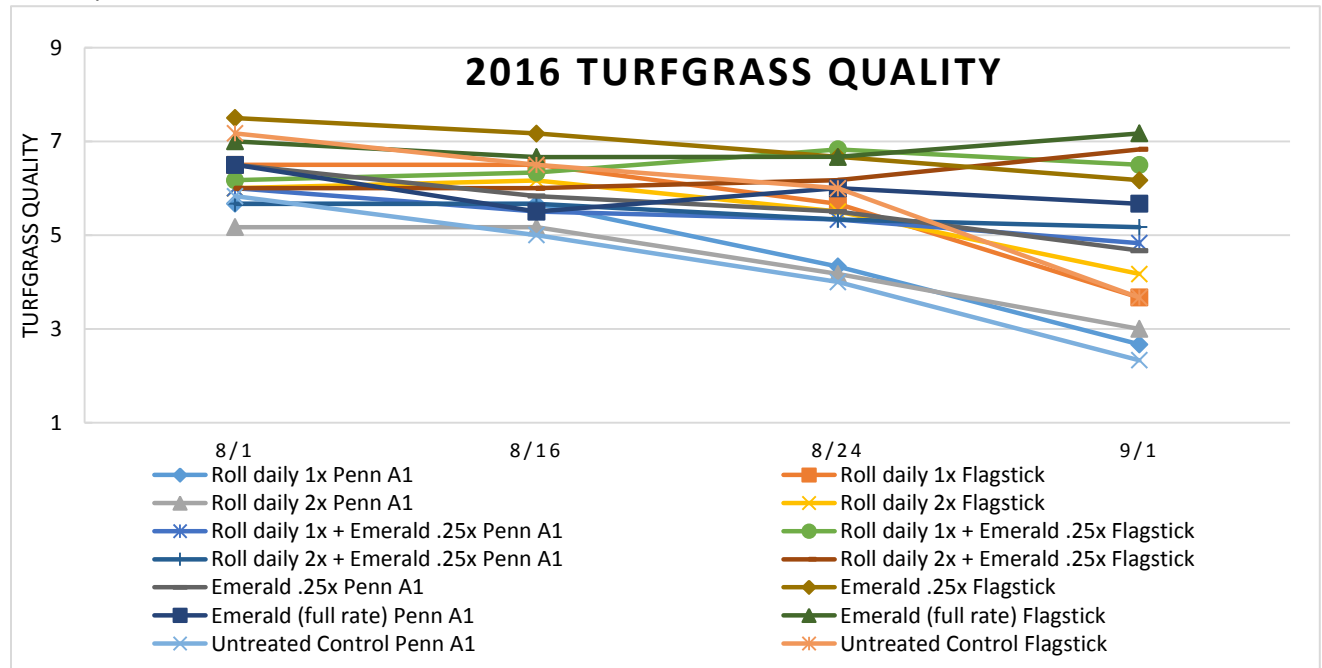


Table 3. Rolling and creeping bentgrass host dollar spot study NDVI results.

Rating Type: NDVI Measurement using a FieldScout TCM 500 NDVI meter.

Rating Scale: 0.000 to 1.000 where 0 = no green and 1 = most green vegetation.

Trt No.	Treatment Name	Boscalid Rate <sup>c</sup>	Creeping Bentgrass Cultivar	8/1/2016		8/15/2016		8/22/2016		8/31/2016	
				Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>
1	Roll daily 1x		Penn A1	0.754	ef	0.754	fg	0.749	f	0.688	h
2	Roll daily 1x		Flagstick	0.757	de	0.761	ef	0.768	cd	0.731	f
3	Roll daily 2x		Penn A1	0.746	f	0.757	fg	0.749	f	0.707	g
4	Roll daily 2x		Flagstick	0.758	cde	0.766	de	0.763	de	0.737	ef
5	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	0.765	b-e	0.750	g	0.760	de	0.752	cde
6	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	0.766	bcd	0.753	g	0.753	ef	0.756	bcd
7	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	0.757	de	0.764	de	0.766	cd	0.756	bcd
8	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	0.764	b-e	0.752	g	0.762	de	0.746	def
9	Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	0.769	b	0.773	bc	0.775	bc	0.764	abc
10	Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	0.780	a	0.781	a	0.785	a	0.770	ab
11	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Penn A1	0.769	bc	0.780	ab	0.785	a	0.759	a-d
12	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Flagstick	0.770	ab	0.782	a	0.787	a	0.777	a
13	Untreated Control		Penn A1	0.766	bcd	0.769	cd	0.768	cd	0.689	h
14	Untreated Control		Flagstick	0.774	ab	0.782	a	0.778	ab	0.748	c-f

<sup>a</sup> Represents the average of 3 replications.

<sup>b</sup> Means followed by the same letter are not significantly different (LSD, p=0.05.)

<sup>c</sup> All boscalid applications made on a 28 day interval on 6/30/16, 7/27/16, and 8/26/16.

Figure 7. 2016 mean NDVI ratings. Ratings were collected using a FieldScout TCM 500 NDVI Meter and are based on a 0-1 scale where 0=no green1=maximum green vegetation.

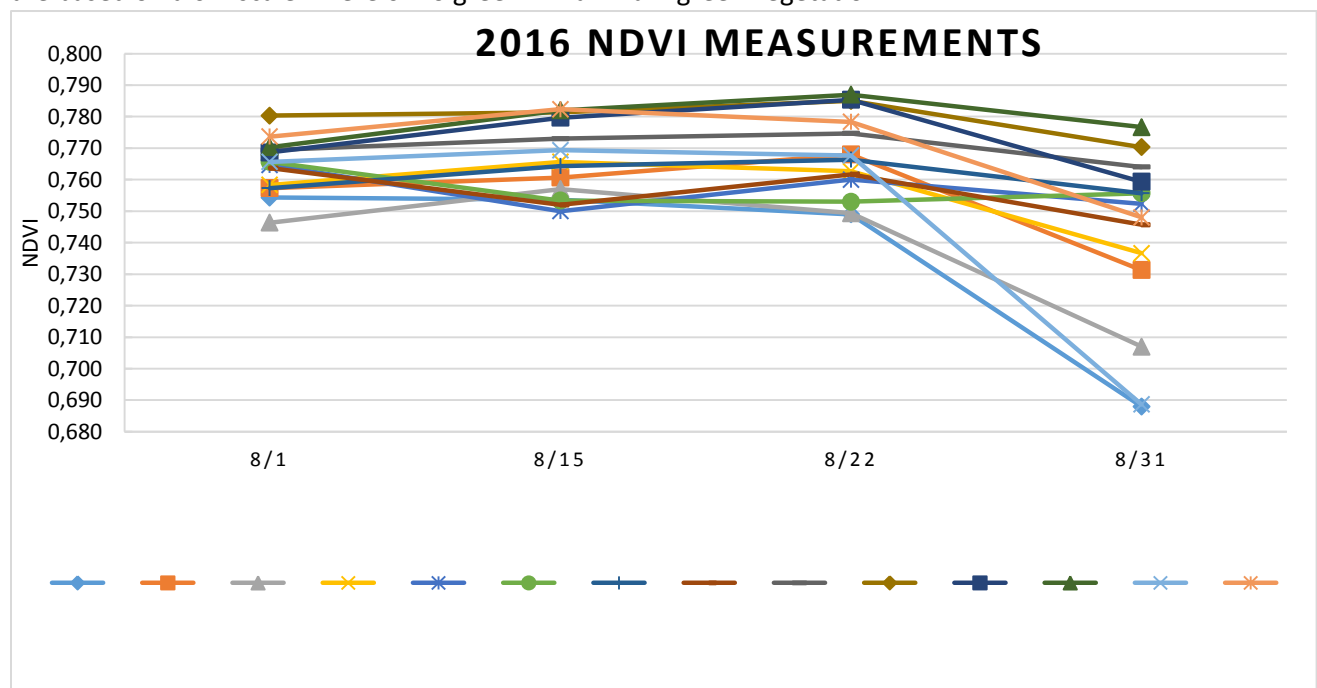




Table 4. Rolling and creeping bentgrass host dollar spot study chlorophyll meter ratings.

Rating Type: Chlorophyll measurements using a Spectrum Technologies Fieldscout CM1000 Chlorophyll Meter.

Rating scale: Index of relative chlorophyll content; 0 = no green and 999 = most green vegetation.

Trt No.	Treatment Name	Boscalid Rate <sup>c</sup>	Creeping Bentgrass Cultivar	8/1/2016		8/15/2016		8/22/2016		8/31/2016	
				Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>
1	Roll daily 1x		Penn A1	260	e	267	hi	243	ef	212	e
2	Roll daily 1x		Flagstick	281	cd	294	bcd	273	bcd	248	d
3	Roll daily 2x		Penn A1	259	e	263	i	225	f	217	e
4	Roll daily 2x		Flagstick	271	cde	277	fgh	244	ef	248	d
5	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	277	cde	272	f-i	259	de	266	c
6	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	276	cde	280	efg	268	bcd	274	c
7	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	280	cd	269	ghi	260	cde	268	c
8	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	266	de	266	hi	249	e	272	c
9	Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	285	c	284	def	278	bc	291	b
10	Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	308	ab	305	ab	301	a	320	a
11	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Penn A1	287	c	292	cde	283	ab	317	a
12	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Flagstick	313	a	316	a	300	a	318	a
13	Untreated Control		Penn A1	290	bc	272	ghi	245	e	213	e
14	Untreated Control		Flagstick	326	a	297	bc	280	b	277	c

<sup>a</sup> Represents the average of 3 replications.

<sup>b</sup> Means followed by the same letter are not significantly different (LSD, p=0.05.)

<sup>c</sup> All boscalid applications made on a 28 day interval on 6/30/16, 7/27/16, and 8/26/16.

Figure 8. Mean chlorophyll measurements collected using a Spectrum Technologies Fieldscout CM1000 chlorophyll meter. Ratings are a measure of the index of relative chlorophyll content; where 0 = no green and 999 = most green vegetation.

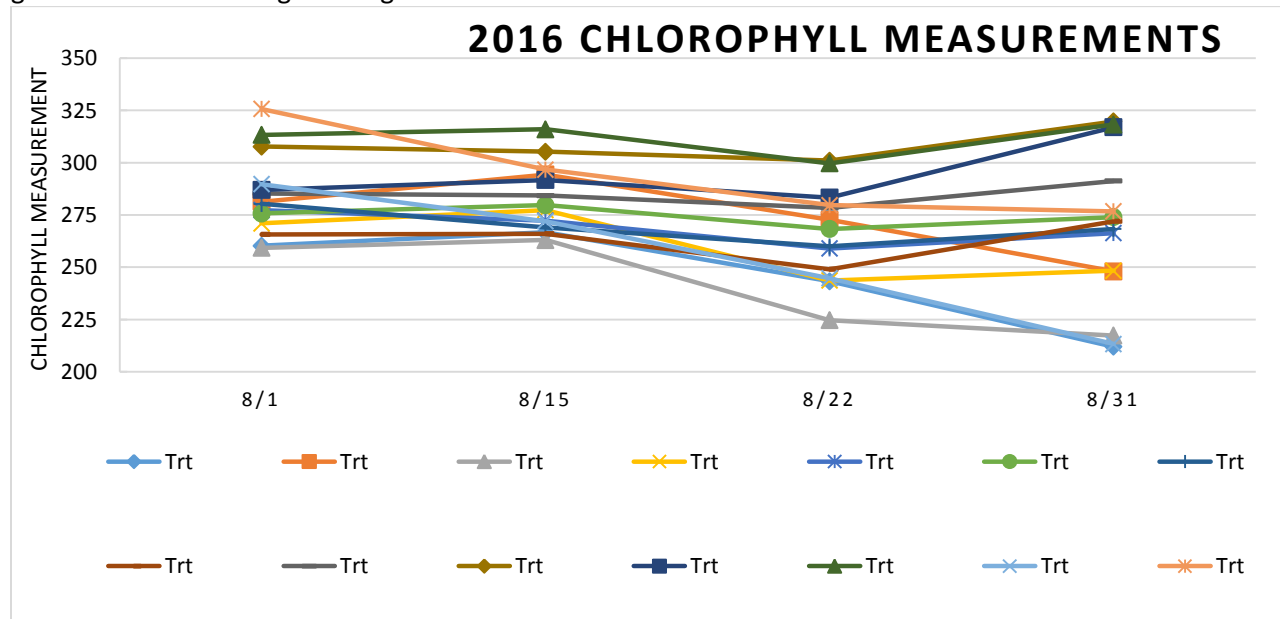


Table 5. Rolling and creeping bentgrass host dollar spot study greenspeed ratings.  
 Rating Type: Ball roll distance (greenspeed) measured using a Pelz Meter.  
 Rating scale: Distance in meters (m).

Trt No.	Treatment Name	Boscalid Rate <sup>c</sup>	Creeping Bentgrass Cultivar	7/25/2016		8/1/2016		8/15/2016		8/22/2016	
				Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>	Mean <sup>a</sup>	LSD <sup>b</sup>
1	Roll daily 1x		Penn A1	2.89	cd	3.02	abc	2.89	abc	3.10	a-d
2	Roll daily 1x		Flagstick	2.65	d	2.79	c-f	2.64	def	2.93	b-f
3	Roll daily 2x		Penn A1	3.29	ab	3.06	abc	2.98	a	3.46	a
4	Roll daily 2x		Flagstick	3.06	bc	3.23	a	2.88	abc	3.31	ab
5	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	3.20	ab	2.88	b-e	2.74	bcd	3.18	abc
6	Roll daily 1x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	3.05	bc	2.89	bcd	2.70	cde	3.06	a-e
7	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	3.38	a	3.18	ab	3.02	a	3.26	ab
8	Roll daily 2x + Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	3.22	ab	3.12	ab	2.95	ab	3.21	abc
9	Boscalid (25%)	0.014 g m <sup>-2</sup>	Penn A1	2.66	d	2.55	f	2.62	def	2.64	ef
10	Boscalid (25%)	0.014 g m <sup>-2</sup>	Flagstick	2.67	d	2.65	def	2.51	ef	2.64	ef
11	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Penn A1	2.88	cd	2.58	def	2.41	f	2.78	c-f
12	Boscalid (full rate)	0.055 g m <sup>-2</sup>	Flagstick	2.61	d	2.57	ef	2.49	ef	2.60	f
13	Untreated Control		Penn A1	2.74	d	2.51	f	2.48	ef	2.67	def
14	Untreated Control		Flagstick	2.70	d	2.50	f	2.43	f	2.62	ef

<sup>a</sup> Represents the average of 3 replications.

<sup>b</sup> Means followed by the same letter are not significantly different (LSD, p=0.05.)

<sup>c</sup> All boscalid applications made on a 28 day interval on 6/30/16, 7/27/16, and 8/26/16.

Figure 9. Greenspeed represented by the measurement of ball roll distance using a Pelz meter (meters.)

