Validation of a Logistic Regression Model for Prediction of Dollar Spot of Amenity Turfgrasses

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Objectives:

To validate new dollar spot prediction models for accuracy in predicting dollar spot epidemics so that preventative fungicide applications can be precisely applied in diverse locations of the United States.

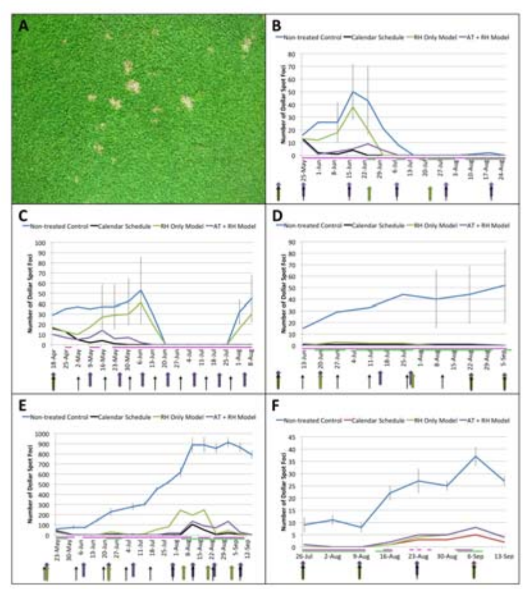
Start Date: 2011
Project Duration: 2 years
Total $29,188

Dollar spot (*Sclerotinia homoeocarpa*) is the most economically important turfgrass disease in North America. The disease is frequently found on golf greens and fairways where it can be quite destructive. In the northern U.S., golf courses routinely spend 60-75 % of their pesticide budget to manage dollar spot and the fungicide applications are often conducted even if they are not required for disease control. An improved dollar spot prediction model for making fungicide application decisions would promote targeted use of fungicides for control of dollar spot.

This research focused on validating two new dollar spot prediction models. Models used in the validation were previously constructed using logistic regression. In 2011, all validation was conducted on creeping bentgrass (*Agrostis stolonifera*) putting greens with four treatments and a minimum of four replications. Treatments included a non-fungicide treated control, fungicide applied using a standard calendar-based application where the spray interval was 14 to 28 days (depending on location), fungicide applied using the newly developed air temperature and relative humidity (AT+RH) model, and fungicide applied based on a relative humidity (RH) only model.

ZedX, Inc. supplied weather data (interpolated weather), which served as inputs for the models. Each location was provided a unique subscription (based on GPS coordinates) where cooperators received from ZedX, Inc. weather information along with spraying recommendations based on the models each morning via email. Sprays were applied for the model treatments only if fungicide protection had lapsed (e.g. fungicide was applied more than 14 – 28 days before) using established probability thresholds for each model. If fungicide protection had not lapsed, then no action was required by the user.

The number of dollar spot foci were recorded for each plot on a weekly basis throughout the growing season. Data were analyzed using standard analysis of variance, disease progress curves were developed for each treatment at each location, area under the disease progress curves (AUDPC) were determined, and separation of means were calculated using Fisher's test of protected least significant difference.



Depending on the location, models differed in their accuracy to predict dollar spot. In the "deep south" and "transition zone" states (Figs. B, C, and D) the models were less accurate than in the "northern" states (Figs. E and F).

For all locations, fungicide applications based on the models provided a reduction in dollar spot compared to not treating. Depending on the location, models differed in their accuracy to predict dollar spot. In the "deep south" and "transition zone" states (Figs. B, C, and D) the models were less accurate than in the "northern" states (Figs. E and F).

At the Mississippi and Oklahoma locations, applying fungicide according to the AT+RH model provided control of dollar spot that was comparable to the calendar-based treatment and significantly less (AUDPC; $P<0.05$) than the non-treated control, however, the number of fungicide applications were the same for the two application strategies.

The RH only model prevented the need for three applications at the Mississippi location and seven at the Oklahoma location, but control was not significantly different from the non-treated control. At all other locations, spraying according to both models provided a significant reduction in the amount of dollar spot compared to the non-treated controls, and was comparable to the calendar-based treatment. The reduction in fungicide applications using the AT+RH model ranged from zero to two at these locations while using the RH model ranged from one to four. The AT+RH model resulted in a slight over-prediction of dollar spot while the RH model often resulted in an under-prediction. Data suggest that there might be different models, or probability thresholds, required for each region of the U.S.

Summary Points

- The AT + RH model provided control of dollar spot, which was comparable to the calendar-based treatments while providing an average reduction of one-fungicide application.
- The RH only model averaged a four-spray reduction versus the calendar based applications with improved control over not-treating for dollar spot; however, it consistently under-predicted dollar spot epidemics, which resulted in high levels of disease compared to the calendar-based treatment in two locations.
- The AT + RH model tended to over-predict fungicide applications by one spray vs. the RH only model which tended to under-predict fungicide application by at least two sprays.
- To improve the accuracy of the models, 2012 research will focus on tailoring action thresholds and also specific models to each "zone" of the U.S. where the models are tested.