Disease Forecasting in Turfgrass... Is It Worth the Risk?

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Turfgrass disease management has come a long way in the last 25 years. New pathogens have been isolated and identified, fungicide resistance has been classified in many pathogens, root diseases such as take-all patch and necrotic ring spot are now recognized as their own diseases, and we no longer spray mercury like it's a race to empty it out of the chemical shed. But for all our advances and the millions of dollars worth of turfgrass research being completed every year, many areas of turfgrass pathology are frustratingly unclear. Little is known about the infection capabilities of root diseases. Fungicides continually break down in the face of heavy disease pressure from stress-related diseases like anthracnose. And dollar spot, the most common turfgrass disease in the world, isn't even classified correctly.

All superintendents, especially in slow economic times, are looking for ways to reduce both the overall number of fungicide applications to control disease as well as the overall cost of those applications. But this reduction cannot come at the expense of quality turfgrass. Knowing that most diseases are heavily dependent on specific weather conditions, pathologists for years have been attempting to develop mathematical models to predict precisely when conditions are ripe for infection. Predicting when conditions will be ripe for infection would limit fungicide applications to times when they are needed, providing the aforementioned reduction in fungicide applications without sacrificing turfgrass quality.

Well that sounds easy, so why aren't you all using these models? The answer in most cases is because in turfgrass they haven't been that effective. Some models have been more effective than others. Models for Pythium blight (Nutter *et al.* 1983), brown patch

of perennial ryegrass (Fidanza *et al.*, 1996), and gray leaf spot (Uddin *et al.*, 2007) have been relatively effective. Though not really mathematical models, the use of soil temperatures in timing fungicide applications to control root diseases has improved the efficacy of those fungicides.

But when it comes to dollar spot, the most sprayed-for turfgrass disease on the planet, these models have fallen woefully short. A model developed by Mills and Rothwell in 1982 recommended a fungicide application when maximum air temperatures were greater than 77°F and relative humidity was greater than 90% during any 3 days of a 7 day period (Mills and Rothwell, 1982). But these conditions are present for nearly the entire growing season for most of the country and, as you may have already guessed, the model recommended more fungicide applications than we would make without using the model (Walsh *et al.*, 1999). On the other end of the spectrum is the Hall model, which recommends a fungicide application after two consecutive days of rainfall and a mean air temperature of greater than 72°F or after three consecutive days of rainfall and mean air temperatures greater than 59°F (Hall, 1984). But this model doesn't account for the driving force behind dollar spot development, which is the duration of leaf wetness caused by dew and other moistures (Williams *et al.*, 1996). This model recommended far too few fungicide applications and the turf was heavily damaged by dollar spot.

Both these models used easily measurable variables such as temperature and rainfall, but those are not necessarily the major driving forces behind disease development. Many weather stations now have the ability to measure a range of factors, such as canopy humidity, and with the right model could provide more beneficial recommendations regarding a fungicide application.

But even with a weather station at the golf course to measure a range of factors both above and below the surface of the soil, problems can still arise due to the incredible environmental variance found within a golf course. Some of the more obvious variances are found due to shade, elevation changes, and exposure to the wind and other elements. But a more subtle variation lies on every single hole of the golf course. Research has shown that mowing the turf at a typical putting green height, fairway height, or rough height has a dramatic effect on the local turf-

grass environment and in turn the pathogens inhabiting it (Giesler *et al.*, 2000). This would mean that while environmental conditions may be ripe for infection and warrant a fungicide application at one location, it may not at another. This uniformity is a key difference between turfgrass management and agricultural production, where forecasting models have been more successful.

So are turfgrass disease models completely useless? No, they can have great value to any turfgrass manager. But a superintendent cannot use these models in a vacuum, they must be a single tool in his or her decision-making toolbox. Models can be useful in making a superintendent more aware of the need to spray, but in the end it must come down to the superintendent's knowledge of the disease-prone areas of the golf course and what the future weather holds. A prime example this spring has been root-disease fungicide timing and annual bluegrass seed head suppression timing. A string of warm days in early spring triggered a spray in many models, but a rapid drop in temperatures soon thereafter meant the conditions may have been too cold to really warrant the application. In the end you can't let a model make the decision for you, since I'm guessing it won't be the model that gets fired if things go wrong.

Figure 1: The weather was pretty nice for the Sentryworld GC Field Day, once the snow was cleared off the treatment plots of course. Thanks to Gary Tanko and his staff for their assistance.

Successful Snow Mold Field Days

The Turfgrass Diagnostic Lab, along with the Wisconsin Turfgrass Association, held their Snow Mold Field Days in Edina, MN; Stevens Point, WI; and Iron Mountain, MI on April 28th, 29th, and 30th, respectively. Despite low disease pressures at one site and snowfall at another there was good turnout at all three sites, especially at our inaugural event held at Edina CC. Thanks to superintendents Mike Powers, Jared Finch, and Bill Kehoss for making their courses available for this valuable research. And a special thanks goes out to Gary Tanko and his crew at Sentryworld GC for their help in making the field day possible. When I showed up at the golf course the morning of the 29th they were covered in a fresh 6 inches of snow. Unfazed, Gary and his crew (even I picked up a shovel) shoveled off the entire treatment area in less than an hour (Figure 1). It just goes to show that there's nothing like a coating of fresh snow to go with Snow Mold Field Days.

References

Giesler, L. J., Yuen, G. Y., Horst, G. L. (2000). Canopy microenvironments and applied bacteria population dynamics in shaded tall fescue. *Crop Science*, 40(5), 1325-1332.

Fidanza, M. A., Dernoeden, P. H., Grybauskas, A. P. 1996. Development and field evaluation of a brown patch warning model for perennial ryegrass turf. Phytopathology 86: 385-390.

Hall, R. 1984. Relationship between weather factors and dollar spot of creeping bentgrass. Can. J. Plant Sci. 64: 167-174

Mills, G., Rothwell, J. D. 1982. Predicting diseases - The hygothermograph. Greenmaster 8: 14-15.

Nutter, F. W., Cole, H. Jr., Schein, R. D. 1983. Disease forecasting system for warm weather Pythium blight of turfgrass. Plant Disease 67:1126-1128.

Uddin, W., Serlemitsos, K., Viji, G. 2003. A temperature and leaf wetness duration-based model for production of gray leaf spot of perennial ryegrass turf. Phytopathology 93: 336-343.

Walsh, B., Ikeda, S. S., Boland, G. J. 1999. Biology and management of dollar spot (*Sclerotinia homoeocarpa*); an important disease of turfgrass. HortScience 34: 13-21.

Williams, D. W., Powell, A. J., Vincelli, P., Dougherty, C. T. 1996. Dollar spot on bentgrass influenced by displacement of leaf surface moisture, nitrogen, and clipping removal. *Crop Science*, 36(5), 1304-1309.