COLLEGE OF AGRICULTURE & NATURAL RESOURCES

MAES | MARYLAND AGRICULTURAL EXPERIMENT STATION

CMREC Paint Branch Turfgrass Facility

ROOTS IN RESEARCH

Yield of 2022

We are proud to present you with the first edition of a series of annual newsletters showcasing the diversity of applied research and hands-on educational programming that happen at the University of Maryland Research and Education Centers across the state. These facilities provide a living-laboratory space to carry out research addressing the real-world problems facing our farmers from issues like invasive species, climate change, economics, and environmental conservation. The information produced from these research projects is shared with the scientific community and directly to the public through journal articles, extension newsletters, and many other formats, but compiling summaries of all of the work done at each facility in one publication here gives a snapshot of how many projects are carried out at each research farm every year.

Here, we have compiled reports on the 2022 projects at the Central Maryland Research and Education Center (CMREC) at Paint Branch, also known as the Turfgrass Facility. CMREC-Paint Branch is unique among the RECs, because the main facility buildings are actually located on the northernmost point of the College Park campus, while the fields are on USDA ground, which is a part of the Beltsville ARS South Farm. As other RECs have diversified the types of agricultural research they support, this facility maintains the specialization on turf management. With fields representing residential lawns, sports fields, and even putting greens, the perennial grasses maintained at this facility provide a living laboratory for research, teaching, and extension in the field of turf science. This research facility continues to actively engage with industry to develop research priorities, while engaging undergraduate students with the proximity to the rest of campus. We hope you enjoy reading about the breadth of different projects, and gain some insight on the value of the work carried out at the RECs each year.

In This Issue:

Roots in Research
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Maryland Extension Publications and Resources on Turf Grass

There is a compiled list of resources from the Maryland Department of Agriculture, Maryland Extension Publications, along with other resources and manuals to help support the turfgrass industry. The Turfgrass Technical Updates (TT-Bulletins) of the University of Maryland's Department of Natural Resource Science and Landscape Architecture are featured here. These are the most current versions of the publications.
Check out Maryland Turfgrass Council website for this list.

Evaluation of new and commercial fungicides for the management of brown patch (*Rhizoctonia solani*)

Fereshteh Shahoveisi, Department of Plant Sciences and Landscape Architecture, University of Maryland, College Park

Brown Patch (caused by the fungus *Rhizoctonia solani*) could be devastating to several turfgrass species including tall fescue. A field study was designed and conducted at the Paint Branch Turfgrass Facility (University of Maryland) to evaluate the efficacy of a new and two commonly available fungicides in the management of the disease. Tall fescue cv. Bullseye with a 3-inch height of cut was used to test fungicides; a non-treated control was also included.

Treatments were applied approximately every 21 days beginning June 1st until August 26th, 2022. A total of 1.5 gal /1000 ft^2 fungicides in 3×6 feet plots were sprayed at each application using a CO2 backpack sprayer equipped with a Teejet AI9506E nozzle. A randomized complete block design with four replications was used. Brown patch disease severity (percentage), quality and color (1-9 scale) were measured every two weeks after disease onset in mid-July until three weeks after the last application. Urea fertilizer was applied twice (0.9 lb/ 1000 ft^2 on June 6th and 0.5lb/ 1000 ft^2 on July 6th). The experiment was concluded on September 15th as the disease severity did not progress. Analysis of variance and Fisher's least significant difference (LSD) procedure at α= 0.05 were used to compare the treatments in their efficacy in managing brown patch and improving the quality and color of turfgrass. Rank transformations were used for non-parametric data including quality and color.

The brown patch severity was relatively low until late July but the favorable weather environment increased the disease pressure in non-treated plots by early August. Among the treatments, non-treated control resulted in the highest disease severity compared to treated plots. In general, Pedigree and UMD-BP-TF-1 had significantly better disease management compared to non-treated. They also outperformed Immunox later in the season but differences were not significant early in the season when disease pressure was lower. The standardized area under the disease progress curve (SAUDPC) indicated that Pedigree and UMD-BP-TF-1 had an overall better performance in managing the disease over time (Table 1).

There were no significant differences among the quality and color of the treated and nontreated plots until July 18th. The quality and color of turfgrass in the non-treated plots started to decline later in the season when disease severity was higher. In general, plots treated with UMD-BP-TF-1 followed by Pedigree had better quality and color scores compared to non-treated and Immunox where some of these differences were statistically significant. (Tables 2 and 3).

Table 1. Brown patch severity on Bullseye tall fescue following the application of fungicides, growing season 2022

	Treatment and Rate per 1000ft²	Application timing [a]	Brown Patch Severity (%) [b]				
			18 Jul	27 Jul	3 Aug	11 Aug	18 Aug
1	Non-treated	-------	3.0 a [c]	9.3 a	20.8 a	32.4 a	32.5 a
2	UMD-BP-TF-1	ADGJM	0.1 b	0.5 b	0.8 c	0.9 c	2.3 c
3	Immunox 12.8 fl oz	ADGJM	1.7 a	3.8 b	5.3 b	12.5 b	16.3 b
4	Pedigree 2.46 fl oz	ADGJM	0.3 b	0.8 b	1.8 bc	3.5 c	5.8 c

Table 1. (continue) Brown patch severity on Bullseye tall fescue following the application of fungicides, growing season 2022

	Treatment and Rate per 1000ft²	Application timing [a]	Brown Patch Severity (%) [b]				
			24 Aug	1 Sep	7 Sep	15 Sep	SAUDPC [d]
1	Non-treated	-------	33.8 a [c]	38.8 a	35.0 a	32.5 a	26.8 a
2	UMD-BP-TF-1	ADGJM	3.8 c	7.3 b	4.8 c	4.3 b	2.7 c
3	Immunox 12.8 fl oz	ADGJM	22.5 b	35.0 a	32.5 a	31.3 a	17.5 b
4	Pedigree 2.46 fl oz	ADGJM	7.0 c	11.3 b	10.8 b	8.3 b	5.6 c

[a] The letters indicate the application timing where A=June 1st, D=June 22nd, G=July 13th, and J=August 3rd, M=August 24th. Due to a precipitation event 30 minutes after the August 24th application, all treatments were repeated on August 26th.
[b] Brown patch severity was visually assessed on a 0 to 100% scale where 0 presents no disease and 100 shows the entire plot area affected by the pathogen.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
[d] Standardized area under the disease progress curve

Table 2. Turfgrass quality of Bullseye tall fescue following the application of fungicides for the management of brown patch, growing season 2022

	Treatment and Rate per 1000ft²	Application timing [a]	Quality (Scale 1-9) [b]				
			18 Jul	27 Jul	3 Aug	11 Aug	18 Aug
1	Non-treated	-------	7.8 NS	7.3 b	6.8 b	5.3 b	5.0 c
2	UMD-BP-TF-1	ADGJM	8.0 NS	8.0 a	7.6 a	7.6 a	7.6 a
3	Immunox 12.8 fl oz	ADGJM	8.0 NS	8.0 a	7.0 ab	6.9 a	6.8 b
4	Pedigree 2.46 fl oz	ADGJM	8.0 NS	8.0 a	7.5 a	7.3 a	7.0 ab

Table 2. (continue) Turfgrass quality of Bullseye tall fescue following the application of fungicides for the management of brown patch, growing season 2022

	Treatment and Rate per 1000ft^2	Application timing [a]	Quality (Scale 1-9) [b]			
			24 Aug	1 Sep	7 Sep	15 Sep
1	Non-treated	-------	5.0 c [c]	4.8 c	5.5 c	5.8 c
2	UMD-BP-TF-1	ADGJM	7.4 a	7.0 a	7.5 a	7.8 a
3	Immunox 12.8 fl oz	ADGJM	6.5 b	6.0 b	6.4 bc	6.4 bc
4	Pedigree 2.46 fl oz	ADGJM	7.0 ab	6.9 a	6.6 ab	6.75 b

a The letters indicate the application timing where A=June 1st, D=June 22nd, G=July 13th, and J=August 3rd, M=August 24th. Due to a precipitation event 30 minutes after the August 24th application, all treatments were repeated on August 26th.
b Turfgrass quality was visually assessed on a 1 to 9 scale where 1 = turfgrass brown or dead, 6 = minimum acceptable level, and 9 = optimum density and greenness.
c Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
NS represents no significant differences among the treatments in the column.

Table 3. Turfgrass color of Bullseye tall fescue following the application of fungicides for the management of brown patch, growing season 2022

	Treatment and Rate per 1000ft^2	Application timing [a]	Color (Scale 1-9) [b]				
			18 Jul	27 Jul	3 Aug	11 Aug	18 Aug
1	Non-treated	-------	8.0 NS [c]	7.5 b	6.8 b	6.1 d	6.1 c
2	UMD-BP-TF-1	ADGJM	8.4 NS	8.4 a	7.9 a	7.8 a	7.6 a
3	Immunox 12.8 fl oz	ADGJM	8.0 NS	8.0 a	7.0 b	7.0 c	7.0 b
4	Pedigree 2.46 fl oz	ADGJM	8.0 NS	8.0 a	7.6 a	7.4 b	7.4 ab

Table 3. (continue) Turfgrass color of Bullseye tall fescue following the application of fungicides for the management of brown patch, growing season 2022

	Treatment and Rate per 1000ft^2	Application timing [a]	Quality (Scale 1-9) [b]			
			24 Aug	1 Sep	7 Sep	15 Sep
1	Non-treated	-------	6.0 c [c]	5.6 c	6.1 b	6.3 b
2	UMD-BP-TF-1	ADGJM	7.4 a	7.0 a	7.0 a	7.0 a
3	Immunox 12.8 fl oz	ADGJM	6.8 b	6.4 b	6.8 a	6.8 a
4	Pedigree 2.46 fl oz	ADGJM	7.1 ab	6.9 ab	7.0 a	7.0 a

[a] The letters indicate the application timing where A=June 1st, D=June 22nd, G=July 13th, and J=August 3rd, M=August 24th. Due to a precipitation event 30 minutes after the August 24th application, all treatments were repeated on August 26th.
[b] Turfgrass color was visually assessed on a 1 to 9 scale where 1 = entire plot brown or dead and 9 = optimum dark green color.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
NS represents no significant differences among the treatments in the column.

Humid Temperate and Subtropical Turfgrass Species Growth in Maryland: A Living Lab for Students

Mark Carroll, Department of Plant Science and Landscape Architecture

As a member of the University of Maryland turfgrass team, and the instructor of the University of Maryland's introductory turfgrass management course, I am always mindful that a turf student may do an internship or relocate to another region of the country following graduation. As such, I dedicate equal amounts of time introducing students to turfgrass species that are common in mid-Atlantic region as well those that found in other regions of the country.

Figure 1. The demonstration area where students are introduced to turfgrass species that do not persist in Maryland. The grass seen in the foreground is an ultra-dwarf species of bermudagrass that is used as putting green surface on golf courses in the southern United States. This species does not persist in Maryland. Behind it is common bermudagrass, a species that thrives as both a weed and managed turfgrass in Maryland.

Several turfgrass species that are commonly found in the deep south, and coastal California, do not survive winters in the Mid-Atlantic. To show these grasses to students as they would appear in a lawn, samples of these species are maintained in a greenhouse from November to May after which, flats of each are planted in a field adjacent to the classroom at Paint Branch Turfgrass Facility. The grasses are spaced far enough apart from one another, that when they are viewed by students in September, they can see how the growth rates of the various species vary over the course of the summer. Visitors attending educational workshops at the facility over the summer months are also afforded the opportunity to view and learn about these turfgrass species. With the onset of freezing temperatures, the samples are dug up and placed back in the greenhouse where they remain until the following May.

Figure 2. Introducing the identification of turfgrass species to high school science educators attending a workshop held at the Paint Branch turfgrass research facility in August of 2022.

Over the winter months, turf student teams that are preparing for the National Collegiate Turf Bowl and Student Challenge competitions, use the plant material to prepare for the turfgrass identification sections of these two competitions. The two competitions, which take place at the Golf Course Superintendents Association of America Conference and Trade Show, and the Sports Field Management Association Conference respectively, are intensively competitive events that can involve has many as 80 student teams from universities around the country. Under the direction of Dr. Kevin Mathias, and more recently Senior Lecturer Geoffrey Rhinehart, the University of Maryland teams have done very well in these competitions, including several first-place finishes over the past 10 years. I like to think the Humid Temperate and Subtropical Turfgrass Species Growth in Maryland: A Living Lab for Students, has played a small part in team's successes.

Evaluation of fungicides for the management of gray leaf spot (*Pyricularia grisea*) on perennial ryegrass (*Lolium perenne*)

Fereshteh Shahoveisi, Department of Plant Sciences and Landscape Architecture, University of Maryland, College Park

A field study was carried out at the Paint Branch Turfgrass Facility in College Park, Maryland. Perennial ryegrass cv. Majesty with a 3-inch height of cut was used to test the efficacy of fungicides in the management of gray leaf spot disease caused by *Pyricularia grisea*. Treatments were applied approximately every 14 or 28 days beginning June 30th, 2022, and concluded on September 23rd, 2022. Non-treated plots were also included as negative controls. A CO2 backpack sprayer equipped with a Teejet AI9508E nozzle was used to spray 2 gal /1000 ft^2 fungicides in 3×6 feet plots. A total of four replications and a randomized complete block design were used. Quality and color were measured once a month (on July 18th, August 26th, and September 7th) prior to disease initiation. The plots were inoculated with 4000 spores/ml of *P. grisea* suspension on September 11th as the disease did not occur naturally. Gray leaf spot disease severity (percentage), quality and color (1-9 scale) were measured every week after disease symptoms appeared on September 15th; the rating was continued until October 13th. Urea fertilizer was applied three times (0.9 lb/ 1000 ft^2 on June 6th, 0.5 lb/1000 ft^2 on July 11th, and July 25th). Further, plots were sprayed with Prostar® (or Pedigree) and Emerald® fungicides on June 30th, July 13th, July 25th, August 8th, and August 24th for the management of brown patch and dollar spot, respectively. Two herbicide applications were used on July 8th (Three-Way™ Ester) and July 27th (TZone™) for the management of broad-leaf weeds. The experiment was concluded on October 13th as the disease severity did not progress. Analysis of variance and Fisher's least significant difference (LSD) procedure at $\alpha = 0.05$ were used to compare the treatments in their efficacy in managing gray leaf spot and improving the quality and color of turfgrass. Rank transformations were used for nonparametric data including quality and color.

Among the treatments, non-treated control resulted in the highest disease severity compared to treated plots except on September 22nd where Pillar G had a numerically higher disease severity but it was not significantly different from the non-treated control. Overall, Daconil Action, Rayora, and Tekken resulted in the lowest disease severity while Banner Max II and Pillar G offered moderate to low disease management. The standardized area under the disease progress curve (SAUDPC) that shows the progress of the disease over time also showed that Daconil Action, Rayora, and Tekken had a significantly better performance in contrast to non-treated and other treatments (Table 1).

The color of turfgrass was generally above the minimum acceptable range (6 on a scale of 1-9); however, the quality was slightly below 6 from late August to late September. Starting in late August, changes in turfgrass quality/color were noticed in some treated plots which were mainly due to leaf spot infections. The turfgrass recovered from the stress and discoloration by the end of September. Further, the quality and color of the non-treated plots were affected by gray leaf spot after late September where disease pressure was significantly higher compared to treated plots. In general, fungicide treatments improved the quality and color except during the period of late August and September when leaf spot affected the turfgrass. (Tables 2 and 3).

Table 1. Gray leaf spot severity on Majesty perennial ryegrass following the application of fungicides, growing season 2022.

	Treatment and rate per 1000ft	Application Timing [a]	Gray leaf spot severity (%) [b]					
			15 Sep	22 Sep	29 Sep	6 Oct	13 Oct	SAUDPC[d]
1	Non-treated	-------	0.8 a [c]	2.8 ab	5.3 a	7.8 a	9 a	5.3 a
2	Rayora/ 1.4 fl oz	AEIM	0.0 b	0.9 b	1.3 bc	1.3 c	1.3 c	1.0 b
3	Banner Max II/2.0 fl oz	AEIM	0.0 b	2.4 ab	4.0 ab	6.5 ab	6.5 ab	4.2 a
4	Tekken/ 3.0 fl oz	AEIM	0.0 b	0.8 b	1.3 bc	1.3 c	1.3 c	1.0 b
5	Pillar G/ 3.0 lb	AEIM	0.3 b	4.3 a	4.8 a	5.0 b	5.0 b	4.2 a
6	Daconil Action/ 3.5 fl oz	ACEGIKM	0.0 b	0.6 b	0.8 c	1.0 c	1.0 c	0.8 b

[a] The letters indicate the application timing where A=June 30th, C= July 14th, E= July 28th, G= August 11th, I= August 24th, K= September 8th, M= September 23rd. About 5 hours after the August 24th application, there was a rain event for a few minutes.
[b] Gray leaf spot severity was visually assessed on a 0 to 100% scale where 0 presents no disease and 100 shows the entire plot area affected by the pathogen. c Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05). [d] Standardized area under the disease progress curve.

Table 2. Turfgrass quality of Majesty perennial ryegrass following the application of fungicides for the management of gray leaf spot, growing season 2022.

	Treatment and rate per 1000ft	Application timing [a]	Quality (scale 1-9) [b]							
			18 Jul	26 Aug	7 Sep	15 Sep	22 Sep	29 Sep	6 Oct	13 Oct
1	Non-treated	-------	6.1 b[c]	5.8 NS	5.8 ab	5.8 a	6.0 a	5.9 ab	5.4 b	5.4 b
2	Rayora/ 1.4 fl oz	AEIM	7.5 a	5.9 NS	5.8 ab	5.9 a	6.0 a	6.4 ab	7.0 a	6.9 a
3	Banner Max II/2.0 fl oz	AEIM	7.4 a	5.8 NS	4.9 c	5.0 c	5.0 c	5.8 b	6.9 a	6.8 a
4	Tekken/ 3.0 fl oz	AEIM	7.0 a	5.9 NS	5.3 bc	5.1 bc	5.4 bc	6.0 ab	6.8 a	6.8 a
5	Pillar G/ 3.0 lb	AEIM	7.0 a	5.9 NS	6.0 a	5.8 a	5.5 abc	6.3 ab	7.0 a	7.0 a
6	Daconil Action/ 3.5 fl oz	ACEGIKM	7.4 a	6.3 NS	6.0 a	5.6 ab	5.8 ab	6.5 a	7.3 a	7.0 a

[a] The letters indicate the application timing where A=June 30th, C= July 14th, E= July 28th, G= August 11th, I= August 24th, K= September 8th, M= September 23rd. About 5 hours after the August 24th application, there was a rain event for a few minutes.
[b] Turfgrass quality was visually assessed on a 1 to 9 scale where 1 = turfgrass discolored or dead, 6 = minimum acceptable level, and 9 = optimum density and greenness. [c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05). NS represents no significant differences among the treatments in the column.

Table 3. Turfgrass color of Majesty perennial ryegrass following the application of fungicides for the management of gray leaf spot, growing season 2022.

	Treatment and rate per 1000ft	Application timing [a]	Color (Scale 1-9) [b]							
			18 Jul	26 Aug	7 Sep	15 Sep	22 Sep	29 Sep	6 Oct	13 Oct
1	Non-treated	-------	7.5 NS[c]	6.1 b	6.1 bc	6.1 NS	6.0 NS	5.8 b	5.4 c	5.5 c
2	Rayora/ 1.4 fl oz	AEIM	7.5 NS	6.5 ab	6.5 ab	6.0 NS	6.0 NS	6.8 a	7.5 ab	7.0 ab
3	Banner Max II/2.0 fl oz	AEIM	7.3 NS	6.4 ab	5.8 c	6.0 NS	6.0 NS	6.4 a	6.9 b	6.8 b
4	Tekken/ 3.0 fl oz	AEIM	7.0 NS	6.3 ab	6.0 bc	5.9 NS	6.1 NS	6.8 a	7.1 ab	7.0 ab
5	Pillar G/ 3.0 lb	AEIM	7.0 NS	6.3 ab	6.8 a	6.0 NS	6.3 NS	6.3 ab	7.0 ab	6.8 b
6	Daconil Action/ 3.5 fl oz	ACEGIKM	7.3 NS	6.9 a	6.9 a	6.4 NS	6.3 NS	6.5 a	7.6 a	7.4 a

[a] The letters indicate the application timing where A=June 30th, C= July 14th, E= July 28th, G= August 11th, I= August 24th, K= September 8th, M= September 23rd. About 5 hours after the August 24th application, there was a rain event for a few minutes.
[b] Turfgrass color was visually assessed on a 1 to 9 scale where 1 = entire plot discolored or dead and 9 = optimum dark green color.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05). NS represents no significant differences among the treatments in the column.

Evaluation of new and commercially available fungicides for the management of dollar spot on fairway height creeping bentgrass

Fereshteh Shahoveisi, Department of Plant Sciences and Landscape Architecture, University of Maryland, College Park

Dollar spot is caused by several *Clarireedia* species (*Clarireedia spp.*). A field study was designed and conducted at the Paint Branch Turfgrass Facility in College Park, Maryland to evaluate the efficacy of new and commercially available fungicides in the management of the disease. fairway height (0.5-inch height) creeping bentgrass cv. Penncross was used to test the fungicides. A nontreated control was also included.

Treatments were applied every 14 or 21 days beginning May 18th until July 20th, 2022. A total of 1.5 gal /1000 ft^2 fungicides in 3×6 feet plots were sprayed at each application using a CO2 backpack sprayer equipped with a Teejet AI9506E nozzle. A randomized complete block design with four replications was used. The number of dollar spot infection centers, quality and color (19 scale) were rated approximately every week starting June 1st until August 11th. Quality and color were rated on the first application date (May 18th), as well. Analysis of variance and Fisher's least significant difference (LSD) procedure at α= 0.05 were used to compare the treatments in their efficacy in managing dollar spot and improving the quality and color of turfgrass. Rank transformations were used for non-parametric data including quality and color.

The dollar spot pressure was high during the study period. The dollar spot infection centers were significantly higher in non-treated plots compared to treated ones starting June 1st; the number of the centers in non-treated plots increased to an average of 216.6 per plot by August 11th. UMDDS-B-1 and Tekken showed the best performance in disease management with a maximum of 17.5 and 12.7 centers per plot, respectively, on July 19th. Daconil Ultrex and Daconil Ultrex mixed with UMD-DS-B-2 significantly reduced the disease level compared to non-treated plots where the maximum centers were 26.2 and 27.4 (respectively) on July 19th. The standardized area under the disease progress curve (SAUDPC) also verified this result (Table 1).

The quality and color of turfgrass were measured on the first application date (May 18th) and there were no significant differences among treatments. The quality and color of turfgrass in non-treated plots started to decrease as disease pressure elevated. Tekken and UMD-DS-B-1 significantly improved the color and quality of grass throughout the study duration. Further, Daconil Ultrex and Daconil Ultrex mixed with UMD-DS-B-2 improved the quality and color to an above minimum acceptable value (above 6 on a 1-9 scale) with significant differences compared to non-treated plots. While Tekken and UMD-DS-B-1 outperformed Daconil Ultex and Daconil Ultrex mixed with UMD-DS-B-2, only some differences were statistically significant (Tables 2 and 3).

Table 1. Dollar spot infection centers on Penncross creeping bentgrass following the application of fungicides, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Dollar Spot Infection Centers (Count) [b]					
			1 Jun	8 Jun	15 Jun	22 Jun	29 Jun	7 Jul
1	Non-treated	-------	14.2 a [c]	24.8 a	43.7 a	52.9 a	82.4 a	119.2 a
2	UMD-DS-B-1	ADGJ	1.7 c	3.2 c	3.4 d	3.5 c	6.6 c	6.3 c
3	Tekken 3.0 fl oz	ADGJ	3.1 bc	3.1 c	4.7 cd	5.0 c	5.9 c	5.9 c
4	Daconil Ultrex 2.8 fl oz	ACEGI	5.8 ab	9.0 b	10.7 b	11.3 b	13.7 b	15.4 b
5	Daconil Ultrex 2.8 fl oz + UMD-DS-B-2	ACEGI	4.9 bc	6.7 b	8.5 bc	9.0 b	11.2 b	14.5 b

Table 1. (continue) Dollar spot infection centers on Penncross creeping bentgrass following the application of fungicides, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Dollar Spot Infection Centers (Count) [b]					
			14 Jul	19 Jul	27 Jul	4 Aug	11 Aug	SAUDPC [d]
1	Non-treated	-------	135.5 a [c]	152.8 a	179.4 a	216.6 a	216.6a	96.8 a
2	UMD-DS-B-1	ADGJ	10.2 c	12.7 d	9.7 c	6.4 c	5.2 c	5.8 c
3	Tekken 3.0 fl oz	ADGJ	10.4 c	17.5 c	10.4 c	6.2 c	5.1 c	6.4 c
4	Daconil Ultrex 2.8 fl oz	ACEGI	18.6 b	26.2 b	22.0 b	18.6 b	14.4 b	13.7 b
5	Daconil Ultrex 2.8 fl oz + UMD-DS-B-2	ACEGI	20.0 b	27.4 b	22.2 b	20.0 b	18.4 b	13.1 b

[a] The letters indicate the application timing where A: May18th, C: June 1st, D: June 8th, E: June 15th, G: June 29th, I: July13th, J: July20th.
[b] dollar spot was visually rated by counting the number of infection centers.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
d Standardized area under the disease progress curve.

Table 2. Turfgrass quality of Penncross creeping bentgrass following the application of fungicides for the management of dollar spot, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Quality (Scale 1-9) [b]					
			18 May	1 Jun	8 Jun	15 Jun	22 Jun	29 Jun
1	Non-treated	-------	8.0 NS [c]	8.0 NS	7.5 b	7.0 b	6.1 c	6.1 c
2	UMD-DS-B-1	ADGJ	8.0 NS	8.0 NS	8.0 a	8.0 a	8.0 a	8.0 a
3	Tekken 3.0 fl oz	ADGJ	8.0 NS	8.0 NS	8.0 a	8.0 a	8.0 a	8.0 a
4	Daconil Ultrex 2.8 fl oz	ACEGI	8.0 NS	8.0 NS	8.0 a	8.0 a	8.0 a	7.5 b
5	Daconil Ultrex 2.8 fl oz + UMD-DS-B-2	ACEGI	8.0 NS	8.0 NS	8.0 a	7.8 a	7.5 b	7.4 b

Table 2. (continue) Turfgrass quality of Penncross creeping bentgrass following the application of fungicides for the management of dollar spot, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Quality (Scale 1-9) [b]					
			7 Jul	14 Jul	19 Jul	27 Jul	4 Aug	11 Aug
1	Non-treated	-------	6.0 d [c]	5.1 d	4.9 c	4.8 d	4.5 d	4.3 d
2	UMD-DS-B-1	ADGJ	7.9 a	7.8 ab	7.1 a	7.1 ab	7.1 ab	7.1 b
3	Tekken 3.0 fl oz	ADGJ	8.0 a	7.9 a	7.3 a	7.5 a	7.6 a	7.6 a
4	Daconil Ultrex 2.8 fl oz	ACEGI	7.4 b	7.1 bc	6.9 a	6.8 b	6.6 bc	6.4 c
5	Daconil Ultrex 2.8 fl oz + UMD-DS-B-2	ACEGI	7.0 c	6.8 c	6.3 b	6.3 c	6.3 c	6.3 c

[a] The letters indicate the application timing where A: May18th, C: June 1st, D: June 8th, E: June 15th, G: June 29th, I: July13th, J: July20th.
[b] Turfgrass quality was visually assessed on a 1 to 9 scale where 1 = turfgrass discolored or dead, 6 = minimum acceptable level, and 9 = optimum density and greenness.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
NS represents no significant differences among the treatments in the column.

Table 3. Turfgrass color of Penncross creeping bentgrass following the application of fungicides for the management of dollar spot, growing season 2022

	Treatment and rate per 1000ft²	Application timing [a]	Color (Scale 1-9) [b]					
			18 May	1 Jun	8 Jun	15 Jun	22 Jun	29 Jun
1	Non-treated	-------	8.0 NS [c]	7.5 b	7.1 b	7.0 c	6.9 d	6.5 c
2	UMD-DS-B-1	ADGJ	8.1 NS	8.1 a	8.1 a	8.1 a	8.3 a	8.1 a
3	Tekken 3.0 fl oz	ADGJ	8.1 NS	8.1 a	8.1 a	8.1 a	8.1 ab	8.1 a
4	Daconil Ultrex 2.8 fl oz	ACEGI	8.0 NS	8.0 a	8.0 a	8.0 a	7.9 bc	7.6 b
5	Daconil Ultrex 2.8 fl oz + UMD-DS-B-2	ACEGI	8.0 NS	8.0 a	8.0 a	7.6 b	7.8 c	7.5 b

Table 3. (continue) Turfgrass color of Penncross creeping bentgrass following the application of fungicides for the management of dollar spot, growing season 2022

	Treatment and rate per 1000ft²	Application timing [a]	Color (Scale 1-9) [b]					
			7 Jul	14 Jul	19 Jul	27 Jul	4 Aug	11 Aug
1	Non-treated	-------	6.3 c [c]	6.0 c	5.4 c	5.1 d	4.8 e	4.5 d
2	UMD-DS-B-1	ADGJ	8.0 a	7.6 a	7.5 a	7.5 ab	7.4 b	7.3 b
3	Tekken 3.0 fl oz	ADGJ	7.9 a	7.8 a	7.5 a	7.6 a	8.0 a	7.9 a
4	Daconil Ultrex 2.8 fl oz	ACEGI	7.6 ab	7.1 ab	7.1 ab	7.0 bc	6.8 c	6.6 c
5	Daconil Ultrex 2.8 fl oz + UMD-DS-B-2	ACEGI	7.3 b	6.9 b	6.5 b	6.5 c	6.1 d	6.1 c

[a] The letters indicate the application timing where A: May18th, C: June 1st, D: June 8th, E: June 15th, G: June 29th, I: July13th, J: July20th.
[b] Turfgrass color was visually assessed on a 1 to 9 scale where 1 = entire plot discolored or dead and 9 = optimum dark green color.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
NS represents no significant differences among the treatments in the column.

Evaluation of experimental fungicides for the management of gray leaf spot (*Pyricularia grisea*)

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Gray leaf spot (caused by the fungus *Pyricularia grisea*) could be devastating to several turfgrass species including perennial ryegrass and tall fescue. Two field studies were conducted at the Paint Branch Turfgrass Facility (University of Maryland) to evaluate the efficacy of experimental fungicides in the management of the disease. Perennial ryegrass cv. Majesty with a 3-inch height of cut was used to test fungicides; non-treated and CLEARY 3336 4 F fungicide were included as negative and positive controls, respectively.

In both studies, treatments were applied approximately every 14 days beginning June 30th until September 23rd, 2022. A total of 1 gal /1000 ft² fungicides in 3×6 feet plots were sprayed at each application using a CO2 backpack sprayer equipped with a Teejet AI9504E nozzle. A randomized complete block design with four replications was used. The natural infections did not occur and therefore plots were inoculated with the spore suspension (4000 spore/ml) on September 10th. Urea fertilizer was applied three times (0.9 lb/ 1000 ft² on June 13th and July 11th, and 0.5 lb/ 1000 ft² on July 25th). Further, plots were sprayed with Prostar® (or Pedigree) and Emerald® fungicides on June 30th, July 13th, July 25th, August 8th, and August 24th for the management of brown patch and dollar spot, respectively. Gray leaf spot disease severity (percentage) was measured every week after the initiation of the disease from September 15th until October 14th. Quality and color (1-9 scale) were measured multiple times prior to disease establishment as there were quality and color reductions in treated plots starting in late August. Analysis of variance and Fisher's least significant difference (LSD) procedure at α= 0.05 were used to compare the treatments in their efficacy in managing gray leaf spot and improving the quality and color of turfgrass. Rank transformations were used for non-parametric data including quality and color.

Despite the inoculation, the disease pressure and symptoms stayed at a low level. However, significant differences were detected between non-treated and most of the treatments in both studies. The only treatment that was not significantly different from the non-treated throughout the disease rating period was UMD-GLS-PR-2 in study 1. The rest of the treatments successfully managed the disease with the standardized area under the disease progress curve (SAUDPC) of less than 3.2% in study 1 and 0.6% in study 2.

No phytotoxicity was observed in the first month of the fungicide applications but later in the season (mid to late August) yellowing was observed in the treated plots while non-treated looked better in color and quality. After examining the leaves, there was a high level of leaf spot spores and lesions present on the leaves. The leaf spot symptoms started to decrease in late September. High pressure of leaf spot resulted in a lower quality and color rating during this period. In study 1, there were no significant differences between the quality of treated and non-treated plots after the September 22nd rating. In study 2, the non-treated plots had lower quality and density during this period due to the gray leaf spot disease symptoms; however, the differences were not significant compared to most of the treated plots. The color of plots varied after September 22nd rating; the non-treated plots in study 1 had lower ratings for color where the differences were significant only on the October 6th rating. In study 2, most of the plots had above minimum acceptable color (6 on a 1- 9 scale) after September 29th regardless of treatments. In general, the color and quality were affected by leaf spot symptoms until late September, and improvements started in early October.

Table 1. Gray leaf spot severity on Majesty perennial ryegrass following the application of fungicides in study 1, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Gray Leaf Spot Severity (%) [b]					
			15 Sep	22 Sep	29 Sep	6 Oct	14 Oct	SAUDPC [d]
1	Non-treated	-------	4.2 a [c]	5.3 a	7.0 a	9.5 a	9.5 a	7.2 a
2	UMD-GLS-PR-1	ACEGIKM	0.2 bc	2.3 bc	3.5 ab	4.3 b	4.3 b	3.2 b
3	UMD-GLS-PR-2	ACEGIKN	1.2 b	4.5 ab	6.0 a	9.3 a	9.3 a	6.4 a
4	UMD-GLS-PR-3	ACEGIKM	0.1 c	1.8 c	1.8 b	1.8 b	1.8 b	1.6 b
5	CLEARLY 3336 4 F 4.0 fl oz	ACEGIKM	0.0 c	0.5 c	1.0 b	1.0 b	1.0 b	0.8 b

a The letters indicate the application timing where A= June 30th, C=July 14th, E= July 28th, G= August 11th, I= August 24th, K=September 8th, M=September 23rd.

b Gray leaf spot severity was visually assessed on a 0 to 100% scale where 0 presents no disease and 100 shows the entire plot area affected by the pathogen.

c Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).

d Standardized area under the disease progress curve

Table 2. Gray leaf spot severity on Majesty perennial ryegrass following the application of fungicides in study 2, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Gray Leaf Spot Severity (%) [b]					
			15 Sep	22 Sep	29 Sep	6 Oct	14 Oct	SAUDPC [d]
1	Non-treated	-------	1.7 a [c]	4.2 a	5.1 a	6.9 a	6.9 a	5.3 a
2	UMD-GLS-PR-4	ACEGIKM	0.0 b	0.1 b	0.1 bc	0.4 b	0.4 bc	0.4 b
3	UMD-GLS-PR-4 SECURE ACTION SC 0.5 fl oz	ACEGIKM	0.0 b	0.0 b	0.0 c	0.0 c	0.0 c	0.0 b
4	UMD-GLS-PR-5	ACEGIKM	0.0 b	0.0 b	0.0 c	0.0 c	0.0 c	0.0 b
5	UMD-GLS-PR-6	ACEGIKM	0.0 b	0.0 b	0.0 c	0.3 bc	0.4 bc	0.2 b
6	UMD-GLS-PR-7 (lower rate) UMD-GLS-PR-8	ACEGIKM	0.0 b	0.1 b	0.3 b	0.7 b	0.7 b	0.6 b
7	UMD-GLS-PR-7 (higher rate) UMD-GLS-PR-8	ACEGIKM	0.0 b	0.0 b	0.0 c	0.0 c	0.1 bc	0.03 b
8	UMD-GLS-PR-7 UMD-GLS-PR-8 UMD-GLS-PR-9	ACEGIKM	0.0 b	0.0 b	0.0 c	0.0 c	0.0 c	0.0 b
9	CLEARLY 3336 4 F 4.0 fl oz	ACEGIKM	0.0 b	0.0 b	0.0 c	0.0 c	0.0 c	0.0 b

[a] The letters indicate the application timing where A= June 30th, C=July 14th, E= July 28th, G= August 11th, I= August 24th, K=September 8th, M=September 23rd.
[b] Gray leaf spot severity was visually assessed on a 0 to 100% scale where 0 presents no disease and 100 shows the entire plot area affected by the pathogen.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
[d] Standardized area under the disease progress curve

Table 3. Turfgrass quality of Majesty perennial ryegrass following the application of fungicides for the management of gray leaf spot in study 1, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Quality (Scale of 1-9) [b]							
			18 Jul	26 Aug	7 Sep	15 Sep	22 Sep	29 Sep	6 Oct	14 Oct
1	Non-treated	-------	7.5 NS [c]	6.0 a	5.8 a	5.5 a	5.5 NS	6.0 NS	6.3 NS	6.0 NS
2	UMD-GLS-PR-1	ACEGIKM	7.0 NS	4.5 b	4.3 b	5.3 ab	5.0 NS	5.8 NS	6.5 NS	6.3 NS
3	UMD-GLS-PR-2	ACEGIKN	7.5 NS	4.5 b	4.3 b	5.0 ab	5.0 NS	5.8 NS	6.8 NS	6.3 NS
4	UMD-GLS-PR-3	ACEGIKM	7.5 NS	5.0 b	4.0 b	4.8 b	5.0 NS	5.8 NS	6.8 NS	6.5 NS
5	CLEARLY 3336 4 F 4.0 fl oz	ACEGIKM	7.5 NS	5.0 b	5.3 b	5.3 ab	5.5 NS	6.0 NS	7.0 NS	6.3 NS

a The letters indicate the application timing where A= June 30th, C=July 14th, E= July 28th, G= August 11th, I= August 24th, K=September 8th, M=September 23rd.
b Turfgrass quality was visually assessed on a 1 to 9 scale where 1 = turfgrass discolored or dead, 6 = minimum acceptable level, and 9 = optimum density and greenness.
c Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
NS represents no significant differences among the treatments in the column.

Table 4. Turfgrass quality of Majesty perennial ryegrass following the application of fungicides for the management of gray leaf spot in study 2, growing season 2022

	Treatment and rate per 1000ft²	Application timing [a]	Quality (Scale of 1-9) [b]							
			18 Jul	26 Aug	7 Sep	15 Sep	22 Sep	29 Sep	6 Oct	14 Oct
1	Non-treated	-------	5.5 b [c]	5.8 a	6.0 a	5.5 a	5.0 abc	5.3 bc	5.9 d	5.9 bcd
2	UMD-GLS-PR-4	ACEGIKM	6.0 ab	5.3 a	5.0 bc	5.0 ab	5.3 ab	6.0 a	6.8 ab	6.4 ab
3	UMD-GLS-PR-4 SECURE ACTION SC 0.5 fl oz	ACEGIKM	6.0 ab	5.0 ab	5.5 a	5.0 ab	4.8 bc	5.8 ab	6.5 abc	6.5 a
4	UMD-GLS-PR-5	ACEGIKM	6.3 a	5.5 a	4.8 bcd	5.0 ab	5.0 abc	5.8 ab	6.9 a	6.1 abc
5	UMD-GLS-PR-6	ACEGIKM	6.4 a	5.0 ab	5.0 bc	5.0 ab	4.8 bc	5.3 bc	6.1 cd	5.5 d
6	UMD-GLS-PR-7 UMD-GLS-PR-8	ACEGIKM	6.4 a	5.3 a	4.5 cd	4.6 b	4.5 c	5.6 ab	6.3 bcd	5.9 bcd
7	UMD-GLS-PR-7 UMD-GLS-PR-8	ACEGIKM	6.6 a	5.0 ab	4.0 d	4.5 b	4.8 bc	5.3 bc	6.1 cd	5.9 bcd
8	UMD-GLS-PR-7 UMD-GLS-PR-8 UMD-GLS-PR-9	ACEGIKM	6.4 a	4.3 b	4.3 cd	4.5 b	4.5 c	5.0 c	6.3 bcd	5.8 cd
9	CLEARLY 3336 4 F 4.0 fl oz	ACEGIKM	6.5 a	5.0 ab	5.0 bc	4.9 b	5.5 a	5.9 a	6.5 abc	6.0 a-d

[a] The letters indicate the application timing where A= June 30th, C=July 14th, E= July 28th, G= August 11th, I= August 24th, K=September 8th, M=September 23rd.
[b] Turfgrass quality was visually assessed on a 1 to 9 scale where 1 = turfgrass discolored or dead, 6 = minimum acceptable level, and 9 = optimum density and greenness.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).

Table 5. Turfgrass color of Majesty perennial ryegrass following the application of fungicides for the management of gray leaf spot in study 1, growing season 2022

	Treatment and rate per 1000ft²	Application timing [a]	Color (Scale of 1-9) [b]							
			18 Jul	26 Aug	7 Sep	15 Sep	22 Sep	29 Sep	6 Oct	14 Oct
1	Non-treated	-------	7.5 ab[c]	6.5 a	6.5 a	6.0 a	5.8 NS	6.0 NS	6.0 b	6.5 NS
2	UMD-GLS-PR-1	ACEGIKM	7.5 ab	5.3 b	5.3 b	5.8 ab	5.5 NS	6.3 NS	7.0 a	6.8 NS
3	UMD-GLS-PR-2	ACEGIKN	7.0 b	6.0 a	4.8 b	5.3 b	5.3 NS	6.0 NS	7.0 a	6.5 NS
4	UMD-GLS-PR-3	ACEGIKM	7.0 b	6.0 a	4.8 b	5.5 ab	5.3 NS	6.3 NS	7.0 a	6.8 NS
5	CLEARLY 3336 4 F 4.0 fl oz	ACEGIKM	7.8 a	6.0 a	5.5 b	5.8 ab	6.0 NS	6.3 NS	7.0 a	7.0 NS

[a] The letters indicate the application timing where A= June 30th, C=July 14th, E= July 28th, G= August 11th, I= August 24th, K=September 8th, M=September 23rd.
[b] Turfgrass color was visually assessed on a 1 to 9 scale where 1 = entire plot discolored or dead and 9 = optimum dark green color.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
NS represents no significant differences among the treatments in the column.

Table 6. Turfgrass color of Majesty perennial ryegrass following the application of fungicides for the management of gray leaf spot in study 2, growing season 2022

	Treatment and rate per 1000ft²	Application timing [a]	Color (Scale of 1-9) [b]							
			18 Jul	26 Aug	7 Sep	15 Sep	22 Sep	29 Sep	6 Oct	14 Oct
1	Non-treated	-------	6.3 b [c]	6.5 a	6.3 a	6.0 a	5.8 a	6.0 a	7.0 a	6.5 a
2	UMD-GLS-PR-4	ACEGIKM	6.8 ab	6.0 ab	5.5 abc	5.3 b	5.0 bc	6.3 a	7.0 a	6.3 a
3	UMD-GLS-PR-4 SECURE ACTION SC 0.5 fl oz	ACEGIKM	6.5 ab	6.0 ab	6.0 ab	5.1 b	5.0 bc	6.0 a	6.8 ab	6.3 a
4	UMD-GLS-PR-5	ACEGIKM	7.0 a	6.0 ab	5.3 bc	5.0 b	5.3 abc	6.0 a	7.0 a	6.4 a
5	UMD-GLS-PR-6	ACEGIKM	7.0 a	5.5 bc	5.5 abc	5.3 b	5.0 bc	6.0 a	6.3 c	6.4 a
6	UMD-GLS-PR-7 UMD-GLS-PR-8	ACEGIKM	7.0 a	5.8 bc	5.3 bc	5.0 b	5.0 bc	6.0 a	6.4 bc	6.1 ab
7	UMD-GLS-PR-7 UMD-GLS-PR-8	ACEGIKM	7.0 a	5.8 bc	5.1 c	5.0 b	5.0 bc	6.0 a	6.4 bc	5.6 b
8	UMD-GLS-PR-7 UMD-GLS-PR-8 UMD-GLS-PR-9	ACEGIKM	7.0 a	5.3 c	5.3 bc	5.4 b	4.8 c	5.5 b	6.9 a	6.3 a
9	CLEARLY 3336 4 F 4.0 fl oz	ACEGIKM	6.8 ab	6.0 ab	6.1 a	5.3 b	5.4 ab	6.0 a	6.9 a	6.3 a

[a] The letters indicate the application timing where A= June 30th, C=July 14th, E= July 28th, G= August 11th, I= August 24th, K=September 8th, M=September 23rd.
[b] Turfgrass color was visually assessed on a 1 to 9 scale where 1 = entire plot discolored or dead and 9 = optimum dark green color.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).

Evaluation of fungicides for the management of brown patch (*Rhizoctonia solani*) on tall fescue (*Festuca arundinacea*)

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Brown Patch (caused by *Rhizoctonia solani*) is one of the important turfgrass diseases commonly observed in home lawns in the Mid-Atlantic region. A field study was carried out at the Paint Branch Turfgrass Facility (University of Maryland) to evaluate the efficacy of some fungicides in the management of the disease. Tall fescue cv. Bullseye with a 3-inch height of cut was used to test fungicides and a non-treated control. Treatments were applied approximately every 28 days beginning June 1st until August 26th, 2022. A total of 2 gal /1000 ft² fungicides in 3×6 feet plots were sprayed at each application using a CO2 backpack sprayer equipped with a Teejet AI9508E nozzle. A randomized complete block design with four replications was used. Brown patch disease severity (percentage), quality and color (1-9 scale) were measured every two weeks after disease onset in mid-July until three weeks after the last application. Urea fertilizer was applied twice (0.9 lb/ 1000 ft² on June 6th and 0.5 lb/1000 ft² on July 6th). The experiment was concluded on September 15th as the disease pressure started to decline. Analysis of variance and Fisher's least significant difference (LSD) procedure at α= 0.05 were used to compare the treatments in their efficacy in managing brown patch and improving the quality and color of turfgrass. Rank transformations were used for non-parametric data including quality and color.

The brown patch severity was relatively low until late July but the favorable weather environment increased the disease pressure by early August. Among the treatments, non-treated control resulted in the highest disease severity compared to treated plots. Fame SC had significantly better disease management at all tested dates compared to non-treated. It also outperformed Rayora and Banner Max II but the difference was not significant on all application dates. While Rayora and Banner Max II had similar results in disease management, Rayora resulted in numerically lower disease severities on September 7th and 15th. Considering that Fame SC resulted in considerably lower disease pressure, significant differences between Rayora/ Banner Max II and the non-treated control were masked. The standardized area under the disease progress curve (SAUDPC) that shows the progress of the disease over time also showed that Fame SC had a significantly better performance in contrast to other treatments (Table 1).

While the quality and color of turfgrass were generally good, they were affected by brown patch disease later in the season. There was no significant difference in the quality and color of the treatments until mid to late July, respectively. Later in the season, non-treated control and Fame SC resulted in the lowest and highest quality and color scores, respectively. Rayora and Banner Max II applications improved the color and quality of turfgrass compared to the non-treated control; however, the differences were not significant for all evaluated dates (Tables 2 and 3).

Table 1. Brown patch severity on Bullseye tall fescue following the application of fungicides, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Brown patch severity (%) [b]						
			18 Jul	28 Jul	11 Aug	24 Aug	7 Sep	15 Sep	SAUDPC [d]
1	Non-treated	-------	2.0 a[c]	7.9 a	17.1 a	27.5 a	34.7 a	28.5 a	21.2 a
2	Fame SC 0.27 fl oz	AEIM	.03 b	.04 b	1.0 b	7.0 b	8.3 b	6.3 b	4.4 b
3	Rayora 1.4 fl oz	AEIM	.05 b	2.5 ab	8.0 a	21.8 ab	23.9 a	19.4 a	14.1 a
4	Banner Max II 2.0 fl oz	AEIM	.05 b	1.9 ab	9.6 a	21.3 ab	30.6 a	23.1 a	15.5 a

[a] The letters indicate the application timing where A=June 1st, E=June 29th, I=July 28th, and M=August 24th. Due to a precipitation event 30 minutes after the August 24th application, all treatments were repeated on August 26th.
[b] Brown patch severity was visually assessed on a 0 to 100% scale where 0 presents no disease and 100 shows the entire plot area affected by the pathogen.
[c] Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
[d] Standardized area under the disease progress curve

Table 2. Turfgrass quality of Bullseye tall fescue following the application of fungicides for the management of brown patch, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Color (Scale of 1-9) [b]						
			18 Jul	28 Jul	11 Aug	24 Aug	7 Sep	15 Sep	SAUDPC [d]
1	Non-treated	-------	6.5 NS [c]	6.3 b	5.5 b	5.5 b	5.5 b	5.3 b	5.3 b
2	Fame SC 0.27 fl oz	AEIM	7.0 NS	7.0 a	7.0 a	6.8 a	6.8 a	6.8 a	6.5 a
3	Rayora 1.4 fl oz	AEIM	6.5 NS	7.0 a	6.8 a	6.5 ab	6.5 ab	6.0 ab	6.0 a
4	Banner Max II 2.0 fl oz	AEIM	6.7 NS	6.8 ab	6.5 a	6.3 ab	6.3 ab	5.8 b	6.0 a

a The letters indicate the application timing where A=June 1st, E=June 29th, I=July 28th, and M=August 24th. Due to a precipitation event 30 minutes after the August 24th application, all treatments were repeated on August 26th.
b Turfgrass quality was visually assessed on a 1 to 9 scale where 1 = turfgrass brown or dead, 6 = minimum acceptable level, and 9 = optimum density and greenness.
c Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
NS represents no significant differences among the treatments in the column.

Table 3. Turfgrass color of Bullseye tall fescue following the application of fungicides for the management of brown patch, growing season 2022

	Treatment and rate per 1000ft^2	Application timing [a]	Color (Scale of 1-9) [b]						
			18 Jul	28 Jul	11 Aug	24 Aug	7 Sep	15 Sep	SAUDPC [d]
1	Non-treated	-------	6.5 NS [c]	6.3 b	5.5 b	5.5 b	5.5 b	5.3 b	5.3 b
2	Fame SC 0.27 fl oz	AEIM	7.0 NS	7.0 a	7.0 a	6.8 a	6.8 a	6.8 a	6.5 a
3	Rayora 1.4 fl oz	AEIM	6.5 NS	7.0 a	6.8 a	6.5 ab	6.5 ab	6.0 ab	6.0 a
4	Banner Max II 2.0 fl oz	AEIM	6.7 NS	6.8 ab	6.5 a	6.3 ab	6.3 ab	5.8 b	6.0 a

a The letters indicate the application timing where A=June 1st, E=June 29th, I=July 28th, and M=August 24th. Due to a precipitation event 30 minutes after the August 24th application, all treatments were repeated on August 26th.
b Turfgrass color was visually assessed on a 1 to 9 scale where 1 = entire plot brown or dead and 9 = optimum dark green color.
c Means in a column followed by the same letter are not significantly different according to Fisher's least significant difference (α= 0.05).
NS represents no significant differences among the treatments in the column.

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