

## // FIGURING OUT FUNGICIDES

# Factors affecting fungicide performance

## Part 1 of 3: Fungicide selection

By Jim Kerns Ph.D.

**I**n a perfect world fungicides would not be needed to manage diseases of turfgrass. However, we do not live in a perfect world and pesticides are necessary for managing pests. Yet there are ways to maximize the effectiveness of the products we choose to manage those pests. This article is the first in a series of articles that explores the factors affecting fungicide performance and ways to ensure we are getting the biggest bang for our buck when using fungicides. The first two things to consider when selecting a fungicide are plant health and deposition of the fungicide.

effects of fungicides. That being said, we do see benefits from certain fungicides with respect to turf quality. Yet it is important to select a fungicide for its primary purpose, controlling a plant pathogen.

What is plant health? How do we measure it? These are all difficult questions facing turfgrass managers and researchers. Typically we hear that rooting is a measure of plant health and in most respects roots are an excellent measure of plant health. Root depth is not the only measure of plant health though. We can also measure turf quality or growth. Growth is challenging for the golf industry

compaction, moisture stress and other abiotic issues that develop on golf courses. So if you have struggled with the efficacy of your fungicides, I would suggest examining your soil, fertility and moisture management. Of the numerous samples we receive each year, at least 30 to 50 percent of them are diagnosed with an abiotic problem. Not only will a fungicide not fix the problem, in many respects disease can become more severe as abiotic problems persist.

Another important factor for improving fungicide performance is accurate diagnosis. As I mentioned above, we receive numerous samples in which we cannot find disease activity. This is probably the simplest way to improve fungicide performance, as we can suggest alternative ways to manage abiotic problems.

Turf diseases are pretty difficult to diagnose, especially when dealing with root and crown diseases. For example, in the transition zone creeping bentgrass struggles with summer patch, *Pythium* root rot and *Pythium* root dysfunction. These are three totally distinct diseases with three different management strategies for each. Yet the symptoms can be very difficult if not impossible to diagnose without the aid of a microscope.

I have dealt with a few cases where superintendents were spraying preventatively for *Pythium* root dysfunction, but were still struggling to maintain their putting surfaces during the summer months. They actually had *Pythium* root rot. Moral of the story, if you have struggled to achieve efficacy with root diseases, send a sample to a local diagnostic lab. Once you have an

### What is plant health? How do we measure it? These are all difficult questions facing turfgrass managers and researchers.

Yes, I said plant health. This has become a buzzword with pesticides and with good reason. All fungicides are plant health products. We use them to manage a fungus or fungal-like organisms that feed on our precious turf plant. When we prevent that feeding interaction, we are promoting plant health.

I do not intend to discuss the effects of products in absence of disease because I believe that we do not have the entire story regarding fungicide applications and plant growth. Turfgrass systems are extremely complicated, dynamic systems and without a better understanding of the microbial ecology associated with our systems, we cannot begin to understand the true side

because we are always trying to limit growth. Therefore quality may be the best measurement we have for plant health in a turfgrass system.

So how do we maximize turf quality of golf course turf? I think this answer is fairly simple, agronomics. Plants need light, air (oxygen), food and water to be healthy, so fertility, irrigation, cultivation and mowing all are mechanisms that affect plant health as much or more than the pesticides we deploy. If we want to maximize plant health and fungicide efficacy, these practices need to be examined.

Fungicides are designed to suppress the growth of fungal or fungal-like organisms. They cannot remove or cure black layer, nutritional problems,

FIGURE 1

## Application rates and intervals

Application interval (days)	Number of applications	Application rate (oz/M)	Total amount applied	Total cost <sup>b</sup> (fung. + labor \$)	Benefit <sup>c</sup>
14	6	1.0	6.0	1,160	63.2
14	6	2.0	12.0	2,140	94.7
14	6	3.0	18.0	3,120	100.0
14	6	4.0	24.0	4,100	100.0
21	4	2.0	8.0	1,427	68.4
21	4	3.0	12.0	2,080	84.2
21	4	4.0	16.0	2,734	94.7
28	3	4.0	12.0	2,050	84.2
No spray	0	0.0	0.0	0	47.4

Adapted from Latin, 2011

<sup>b</sup> Estimated retail cost of Chipco 26 GT applied to 3 acres of putting greens.

<sup>c</sup> Percentage of 19 evaluation days dollar spot severity was less than or equal to 0.5%

accurate diagnosis of the problem, you will succeed when applying fungicides.

Once an accurate diagnosis is accomplished and plant health has been addressed, how do you select the right fungicide? There are many sources that can aid in fungicide selection and I will list just a few of my favorites.

Dr. Paul Vincelli from the University of Kentucky produces a document each year called "Chemical Control of Turfgrass Diseases" (<http://www2.ca.uky.edu/agc/pubs/ppa/ppa1/ppa1.pdf>) that is an excellent resource for fungicide selection. Dr. Vincelli gathers data from all over the U.S. when compiling and updating this publication.

At N.C. State my predecessor Dr. Lane Tredway developed an excellent disease management utility called NCSU Disease Management Utility (<http://turfdisseasemanagement.ncsu.edu/nc>). Right now we are working to update this

tool and we hope to have that complete by this summer.

Many turf scientists publish results of fungicide trials on their program website. For example, when I was at the University of Wisconsin-Madison, we published our fungicide trial work on our website ([www.tdl.wisc.edu](http://www.tdl.wisc.edu)). Here are just a few more websites that I have used in the past for management information; these are by no means exclusive (<http://plant-science.psu.edu/research/centers/turf>, <http://turfpath.missouri.edu>, and <http://turf.rutgers.edu>).

Dr. Rick Latin at Purdue University published a book entitled, "A Practical Guide to Turfgrass Fungicides," which is an excellent source for the basics of fungicides and for fungicide efficacy. Finally, if you are still uncertain about fungicide selection, call your local turfgrass pathologist or turfgrass extension specialist.

The next step is picking the

application rate and volume and timing. Fungicide timing can be tricky as there are many factors that govern timing of fungicide application. However, in order to maximize efficacy, typically preventative applications are best. Dr. Latin showed this very well in his book. He conducted a study examining application rates and intervals for dollar spot control using Chipco 26GT (see Figure 1). He determined the benefit of each strategy he examined, which was calculated as the percentage of 19 evaluation dates that dollar spot severity was less or equal to 0.5 percent.

He also included a total cost of the application strategy that included the fungicide cost and labor. He found that applying the fungicide at two oz. every 14 days provided 94.7 percent benefit at \$2,140. One hundred percent

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control was achieved in the study, but it required more products and more money. With preventative control, fewer products are typically used and in many cases less labor when compared to curative applications. Once a disease develops, high rates and short intervals are normally required to maintain adequate turfgrass quality.

## Fungicide selection is a complicated task and has become extremely difficult as more products are released.

For foliar diseases, watching nighttime temperatures are essential for timing fungicide applications. For example, dollar spot typically starts developing when nighttime temperatures exceed 50°F and relative humidity consistently exceeds 70 percent. For anthracnose, the rule of thumb is to schedule fungicides when nighttime temperatures consistently exceed 65 to 68°F. For brown patch and Pythium blight, they usually do not develop unless nighttime temperatures exceed 72 to 75°F. These are not set in stone and many turfgrass pathologists are working to refine our understanding of the environmental conditions that promote these diseases, but for now, using these nighttime temperatures have been fairly successful in our trials at N.C. State.

Soil borne diseases are a little different. Soil temperatures are the key for scheduling preventative fungicide applications. For fairy ring, Dr. Lee Miller's work demonstrated that DMI fungicides successfully limited or prevented fairy ring development when they were applied when soil

temperatures were between 55 and 75°F. Make sure soil temperatures are consistently 55 to 60°F for four or five days before pulling the trigger. Then one or two follow-up applications a month apart should alleviate your fairy ring issues.

A similar soil temperature regime exists for take-all patch and Pythium root dysfunction. With Pythium root rot and summer patch, they can continue development into the summer months even with preventative applications. More follow-up applications for these diseases may be necessary. However, scheduling the first application when soil temperatures reach 65°F is a good rule of thumb, especially in areas where creeping bentgrass is under extreme physiological stress. For spring dead spot, the best starting point for fungicide applications is when soil temperatures cool down to around 65 to 70°F in the fall.

Fungicide selection is a complicated task and one that has become extremely difficult as more products, both brand name and post-patent, are released. The most important considerations for maximizing fungicide performance is to address agronomic practices that affect plant health and getting an appropriate diagnosis of the potential problem. After considering fungicide selection, plant health, diagnosis, rate and timings, the next consideration is residual. The next article will cover how long fungicides persist in a turfgrass environment and the factors that govern disease pressure.

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