Turf Pathology Report: Managing Dollar Spot with Resistance to DMI fungicides

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Laying out a research plot in Connecticut

Dollar spot caused by *Sclerotinia homoeocarpa* is one of the most economically important diseases on golf courses in the New England region as well as other regions of the United States. Dollar spot begins infecting turfgrass in May and continues until October. Its most destructive periods occur in late spring and early fall when environmental conditions such as high humidity and temperatures ranging from 50-85°F are conducive to its growth. Maintaining turfgrass quality throughout the growing season requires multiple fungicide applications. This requirement makes fungicide efficacy an important factor due to the economic constraints that are inherently tied to large-scale (roughly 25-40 acres per 18 holes) fungicide applications.

Because contact fungicides provide only 7-14 days of residual control, systemic fungicides which provide control for 14-28 days have become an economically appealing control option for superintendents and a major part of fungicide programs targeting dollar spot. However, repeated use of those systemic fungicides in the same class leads to the development of fungicide resistance. Dollar spot resistance to DMI fungicides was first reported on golf courses in the early 1990's and has also been recorded in other systemic fungicide classes including benzimidazoles and dicarboximides. Currently, five fungicide classes adequately control dollar spot, but due to resistance, some superintendents may only have two successful control options. Without adequate and detailed information regarding resistance levels of the entire dollar spot population of their golf course, some superintendents are wasting thousands of dollars a year by increasing application rates and shortening application intervals of fungicides when their course already has or is developing resistance. Further complicating the issue of DMI resistance is the fact there are six DMI fungicides (fenarimol, metconazole, myclobutanil, propiconazole, triadimefon,and triticonazole) available which are used in controlling a wide range of other turfgrass diseases.

How can a golf course save money and improve their turf quality if it has a fungicide resistant dollar spot population?

The Turf Pathology lab at the University of Massachusetts is conducting research on this very question. Fungicide resistance research in other crops has helped recognize the differences in resistance mechanisms between the various fungicide classes. Dollar spot resistance to DMI fungicides has proven to be more complex than resistance to other fungicide classes. Benzimidazole and dicarboximide fungicides exhibit a qualitative resistance response, meaning the dollar spot isolate is either non-resistant or resistant (Fig.1).

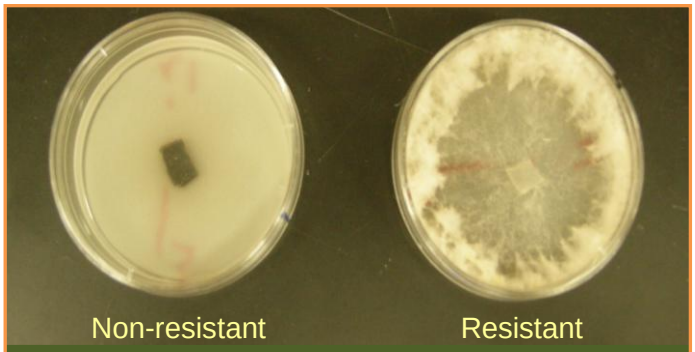

Figure 1. Two dollar spot isolates grown on benzimidazole amended media exhibiting qualitative resistance.

DMI fungicides on the other hand exhibit a quantitative resistance response, which is better described as insensitivity, meaning partial resistance (Fig. 2).

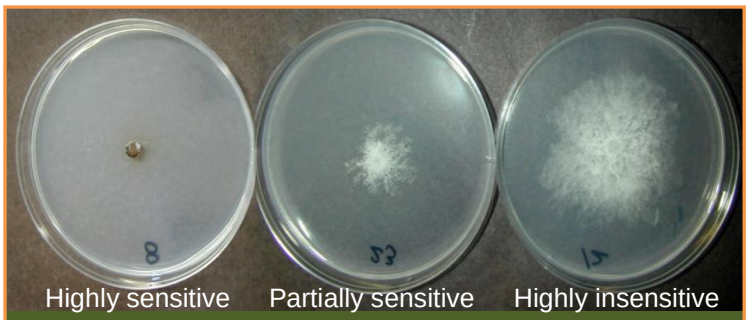

Figure 2. Three dollar spot isolates grown on DMI amended media exhibiting quantitative resistance

DMI insensitivity results in a gradual dollar spot population shift of reduced efficacy to DMI fungicides. Reduced efficacy over a long time period is difficult to detect in field situations due to the many variables connected to fungicide application (fertility, post-spray rainfall, nozzle type, mowing, soil compaction, etc.). The difficulty of detecting or monitoring DMI resistance in the field has led to the development of the *in-vitro* fungicide sensitivity assay shown in Figure 2 which detects levels of DMI resistance that correlate back to resistance levels in the field.

Samples collected from existing DMI resistant dollar spot populations in 2007, 2008, and 2009 has shown that each golf course has a unique dollar spot population structure depending on cultural management and history of fungicide uses at that site. This information has provided useful recommendations to superintendants regarding the level of DMI resistance on their respective golf courses. The recommendations include optimizing cultural practices and implementing a more effective fungicide application program for delaying the shift of a sensitive dollar spot population to a resistant population. Because sensitivity levels on each course are different, their respective fungicide management programs will also differ depending on the level and type of resistance present in the dollar spot population.

On four of the eight courses involved in the 2009 study we observed control efficacy erosion 14 days after DMI application (Fig. 3), whereas DMI applications to courses with sensitive dollar spot populations provided control for the expected 21-28 days. On 2 golf courses, some highly resistant isolates were showing active mycelial growth as early as 7 days after application regardless of DMI rates. The main problem with DMI insensitivity is that fungicide failure shortens control intervals and increases the frequency of fungicide applications. Unexpected fungicide applications to large areas such as fairways cause significant budget constraints and environmental damage. The data from our dollar spot resistance project can serve as a reference for superintendents explaining DMI resistance to their respective greens committees as well as for planning a fungicide program for the future.

Overall, we know that DMI resistance is a real problem and will continue to grow. Our ultimate goal is to provide superintendants with site-specific management strategies for slowing and eventually reverting fungicide resistance on their golf courses. An *in-vitro* fungicide assay can be performed for your course at a cost lower than a single fungicide application. For more information on having your dollar spot population tested for fungicide resistance to DMIs and other fungicide classes (benzamidazole, dicarboxamide, and boscalid) as well as a written report with a suggested fungicide program for reducing dollar spot outbreaks, contact: Geunhwa Jung (jung@psis.umas.edu).

Figure 3. Two DMI treated plots photographed 14 days after application of a DMI fungicide showing breakthrough of highly resistant dollar spot infection centers. The control plot received no fungicide.