Patterns of Disease:
Understanding the nature of dollar spot and its management implications

By Brandon Horvath

Dollar spot is one of our most important but least understood turfgrass diseases. Superintendents spend significant dollars battling the disease and trying to avoid fungicide resistance. Yet for all we know about when the disease occurs and how to control it, we know very little about the biology of this pathogen and how it spreads.

Having a better understanding about the biological processes that affect where dollar spot occurs and how it spreads could ultimately result in the turfgrass manager more effectively managing dollar spot, applying control products only where they are needed and spending less on fungicide applications in the process.

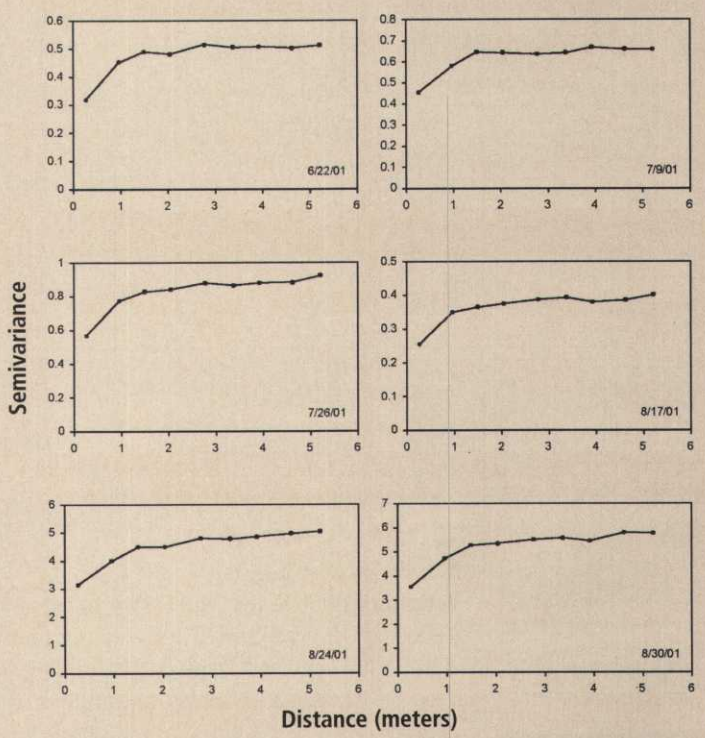
Some of the questions I addressed in my research included: Does dollar spot occur in a pattern? How does that pattern (if it occurs) change over a season? What are the management issues raised by the results? The answers to these questions will lead to a better understanding of this important turfgrass pathogen.

Is there a pattern?

Dollar spot is caused by the fungal pathogen, *Sclerotinia homoeocarpa*. This pathogen infects both cool-season and warm-season grasses and is somewhat unique among the turfgrass pathogens because it is not known to produce spores of any kind. Without spores to move the pathogen around, it is believed that dollar spot moves from place to place via infected plants transported on equipment or on the bottom of our shoes.

So, to answer some of these questions, a research area was established at the Robert Hancock Turfgrass Research Center at Michigan State University in East Lansing. The study area was 30 feet by 60 feet and was comprised of a grid of 200 sampling locations in 2000 and 888 sampling locations in 2001 and 2002.

FIGURE 1A



Variograms of dollar spot epidemic caused by *S. homoeocarpa* on a mixed sward of creeping bentgrass and annual bluegrass on six dates in 2001 selected to be representative of changes in disease progress throughout the growing season.

Dollar spot epidemics were followed each season from 2000-2002, and the number of dollar spots occurring at each of the sampling locations were counted twice per week. Over the course of the study, over 81,000 dollar spots were counted.

Once the number and location of the dollar spots were known, the pattern (or lack thereof) the spots was measured. Statistical tools called geostatistics were used to determine if the dollar spots were occurring in a pattern. These tools were originally developed to

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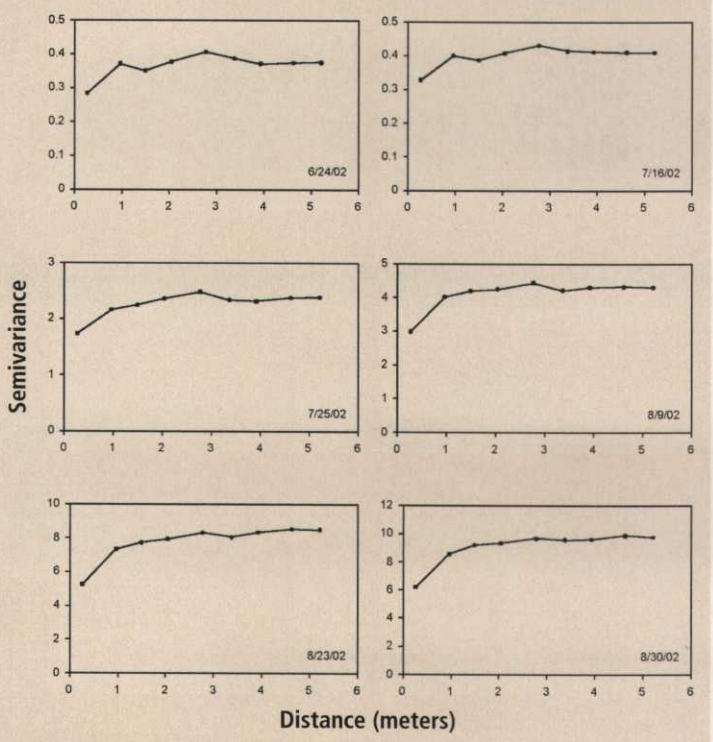
FIGURE 1B



Variograms of dollar spot epidemic caused by *S. homoeocarpa* on a mixed sward of creeping bentgrass and annual bluegrass on six dates in 2002 selected to be representative of changes in disease progress throughout the growing season.

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determine the size and shape of ore bodies and petroleum reserves buried deep underground.

The primary tool, called a variogram, is used to summarize how the trait one measures (in our case, the number of dollar spots) varies with location in space using a measure called semivariance. This value is plotted to graphically show how similar two locations separated by some distance are to each other. Locations separated by shorter distances tend to be more similar and consequently have a smaller semivariance than locations separated by larger distances. If there are differences in semivariance values between locations separated by short vs. longer distances this indicates that the measured value has a spatial pattern. Our semivariance plots showed that dollar spot did occur in a pattern (Figures 1a and 1b).

How does the pattern change?

Over the course of a growing season, the number of dollar spots that occur in an area increases and decreases (Figure 2). Presumably, this is due to environmental conditions that affect the appearance of disease, the growth and vigor of the host plant and the virulence of the pathogen.

If the pattern changed over the course of the season, the expectation would be to observe a similar change in the semivariance plots.

However, the results of this study showed that regardless of how much disease was present, the overall pattern remained stable. (Fig. 1a and Fig. 1b). More interesting was the result that the pattern remained stable over the entire three-year period of the study. This doesn't necessarily mean that dollar spot occurs in the exact same location but rather that whatever pattern begins the season, this pattern remains throughout.

As a result, this indicates that whatever the factors are that affect where dollar spot occurs, they are similarly stable. These results also raise interesting questions about management practices and their impact on spatial pattern.

Management issues raised

The conventional wisdom about the spread and movement of dollar spot is that it moves on infected clippings on equipment and people. Researchers often use this method to inoculate a new area of turf with dollar spot by spreading infected clippings around the area. Since dollar spot isn't known to produce spores, movement via equipment and people seems logical. However, the results of this research do not support this conclusion.

The effect that movement via equipment or through a spore would have on the observed pattern would be a change in the semivariogram plot when movement was taking place.

For example, with regular daily mowing of the study area, if dollar spot was being picked up by the mower and reinoculated downstream, one would expect the spatial pattern to be diluted and more representative of a random pattern as the clusters of dollar spot were spread out from the original foci. It is likely that mowing equipment

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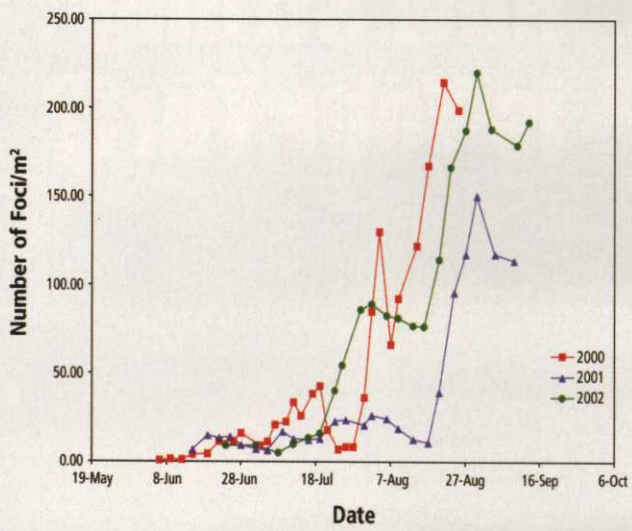
FIGURE 2



Overall disease progress of dollar spot epidemics on a mixed sward of creeping bentgrass and annual bluegrass from 2000 to 2002 as measured by the average number of dollar spot foci m^{-2}.

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and people spread the pathogen to some small degree, but the factor that governs the spatial pattern of dollar spot seems to be as stable our observations of spatial pattern were over the three years of the study.

Based on the results of this study, it seems that mowers are quite efficient in picking up and retaining the tissue that is cut by the mowing unit rather that spreading it downstream. More research is needed to see if dollar spot is moved by mowing equipment and to define the conditions under which movement is possible.

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As we understand more about turfgrass disease biology and spread, management practices can be implemented to improve disease management programs with cultural practices and make chemical applications more efficient and environmentally sensitive. Using these techniques it is possible to develop prediction tools that allow a turfgrass manager to better time chemical applications and can ultimately allow managers to target specific areas of the property in a site-specific manner rather than making the blanket applications that are presently the norm.

Brandon Horvath was recently hired as an assistant professor in the department of plant pathology and weed science at Virginia Polytechnic Institute and State University. He is a turfgrass pathologist at the Hampton Roads Agricultural Research and Extension Center in Virginia Beach, Va.