Residual efficacy of fungicides for brown patch management on creeping bentgrass, 2011

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Turfgrass Science

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SUMMARY: Brown patch, caused by *Rhizoctonia solani*, is a foliar disease of creeping bentgrass that causes significant damage during periods of hot, humid weather throughout the Midwest. Turf managers typically utilize an integrated approach to minimize disease damage. Practices such as adjusting fertility, limiting leaf wetness, selecting less susceptible cultivars, and applying fungicides preventatively have been shown to influence brown patch severity (Smiley et al., 2005). Fungicides used for controlling brown patch are applied at 7 to 28-day intervals per label directions. Once fungicide is delivered to the turf canopy, numerous factors will influence how long it will persist. Frequent mowing, microbial breakdown, photo-degradation, plant metabolism, removal from irrigation or rain, and volatilization can limit the amount of fungicide present (Latin, 2006). Depletion of effective fungicide residues during the latter half of the application interval predisposes turf to brown patch outbreaks if disease-favorable weather persists. The objective of this research was to describe the temporal nature of fungicide residues for controlling brown patch on creeping bentgrass maintained under fairway conditions. Results from the bioassay demonstrate differences in residual efficacy among the selected fungicides.

Materials and Methods

A bioassay was conducted during the growing season of 2011. Experimental plots were established on creeping bentgrass (cv. Penneagle), maintained at 0.5 in. cutting height, at the Daniel Turfgrass Research and Diagnostic Center at Purdue University. Standard fertility, irrigation, and mowing practices for creeping bentgrass fairways were implemented. Five fungicides commonly used to control brown patch on golf course fairways were used in this experiment (Table 1). Fungicides were applied once to field plots (3.3 x 6.6 ft) arranged in a randomized block design with 4 replications. Each replication included a non-sprayed check. Applications were made using a custom-built boom sprayer. Three Tee-Jet air induction nozzles (AI9503EVS for the middle, AIUB8503EVS for both sides) were mounted approximately 12 in. apart on the boom located 14 in. from the ground. The sprayer was calibrated to deliver 2 gal per 1000 sq. ft. at 40 psi. In order to selectively control for Pythium blight and dollar spot, (and prevent their interference

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Table 1. Fungicides applied during 2011.

Treatment	Active Ingredient	Fungicide Class	Rate (Product/1000 ft^2)
Untreated			
Heritage TL (Syngenta)	Azoxystrobin	Quinone Outside Inhibitor (QoI)	2.00 fl oz
Prostar 70 WP (Bayer)	Flutolanil	Carboxamide	2.20 oz
Tourney 50 WDG (Valent)	Metconazole	Demethylation Inhibitor (DMI)	0.37 oz
Endorse WP (Cleary Chemical)	Polyoxin D	Polyoxin	4.00 oz
Insignia (BASF)	Pyraclostrobin	Quinone Outside Inhibitor (QoI)	0.90 oz

with *R. solani* development), mefenoxam (Subdue Maxx, Syngenta) and boscalid (Emerald, BASF) were applied 1 week prior to start of experiment. Turf was sampled by removing 4.25 in. diameter plugs with a cup-cutter beginning the day treatments were applied. Sampling occurred on days 0, 3, 7, 10, 14, 17, and 21. After sampling, plugs were inoculated with white sorghum seeds infested with an isolate of *R. solani* (Purdue isolate RZ0104). Approximately 3-4 grains were placed at the center of each turf plug. The plugs were then incubated in a controlled environment (86°F with >95% relative humidity) for approximately 48 h. Following incubation, disease progress was determined by measuring and recording the diameter of symptomatic patches on each individual turf plug (Figure 1). Data were subjected to repeated measures analysis of variance using Statistica (version 7.1; StatSoft, Inc., Tulsa, OK). Residual efficacy (RE) for each sampling date was determined by comparing the patch diameters on fungicide-treated and untreated plugs as follows: RE = 1 – (patch diameter treated plug / patch diameter untreated plug).

Results and Discussion

The bioassay approach was successful in describing the temporal nature of fungicide residues for different fungicides over the course of the experiment (Figure 2). Brown patch development differed among fungicide treatments and sampling dates (Table 2). All fungicide treatments were effective at suppressing brown patch initially, but differences in residual efficacy were apparent 3 days after application. By the fourth sampling date (10 days after fungicide application), all fungicides were similar to the untreated check. Of the fungicides tested, Prostar provided the greatest residual efficacy. This supports our observations in field trials where Prostar consistently provided high levels of brown patch control.

The results of this bioassay demonstrate that the residual efficacy of fungicides for brown patch control may be less than anticipated when consulting label-recommended spray intervals. This information is of utmost concern for high value golf turf where periodic fungicide applications are applied to limit disease-related damage and maintain turf quality. Shorter application intervals may be required to prevent severe outbreaks when environmental conditions are especially favorable for brown patch establishment and spread. Future research will continue to investigate the decline in residual efficacy through an analytical approach in order to improve scheduling fungicide applications for brown patch control.

References

Latin, R. 2006. Residual efficacy of fungicides for control of dollar spot on creeping bentgrass. Plant Dis. 90:571-575.

Smiley, R.W., Dernoeden, P.H., and Clarke, B.B. 2005. Compendium of Turfgrass Diseases. 3rd ed. American Phytopathological Society, St. Paul, MN.

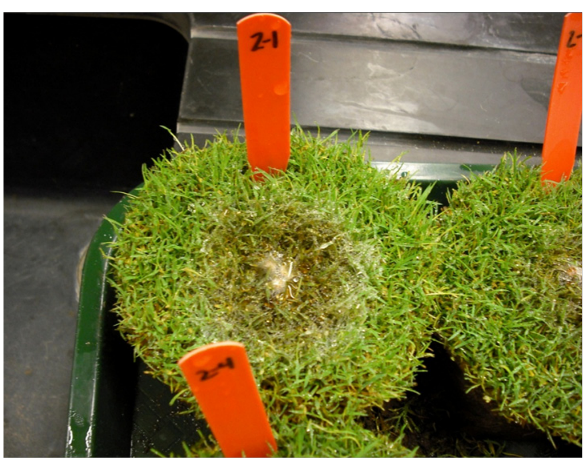

Figure 1. Brown patch diameters were recorded following 48 h incubation period in a disease conducive, controlled environment (86°F with >95% relative humidity).

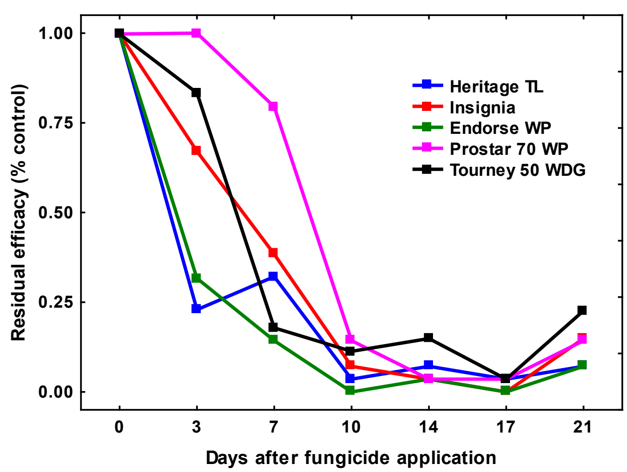

Figure 2. Residual efficacy means for five fungicides (Heritage TL, Prostar 70 WP, Tourney 50 WDG, Endorse WP, and Insignia) were plotted to describe the depletion in fungicide residues over time.

Table 2. Mean brown patch diameters (cm) for treatments applied on June 8, 2011 for each of the 7 sampling dates.

	Days after fungicide application[1]													
Treatment	0		3		7		10		14		17		21	
Azoxystrobin	0.00	a	4.00	bc	4.00	ab	6.50	a	6.25	a	6.75	a	6.50	a
Flutolanil	0.00	a	0.00	a	1.12	a	5.75	a	6.50	a	6.50	a	5.75	a
Metconazole	0.00	a	1.00	ab	5.25	b	6.00	a	5.50	a	6.75	a	5.25	a
Polyoxin D	0.00	a	3.50	bc	5.75	b	7.00	a	6.50	a	7.00	a	6.25	a
Pyraclostrobin	0.00	a	1.75	ab	3.75	ab	6.25	a	6.25	a	7.00	a	5.75	a
Untreated Check	6.25	b	5.25	c	6.25	b	6.75	a	6.50	a	6.75	a	6.75	a

[1]Values within columns followed by the same letter are not significantly different at P=0.05, Tukey HSD test.