Evaluation of Dollar Spot Predictive Models on Bentgrasses in New Jersey

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Introduction

The incidence and severity of dollar spot disease (caused by *Sclerotinia homoeocarpa* F.T. Bennett) varies among bentgrass (*Agrostis* spp.) species and cultivars.

Two weather-based models were recently developed for forecasting dollar spot activity on bentgrass.

1. Ryan et al. (2012): Growing degree day (GDD) model
   - Base temp of 15°C, start date 1 April
   - Predict onset of dollar spot symptoms during the spring
     - 60 to 70 GDD for highly susceptible cultivars
     - 105 to 115 GDD for moderately susceptible cultivars
2. Smith et al. (2013): Logistic regression model
   - 5-day moving averages of relative humidity and air temp
   - Predict dollar spot epidemics season-long

These models have not been validated on bentgrass cultivars that are more tolerant to this disease (e.g., Declaration and Capri) or validated in New Jersey.

Objective

To assess the reliability of two weather-based models for predicting dollar spot epidemics on bentgrasses that range in susceptibility.

Materials and Methods

Experimental and Treatment Design

Table 1. Cultivars seeded in a randomized complete block design with 25 blocks in North Brunswick, NJ on 29 Sept. 2014

Cultivar	Species	Susceptibility Level
'Capri'	*Agrostis capillaris*	Low
'Declaration'	*A. stolonifera*	Low
'007'	*A. stolonifera*	Moderate
'Shark	*A. stolonifera*	Moderate
'Penncross'	*A. stolonifera*	High
'Independence'	*A. stolonifera*	High

Data Collection and Analysis

- Data collection began in May 2015
  - Number and average diameter (mm) of infection centers (IC)
- Transformed to the number of standard-sized infection centers (SSIC; 20-mm diameter and area of 314 mm^2)

$$\text{SSIC's per plot} = \frac{[(\text{IC count per plot}) \times (\text{avg. area of IC per plot})]}{314\ \text{mm}^2}$$

- Disease incidence (SSIC) were summarized over time using the Area Under Disease Progress Curve (AUDPC)
- Data were subjected to ANOVA using PROC GLM in SAS v. 9.4
- Weather data collected on-site and used in the GDD and logistic models.
- Disease progress compared to the predictions of each model
- Ability to assess disease progress during 17 June to 22 Aug. 2016 was not feasible due unintended dollar spot suppression from fludioxonil applied to control anthracnose*

Site Description and Field Maintenance

- Mowed 3 d wk^{-1} at 12.7 mm
- 131, 100, and 66 kg ha^{-1} of N applied during 2015, 2016, and 2017, respectively
- Inoculated with *S. homoeocarpa* isolates NJDS003 and NJDS007 on 7 Apr. 2015
- Pests other than dollar spot chemically controlled as needed

Table 2. Growing degree days accumulated at the time of disease onset during 2015, 2016, and 2017.

Susceptibility Level	2015	2016	2017
	----------GDD----------		
Low	*79*	140	112
Moderate	*79*	140	112
High	*73*	27	92

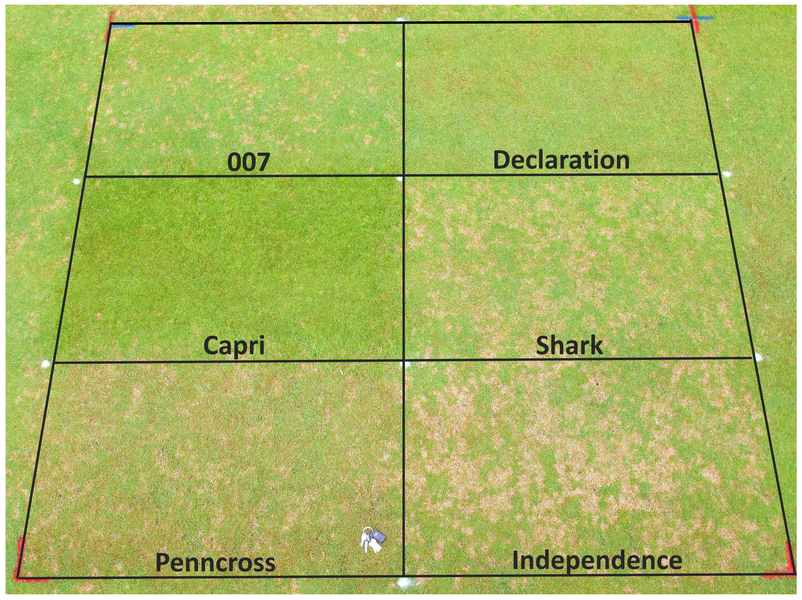

Figure 1. Bentgrass cultivars evaluated representing a range in tolerance to dollar spot

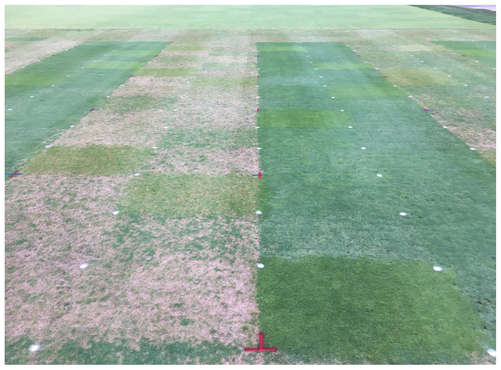

Figure 2. The study was duplicated in five runs that were released from (left) or maintained under (right) fungicide control as needed to facilitate season-long evaluation of dollar spot epiphytotics.

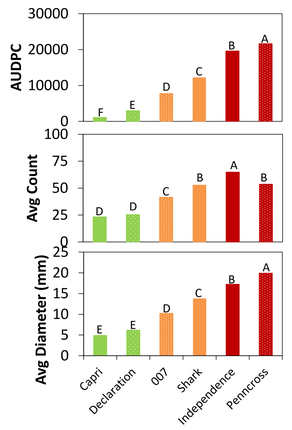

Figure 3. AUDPC and average count and diameter of infection centers during late-2017

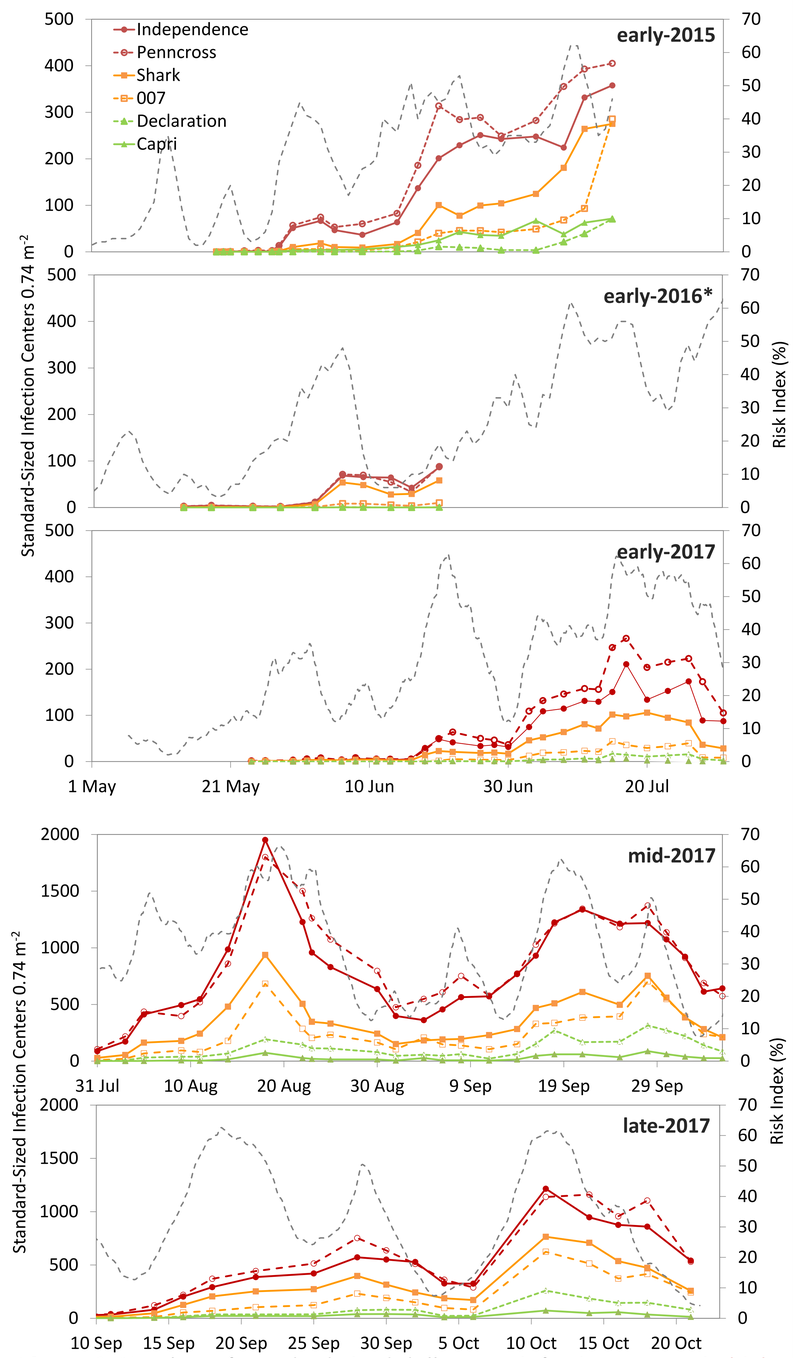

Figure 4. Number of standard-sized dollar spot infection centers in high, moderate, and low susceptibility cultivars and dollar spot risk index (dotted gray line) estimated by the logistic regression model during 2015, 2016, and 2017.

Results and Discussion

Disease onset

- GDD model
  - Disease onset in high susceptibility cultivars occurred within the GDD range reported by Ryan et al. (2012) during 2015 but not 2016 or 2017
  - Disease onset for moderate and low susceptibility cultivars matched the GDD range reported by Ryan et al. (2012) during 2017 but not 2015 or 2016
- Logistic regression model forecasted a risk index of >20% for dollar spot at
  - 7-, 7-, and 21-d before disease onset in high susceptibility cultivars during 2015, 2016, and 2017, respectively
  - 11-, 29-, and 28-d before symptoms on moderate and low susceptibility cultivars

Season-long disease progress

- Logistic regression model accurately forecasted disease progress in high susceptibility cultivars throughout 2015, early-2016, and 2017 (to date).
  - Disease progress in moderate and low susceptibility cultivars was less responsive to the risk index; however, periods of disease incidence did occur during high risk
- Interestingly, disease recovery often occurred when the risk index declined sharply, albeit greater than 20%.

Acknowledgements

USGA
GCSAA GOLF COURSE SUPERINTENDENTS ASSOCIATION OF AMERICA
TRI STATE TURF RESEARCH FOUNDATION, INC
NEW JERSEY
RUTGERS Center for Turfgrass Science

References

Ryan, C. P., P. H. Dernoeden, and A. P. Grybauskas. 2012. Seasonal development of dollar spot epidemics in six creeping bentgrass cultivars in Maryland. HortScience. 47(3):p. 422-426.

Smith, D. 2013. Validation of a logistic regression model for prediction of dollar spot of amenity turfgrass. USGA Turfgrass Environ. Res. Online. 12(2):p. 40-42.

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