

PREVENTIVE AND CURATIVE CONTROL OF BROWN RING PATCH WITH VARIOUS FUNGICIDES, 2010

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INTRODUCTION

Brown ring patch (aka Waitea patch) is a relatively new disease caused by *Waitea circinata* var. *circinata*, which is closely related to the Rhizoctonia species. Primarily a disease of annual bluegrass (*Poa annua*) putting greens, disease symptoms appear as circular patch anywhere from a few inches to a foot or more in diameter. The disease initially was identified in the United States on various golf courses in the western part of the country and later was identified throughout the Northeastern U.S. Due to the relatively novelty of the disease, limited studies have been conducted to evaluate the efficacy of fungicides on disease suppression. The objectives of this study were to assess the preventive and curative suppression of brown ring patch on golf course putting greens.

MATERIALS & METHODS

Two field studies were initiated in the spring of 2010. Varying studies were established on a golf course putting green at the Penn State Blue Course and Bucknell Golf Club located in State College and Lewisberg, PA, respectively. Both putting greens consisted of a mixture of creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*). Soil at the Penn State Blue Course putting green consisted of a modified sand with a pH of 7.0. Soil for the site located at Bucknell was a modified sand, but pH and organic matter were not determined.

All fungicide treatments were applied with a CO₂ pressurized (40 psi) sprayer equipped with a flat-fan nozzle (AI9508E), and calibrated to deliver either 2.0 gal water per 1000 ft². At both sites, treatments were applied twice on either 2 or 4 week intervals. All treatments and application dates are listed in the data tables.

Plots measured 3 ft x 6 ft, and were arranged in a randomized complete block with four replications. Percent of plot area blighted by *W. circinata* var. *circinata* was assessed visually on a linear 0 to 100% scale where 0 = entire plot area green and healthy, and 100 = entire plot area blighted. In addition to disease ratings, other ratings were assessed including percent algae, turfgrass quality and injury. Turfgrass injury in the form of discoloration and growth regulation was rated on a 0 to 5 scale where 0 = no injury observed, 2 = minimum acceptable injury for a golf course putting green, and 5 = entire plot area brown or dead. Turfgrass quality was rated visually on a 1 to 9 scale where 1 = entire plot area brown or dead; 7 = minimum acceptable quality for a golf course putting green; and 9 = optimum greenness and density. Finally, algae infestation was rated visually on a 0 to 10 scale where 0 = no algae present and 10 = maximum severity of algae within plots. All data was subjected to analysis of variance and means separated at $P \leq 0.05$ using Fisher's protected LSD test.

RESULTS

Brown ring patch. For the curative suppression of brown ring patch, disease severity was low when treatments were initiated on 29 April. At this time, plots had between 0.5 and 6.5% disease and no differences were observed among treatments (Table 1). When treatments were reapplied 2 weeks later, disease symptoms had decreased to $\leq 1.0\%$. Subsequent visits to rate plots revealed no disease present even within the untreated control plots. In the preventive study on the 8th green at the Penn State Blue Course, no disease was present when treatments were initiated on 1 April. On 19 May, approximately 3 weeks after the second and final application, brown ring patch pressure had increased to a maximum of 4.3% within the untreated control plots (Table 2). All fungicide plots had significantly reduced disease symptoms and percent plot area blighted in all treatments ranged from 0. to 1.3%. Few differences

existed among treatments, but plots treated with Daconil Ultrex provided an average level of suppression when compared to the treatments providing complete control and the untreated control. Complete suppression of brown ring patch was observed within plots treated with Renown, ProStar, Endorse, Disarm, Heritage, Headway, and Medallion + Trinity.

Algae. Algae were evident in plots at the Bucknell site approximately one week after the final application. At this time, moderate algae was observed within all plots and only those plots treated with chlorothalonil (Renown or Daconil Ultrex) provided near complete suppression (<1.0) of algae (Table 1).

Turfgrass injury. Turfgrass injury in the form of growth regulation was observed within in both studies, but no injury ratings were considered unacceptable. At the Bucknell site, the greatest level of injury was observed within plots treated with Banner MAXX and Headway (Table 3). Moderate injury was observed in plots treated with Trinity. Little to no injury was observed within any other plot 1 week after the initial application. On 19 May (1 week after the second application), minor injury was observed with various plots and only plots treated with Triton FLO (which contains the green pigmented StressGard®) showed no visible injury. Similar to the Bucknell site, injury ratings taken 1 week after the initial application (8 April) revealed that the greatest level of injury within all plots containing Banner MAXX (Table 4). This injury, however, was short lived and only minor injury was observed within these plots on subsequent rating dates. Injury ratings within plots treated with two applications of triticonazole (Trinity and Triton FLO) were considered moderate (2.0) when plots were rated on 19 May.

Turfgrass quality. Turfgrass quality at both sites was rating periodically and was highly variable among treatments (Table 3 and 4). The most important factor in overall turfgrass quality at both sites appeared to be related to either the injury associated with the growth regulation of certain DMI fungicides or the presence of StressGard within Triton FLO. Initial quality ratings within plots exhibiting moderate growth regulation were relatively low. However, when the regulation effects decreased within certain treatments, those plots began to show improved quality. On the other hand, plots treated with two applications of either triticonazole product began to show decreased quality as the growth regulation injury became apparent. In general, plots treated with Triton FLO exhibited improved quality. However, turfgrass quality within plots treated with 1.1 fl oz of Triton FLO began to decline and was among the lowest approximately 3 weeks following the last application at the Penn State site.

DISCUSSION

In both studies, brown ring patch severity was considered low and fungicide efficacy under severe infestations of the pathogen could not be determined. In the preventive trial at Penn State, most treatments included in the study resulted in excellent to moderate suppression of the disease. Among the most effective fungicides were those within the DMI chemical class. These fungicides have been known to cause moderate to severe growth regulation. In this trial, however, the development of the growth regulation effects appeared to vary by active ingredient. In the case of Banner MAXX, the negative impact of the regulation appeared to occur more quickly than some of the other fungicides within the same class. However, this regulation appeared to dissipate following the second application. On the other hand, the growth regulation within plots treated with triticonazole (Trinity or Triton) seemed to take longer to manifest itself. This regulation, however, caused moderate but acceptable levels of injury for up to three weeks following the second and final application.

Future research is needed to determine the timing and efficacy of both preventive and curative fungicide applications for the suppression of brown ring patch. In addition, results of this study indicate that variation in growth regulation-related injury may occur among fungicides within the DMI chemistry. Field studies should be developed to determine the best application rate, application interval, and influence of consecutive applications on the regulation resulting from the various DMI fungicides.

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Table 1. Percent brown ring patch and algae incidence on a golf course putting green at the Bucknell Golf Course following the application of various fungicides for brown ring patch, 2010.

Treatment and rate per 1000 sq ft ^x	Brown ring patch ^z		Algae ^y
	6 May	13 May	19 May
Renown 4.5 fl oz.....	0.6 a ^w	0.2 a	0.8 c
Prostar 70WG 2.25 oz.....	1.5 a	0.2 a	3.0 ab
Triton Flo 3.1SC 0.55 fl oz.....	2.3 a	0.0 a	4.5 a
Daconil Ultrex 3.3 oz.....	0.7 a	0.2 a	0.8 c
Endorse 4 oz.....	2.0 a	0.4 a	4.3 a
Medallion 0.50 oz.....	2.0 a	0.2 a	3.5 ab
Banner MAXX 2.0 fl oz.....	6.5 a	1.0 a	3.8 ab
Trinity 2.0 fl oz.....	2.6 a	0.3 a	4.3 a
Triton FLO 1.1 fl oz	0.8 a	0.1 a	4.3 a
Insignia 0.9 oz.....	1.3 a	0.3 a	4.5 a
Disarm 480SC 0.36 fl oz.....	0.6 a	0.0 a	3.8 ab
Heritage TL 2 fl oz.....	0.5 a	0.1 a	2.5 b
Compass 0.2 oz.....	3.5 a	0.6 a	3.5 ab
Headway 3 fl oz.....	3.3 a	0.5 a	3.5 ab
Untreated.....	2.8 a	0.9 a	3.5 ab

^z Percent plot area affected by brown ring patch was rated visually on a 0 to 100% scale where 0 = no disease symptoms were present and 100 = entire plot area displaying disease symptoms.

^y Algae severity was rated on a 0 to 10 scale where 0 = no algae was present in the plots and 10 = maximum severity of algae within plots.

^x Treatments were applied on 29 Apr and 13 May.

^w Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ level according to the Fisher's protected least significant difference t-test.

Table 2. Percent brown ring patch on a golf course putting green at the Penn State Blue Golf Course following the application of various fungicides for brown ring patch, 2010.

Treatment and rate per 1000 sq ft ^x	Brown ring patch (%)	
	19 May	
Renown 4.5 fl oz.....	0.0	c
Prostar 70WG 2.25 oz.....	0.0	c
Triton Flo 3.1SC 0.55 fl oz.....	0.3	bc
Daconil Ultrex 3.3 oz.....	1.3	b
Endorse 4 oz.....	0.0	c
Medallion 0.50 oz.....	0.5	bc
Banner MAXX 2.0 fl oz.....	0.5	bc
Trinity 2.0 fl oz.....	0.4	bc
Triton FLO 1.1 fl oz.....	0.1	c
Insignia 0.9 oz.....	0.8	bc
Disarm 480SC 0.36 fl oz.....	0.0	c
Heritage TL 2 fl oz.....	0.0	c
Compass 0.2 oz.....	1.1	bc
Headway 3 fl oz.....	0.0	c
Medallion 0.25 oz + Trinity 1.0 fl oz.....	0.0	c
Medallion 0.25 oz + Triton Flo 3.1 SC 0.55 fl oz.....	0.5	bc
Medallion 0.25 oz + Banner MAXX 1.0 fl oz.....	0.3	bc
Untreated.....	4.3	a

^z Percent plot area affected by brown ring patch was rated visually on a 0 to 100% scale where 0 = no disease symptoms were present and 100 = entire plot area displaying disease symptoms.

^x Treatments were applied on 1 and 30 Apr.

^w Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ level according to the Fisher's protected least significant difference t-test.

Table 3. Turfgrass quality and injury on a golf course putting green at the Bucknell Golf Course following the application of various fungicides for brown ring patch, 2010.

Treatment and rate per 1000 sq ft ^x	Injury (0-5) ^z		Quality ^y		
	6 May	19 May	6 May	13 May	19 May
Renown 4.5 fl oz.....	0.0 c ^w	0.5 cde	7.3 ab ^x	7.8 ab	7.0 b
Prostar 70WG 2.25 oz.....	0.0 c	1.0 bcd	6.5 cd	7.3 abc	7.0 b
Triton Flo 3.1SC 0.55 fl oz.....	0.0 c	0.0 e	7.0 bc	7.8 ab	8.0 a
Daconil Ultrex 3.3 oz.....	0.0 c	0.8 cde	7.0 bc	7.3 abc	7.0 b
Endorse 4 oz.....	0.3 c	0.8 cde	6.5 cd	7.0 bcd	7.0 b
Medallion 0.50 oz.....	0.5 c	1.3 bc	6.8 bcd	7.3 abc	6.8 b
Banner MAXX 2.0 fl oz.....	2.5 a	2.3 a	5.5 f	6.3 d	5.8 c
Trinity 2.0 fl oz.....	1.5 b	1.3 bc	6.3 de	7.3 abc	6.8 b
Triton FLO 1.1 fl oz.....	0.0 c	0.0 e	7.8 a	8.0 a	8.0 a
Insignia 0.9 oz.....	0.5 c	0.3 de	6.8 bcd	7.3 abc	7.3 b
Disarm 480SC 0.36 fl oz.....	0.5 c	0.8 cde	7.0 bc	7.8 ab	7.0 b
Heritage TL 2 fl oz.....	0.0 c	0.5 cde	7.3 ab	7.5 abc	7.3 b
Compass 0.2 oz.....	0.3 c	0.8 cde	7.3 ab	6.8 cd	7.0 b
Headway 3 fl oz.....	2.0 ab	1.8 ab	5.8 ef	6.8 cd	6.0 c
Untreated.....	0.3 c	1.0 bcd	6.8 bcd	7.0 bcd	7.0 b

^z Turfgrass injury was rated visually on a 0 to 5 scale where 0 = no injury; 3 = unacceptable injury for a golf course putting green; and 5 = entire plot area brown or dead.

^y Turfgrass quality was rated visually on a 1 to 9 scale where 1 = entire blot area brown or dead; 7 = minimum acceptable quality for a golf course putting green; and 9 = optimum greenness and density.

^x Treatments were applied on 29 Apr and 13 May.

^w Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ level according to the Fisher's protected least significant difference t-test.

Table 4. Turfgrass quality and injury on a golf course putting green at the Penn State Blue Golf Course following the application of various fungicides for brown ring patch, 2010.

Treatment and rate per 1000 sq ft ^x	Quality (1-9) ^z		Injury (0-5) ^y		
	30 Apr	19 May	8 Apr	30 Apr	19 May
Renown 4.5 fl oz.....	7.8 a-d ^w	7.0 cd	0.0 c	0.0 c	0.0 c
Prostar 70WG 2.25 oz.....	7.5 b-e	7.3 bcd	0.0 c	0.0 c	0.0 c
Triton Flo 3.1SC 0.55 fl oz.....	7.5 b-e	7.0 cd	0.0 c	0.3 bc	0.5 bc
Daconil Ultrex 3.3 oz.....	8.3 ab	7.3 bcd	0.0 c	0.0 c	0.0 c
Endorse 4 oz.....	8.5 a	7.3 bcd	0.0 c	0.0 c	0.0 c
Medallion 0.50 oz.....	7.5 b-e	7.0 cd	0.0 c	0.0 c	0.0 c
Banner MAXX 2.0 fl oz.....	7.0 de	8.0 ab	2.0 a	1.0 a	0.8 b
Trinity 2.0 fl oz.....	7.3 cde	6.0 e	0.0 c	0.5 b	2.0 a
Triton FLO 1.1 fl oz	6.8 e	6.0 e	0.0 c	1.0 a	2.0 a
Insignia 0.9 oz.....	8.3 ab	7.3 bcd	0.0 c	0.0 c	0.0 c
Disarm 480SC 0.36 fl oz.....	7.8 a-d	7.5 abc	0.0 c	0.0 c	0.0 c
Heritage TL 2 fl oz.....	8.0 abc	7.3 bcd	0.0 c	0.0 c	0.0 c
Compass 0.2 oz.....	7.3 cde	7.0 cd	0.0 c	0.0 c	0.3 bc
Headway 3 fl oz.....	7.3 cde	8.3 a	1.8 a	0.0 c	0.3 bc
Medallion 0.25 oz + Trinity 1.0 fl oz	7.0 de	7.0 cd	0.0 c	0.0 c	0.8 b
Medallion 0.25 oz + Triton Flo 3.1 SC 0.55 fl oz....	7.5 b-e	7.3 bcd	0.3 c	0.0 c	0.8 b
Medallion 0.25 oz + Banner MAXX 1.0 fl oz.....	7.8 a-d	7.5 abc	1.3 b	0.0 c	0.0 c
Untreated.....	7.8 a-d	6.5 de	0.0 c	0.0 c	0.0 c

^z Turfgrass quality was rated visually on a 1 to 9 scale where 1 = brown or dead turf; 7 = minimum acceptable quality for a golf course putting green; and 9 = optimum greenness and density.

^y Turfgrass injury was rated visually on a 0 to 5 scale where 0 = no injury; 3 = unacceptable injury for a golf course putting green; and 5 = entire plot area brown or dead.

^x Treatments were applied on 1 and 30 Apr.

^w Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ level according to the Fisher's protected least significant difference t-test.