Autumn-applied Fungicide Timing Effects on the Development of Dollar Spot

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INTRODUCTION

- Anecdotal evidence indicates autumn-applied fungicide may suppress the onset and progress of dollar spot caused by *Clarireedia jacksonii* during the next growing season.
- It is not known whether timing or chemistry of fungicide applications can influence the suppression of dollar spot during the next growing season.
- We hypothesize that applying fungicide at certain times during autumn may suppress the dollar spot population and significantly affect disease progress during the subsequent growing season.

OBJECTIVES

- Evaluate the effectiveness of autumn-applied fungicide applications on the onset and progress of dollar spot during the subsequent growing season.

MATERIALS & METHODS

- Field trial initiated in September 2019 on a creeping bentgrass turf (*Agrostis stolonifera* '007'; moderately resistant to dollar spot) mowed at 9.5 mm.
- Experimental design: 9 fungicide treatments including a non-treated control arranged in a RCBD with 4 blocks during 2019-2020 and 6 blocks during 2020-2021
- Fungicide treatments:

Table 1. Fungicide and application timings in a trial to evaluate autumn-applied fungicide effects on dollar spot onset and progress on '007' creeping bentgrass during the subsequent growing season in North Brunswick, NJ.

Treatments[1]	Total Number of Sprays	Fungicide Timing (Date)		
Non-treated control[2]	0			
Sep.[3]	1	Sep. 24		
Oct.[3]	1		Oct. 15	
Nov.[3]	1			Nov. 5
Sep.- Oct.[3]	2	Sep. 24	Oct. 15	
Sep. - Nov.[3]	2	Sep. 24		Nov. 5
Oct. - Nov.[3]	2		Oct. 15	Nov. 5
Sep. - Oct. -Nov.[3]	3	Sep. 24	Oct. 15	Nov. 5
Chlorothalonil[4]	3	Sep. 24	Oct. 15	Nov. 5

[1] Fungicide treatments initiated after the pre-trial suppression of dollar spot on 10 September 2019 and 2020 with fluazinam (Secure) at 0.7 kg a.i. per ha.

[2] The non-treated control received no fungicide after the pre-trial spray

[3] Seven of the treatment timings (three single, three double, and one triple) were applied in September, October and/or November using a tank-mix of fluazinam (Secure) and propiconazole (Banner MAXX) at 0.7 kg a.i. and 1.5 kg a.i. per ha, respectively

[4] The eighth fungicide treatment applied chlorothalonil (Daconil Ultrex 82.5WG) at 15.3 kg a.i. per ha in September, October and November.

- Data Collection and Analysis:
  - Dollar spot infected area was measured every 1 to 7 days Sep to Nov. and May through the terminate of each trial.
  - Disease severity data was $\log_{10}$ transformed and used to calculate the area under disease progress curve (AUDPC).
  - Analyzed fixed effects (fungicide treatment and year) using GLIMMIX in SAS version 9.4.
  - Only significant main and interaction (fungicide treatment × year) effects were retained in the final model.
  - Dollar spot risk index values were calculated using the Smith-Kerns dollar spot predictive model (Smith et al., 2018).

RESULTS and DISCUSSION

Table 2. Dollar spot severity, area under disease progress curve (AUDPC), as affected by nine autumn-applied fungicide treatments on turf managed as a fairway during autumn 2019 and 2020 and subsequent growing seasons of 2020 and 2021 in North Brunswick NJ.

Source[a]	df	*F*	P of significant *F*
Autumn dollar spot progress			
Fungicide treatment	8	30.36	<.0001
Year	1	24.71	0.0011
Fungicide treatment × Year	8	3.16	0.0045
Subsequent growing season dollar spot progress			
Fungicide treatment	8	25.45	<0.0001
Year	1	118.04	<0.0001
Fungicide treatment × Year	8	4.72	<0.0001

[a] Analyzed fixed effects (fungicide treatment, year) using GLIMMIX in SAS

- All fixed effects were significant in the final model as well as the fungicide treatment × year effect, which was included in the final model.

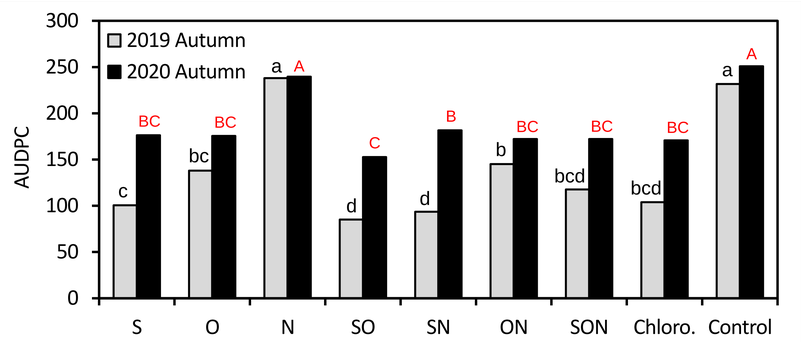

Figure 1. Disease severity, area under disease progress curve (AUDPC), response to the fungicide treatment × year interaction. Lower case, black letters indicated differences in 2019 autumn and capitalized, red letters indicate differences in 2020 autumn according to Fisher's protected $LSD_{0.05}$. S = Sep., O = Oct., N = Nov., SO = Sep. - Oct., SN = Sep. - Nov., ON = Oct. - Nov., SON = Sep. - Oct. - Nov., Chloro. = chlorothalonil, Control = non-treated control.

- The Nov. fungicide timing was applied too late each year to reduce AUDPC during autumn compared to control.
- Fungicide treatments initiated in September generally had the best disease control.

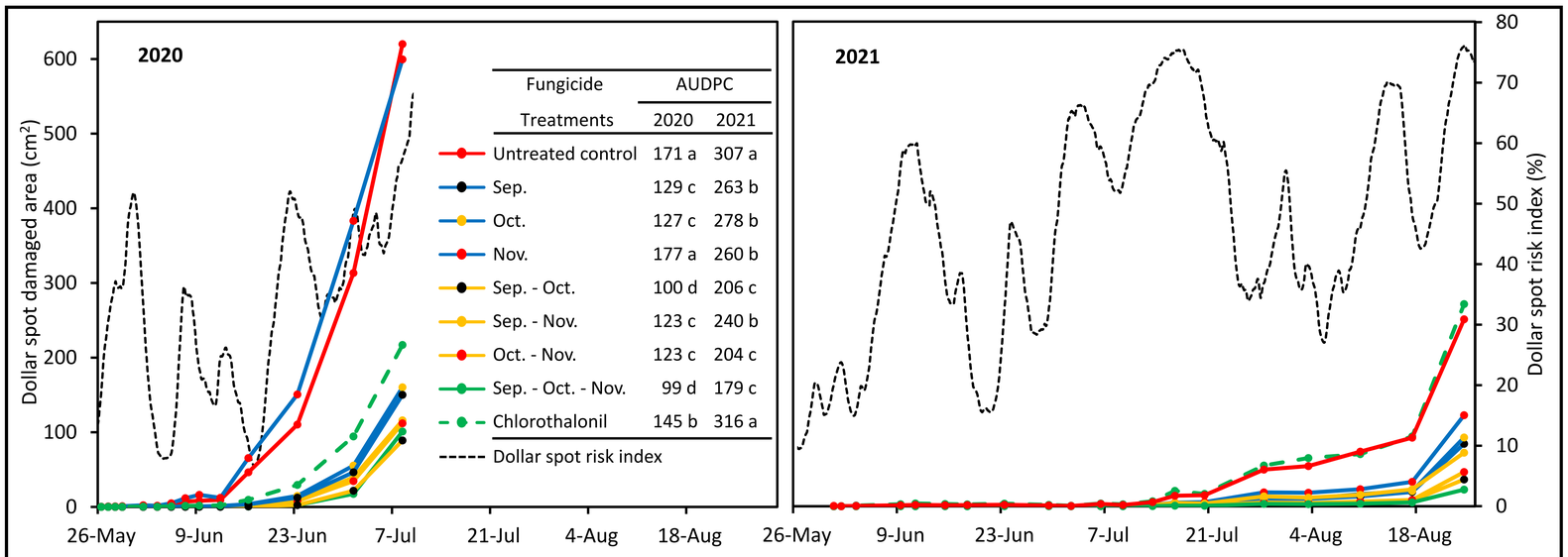

Figure 2. Influence of fungicide chemistry and late-season fungicide timing on dollar spot development on '007' creeping bentgrass mowed at 9.5 mm in North Brunswick, NJ, during May to Sep of the subsequent year. For each year, different letters after AUDPC treatments values indicate a significant difference. The dashed black lines depict the risk index based on the Smith-Kerns dollar spot predictive model.

- Fluazinam + propiconazole suppressed dollar spot development the following spring and early-summer in both years compared to the non-treated control, except for the Nov. application in 2019. However, applying chlorothalonil resulted in reduced (2020) or no (2021) suppression of dollar spot even though chlorothalonil suppressed disease symptoms the previous autumn (Fig. 1).
- The application of fluazinam + propiconazole in Sep. and Oct. or Sep., Oct. and Nov. provided the best suppression of dollar spot the following spring and early-summer in both trials.
- The impact of the Nov. timing of fluazinam + propiconazole appeared dependent on environment conditions at the time of application (data not shown). Dollar spot was not active during colder weather in Nov. 2019, whereas warmer weather resulted in active dollar spot in Nov. 2020.

Figure 3. Low, moderate and high dollar spot severity on 13 Aug. 2021. The tank mix of fluazinam + propiconazole was applied at 0.7 kg a.i. and 1.5 kg a.i. per ha, respectively, during the months listed in the photos. Chlorothalonil was applied at 15.3 kg a.i. per ha. The control did not receive a fungicide application after the pre-trial spray the previous autumn.

CONCLUSIONS

- A difference in fungicide chemistry applied in September, October, and November can affect disease severity during the subsequent growing season.
- The timing of late-season fungicide applications can also affect disease severity during the subsequent growing season. A tank mix application of fluazinam + propiconazole in September and October tended to provide the best suppression of dollar spot the next growing season.

FUTURE RESEARCH

- Observed responses may be related to the pathogen population load; studies to document such differences are needed.
- Additionally, studies to gain a better understanding of the impact that bentgrass cultivars have on pathogen populations would be useful.
- Further insights on timings (e.g., curative threshold or predictive models) and chemistries of fungicide applications late in the growing season are also needed.

ACKNOWLEDGEMENTS

EIFG Environmental Institute for Golf · GCSAA Golf Course Superintendents Association of America · USGA · Golf Course Superintendents Association of New Jersey 1926 · New Jersey Turfgrass Association · Rutgers New Jersey Agricultural Experiment Station, Center for Turfgrass Science