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Development and evaluation of a forecasting system for fungal disease in turfgrass

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*A forecasting system for fungal infection of turfgrass using weather-based empirical indices (the 'Fidanza' and 'Schumann' models) was developed and evaluated for its ability to predict the occurrence of brown patch (*Rhizoctonia *blight) infection episodes at an experimental site in southeastern USA. Disease observations took place at the Turfgrass Field Laboratory in Raleigh, North Carolina between 8 June and 17 August 2003. Three meteorological data sources were used to generate disease risk indices using the empirical models: an on-site observing station, an observing station at a nearby airport, and the US National Weather Service's operational Eta weather forecast model. Visual observations of brown patch activity were conducted in the field and used to evaluate the accuracy of the disease prediction models. Results indicate that the Fidanza and Schumann models correctly predicted brown patch activity on 48% and 30% of the days on which disease occurred, respectively. A diagnosis of the model performance of these disease indices was undertaken. Results are dependent on occurrence of high temperatures and rainfall and independent of the source of the meteorological information (on-site, airport and the Eta model); therefore, regional meteorological information can be effectively applied to develop turfgrass disease forecasting systems. Ongoing efforts are directed towards developing new disease indices and modifying existing indices before an operational disease forecasting system can be implemented.*

Keywords: turf disease forecast system, plant pathology, agriculture meteorology, plant disease, Eta model

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1. Introduction

Turfgrass is a perennial agricultural product, and is often grown on the same land for many years. This practice favours the long-term build-up of turfgrass pests, including many fungi that cause disease. Currently, most turfgrass managers use a calendar-based pesticide application schedule, which is based principally on the manufacturer's recommendations for the duration of the pesticide's effectiveness (typically one to two weeks).

The turfgrass industry in the United States is one of the largest agricultural industries in the country. In North Carolina alone, turf is grown on over 2 million acres, with annual maintenance costs of approximately US$2 billion (Neas & Smith 2000). A large portion of the expenditure for turfgrass maintenance is for the application of pesticides. In 1993, nearly half of all US golf course pesticide budgets were spent on fungicides, totalling approximately US$85 million, and these costs continue to rise (Jackson 1994).

In addition to the financial costs of application, certain fungicides may be harmful to humans and the environment. Such concerns have motivated the creation of a new generation of 'reduced risk' fungicides that are safer to humans and the environment. However, these are more expensive per application and have a narrower control spectrum, requiring application of several products to control all of the diseases that may develop at a given time. Furthermore, reduced risk fungicides are generally more prone to the development of fungicide resistance, which may reduce the effectiveness of the fungicide over time. These changes in the turfgrass industry have sparked interest in methods to reduce the number of fungicide applications required to maintain