UTILIZING DISEASE PREDICTION MODELS TO REDUCE FUNGICIDE USE ON GOLF COURSES

Bruce B. Clarke
Extension Specialist in Turfgrass Pathology
Cook College, Rutgers, The State University of New Jersey
New Brunswick, NJ

The golf course environment is one of the most intensively managed systems in the world. It requires extensive resources, both financial and agronomic, to maintain turf quality at an optimum level. At the same time, turf managers have come under increasing pressure to reduce pesticide usage. Calendar-based applications of fungicides, in particular, have been targeted as wasteful and ecologically unsound. In response to this concern, studies were initiated at Rutgers University to develop and refine disease detection and prediction methods to reduce fungicide inputs. Brown patch, a devastating disease of turfgrass caused by the fungus *Rhizoctonia solani*, was used as a model system for this research.

A commercially available enzyme linked immunosorbent assay (ELISA), marketed under the trade name Reveal, was used to monitor the population of *R. solani* on a bentgrass green from 1989 to 1991. Turf was maintained at a 0.188 in cutting height throughout the study. Foliage was randomly sampled from five locations within four 3 x 9 ft plots. Subsamples were combined within plots and assayed using the Reveal kits. Turf was assayed on a tri-weekly basis (Monday, Wednesday, Friday) between June and August. Pathogen levels, as measured by the color intensity of the assays, were quantified using an Agri-Meter II reflectometer.

Disease progress curves developed for three growing seasons displayed a strong correlation between percent turf area infected by *R. solani* and mean Agri-Meter II readings (R^2 = 0.691 to 0.740). In most cases, meter readings corresponded to visual brown patch symptoms only. However, the ELISA assays did occasionally predict disease outbreaks 24 to 48 hr prior to visual symptom expression. The failure to consistently predict brown patch epidemics was presumably due to the sampling interval rather than an inability of the assay to detect low pathogen levels.

ELISA assays were also utilized to schedule the application of propiconazole (Banner), a fungicide commonly used to control diseases on golf course greens. Using the assay procedures described above, propiconazole was applied to turf at a rate of 2.0 fl oz product/1000ft^2 whenever a mean Agri-Meter II disease threshold value of 23 was reached or exceeded. Within these parameters, the incidence of brown patch (>5% turf area diseased) was reduced from five outbreaks (for non-treated turf) to one outbreak. When this was compared to a 14-day calendar-based spray schedule typically used by turfgrass managers, the ELISA-based format reduced the number of fungicide applications from four to two, while disease incidence remained the same (one epidemic each).

The ELISA and calendar-based schedules were also compared to a computer-based disease forecasting model developed in association with Neogen Corporation. The computer model utilized hourly weather data (including air temperature, relative humidity, and rainfall/ irrigation) to predict when conditions were conducive for brown patch development. Propiconazole was applied in response to model predictions, providing ten days had elapsed since the previous fungicide application. Throughout the 1991 season, the model predicted each brown patch outbreak 24 to 48 hr before symptoms developed on untreated turf. Although turf treated in response to model predictions remained disease free, a total of five propiconazole applications were made during the summer.

It is apparent that both the ELISA and computer-based disease forecasting formats have advantages over the 14-day calendar-based spray schedule currently being used on many golf courses to control brown patch. While the computer model effectively targets environmental conditions that are conducive to brown patch development, it does not take pathogen populations into account and, therefore, may overestimate the number of fungicide applications needed. Monitoring pathogen levels on a daily basis throughout the growing season with ELISA, however, is too costly and labor intensive. As a result, a combination of the two methods would appear to offer the most efficient

and cost effective means of reducing fungicide inputs on bentgrass greens. This hypothesis was extensively tested between 1992 and 1996 using the ELISA format to intensively monitor fungal populations once disease development was predicted by the computer-based disease forecasting model. In all years, the combined ELISA/computer model format reduced the total number of fungicide applications required to effectively suppress brown patch. This allowed turf managers to accurately monitor pathogen populations on greens and to withhold fungicide application until they were required. The ELISA/computer model format has been successfully field tested on golf greens in New Jersey, Massachusetts, and Georgia.