

Strategies from the Field to Delay Fungal Resistance

Taking a holistic approach to disease control and managing fungal resistance.

BY STANLEY ZONTEK

FUNGAL RESISTANCE! The thought that your golf course may one day develop a disease that is resistant to the chemicals you know and rely upon causes most turf managers more than a passing concern. It is a real worry, especially in the Transition Zone areas of the country where the *normal* weather patterns each year include extended periods of oppressive heat and humidity and are punctuated by thunderstorms. These are perfect conditions for fungal diseases to develop and cause damage to turfgrasses. As a general rule, more disease problems occur in this region of the country than the more temperate northern regions or in the South, where the more disease-tolerant bermudagrasses are grown. Suggestions on ways to control turfgrass diseases without inducing fungal resistance are the subjects of this article.

Currently there is a debate among turfgrass pathologists about which fungicide use concept is the best. Fortunately, fungal resistance problems are not yet rampant in the Mid-Atlantic region of the country, where disease pressure is high and fungicide usage is heavier than in other regions. A few cases of fungal resistance have occurred, associated primarily with gray leaf spot resistance to strobilurin fungicides, such as Heritage, and with pythium blight resistance to Subdue. However, when you consider how many different diseases are a problem and how many fungicide sprays are made during the year, the superintendents in this region of the country generally are doing a very good job of controlling disease



The first line of defense for disease control is to grow a healthy stand of grass. Maintaining plant health and improving the growing environment are essential aspects of managing putting green turf.

while managing, or at least delaying, fungal resistance problems.

Suggesting ways to manage disease problems in a tough grass-growing region of the country is the purpose of this article. Additionally, the practices outlined in this paper are not a theoretical approach to disease control. They are in routine use throughout the Mid-Atlantic region and other areas of the country. Several turfgrass pathologists were contacted in preparing this paper, and there was enthusiastic agreement that a holistic approach to disease control is the best method for managing or at least delaying fungal resistance to currently available fungicides.

THE HOLISTIC APPROACH

What is meant by a *holistic approach*? The definition of *holism* suggests a “functional relationship between parts

that make a whole.” In this case, it could include various management programs and techniques working together for disease control and managing resistance. Call it what you like: Best Management Practices (BMPs), Integrated Pest Management (IPM), or common sense and experience, etc. Effective disease control, as it is commonly practiced in many areas of the country, involves much more than simply spraying a fungicide every 7-14 days. This holistic approach includes:

PLANT HEALTH

Weak, stressed grass is more prone to disease, and if disease occurs, unhealthy grass is slower to recover. Fungicides, even the best ones, just do not seem to work as effectively when grass is unhealthy. In my opinion, the cause for many a fungicide failure is unhealthy grass, rather than fungicide failure or fungal resistance. Simply put, healthy grass on putting greens is:

- **Free of Undue Environmental Stress.** That is, a turf growing in a good grass-growing environment, free of shade problems and enjoying good air circulation and soil drainage.
- **Free of Undue Mechanical Stress.** The grass should not be too heavily topdressed, aggressively brushed, groomed, aerated, verticut, dethatched, or otherwise mechanically damaged during periods of hot weather in the summer. Spores of pathogens that cause anthracnose and other diseases enter the grass plant more easily through wounds caused by mechanical damage.
- **Free of Mower Stress.** Grass should not be cut too closely during periods of



Streaking *Pythium* on a perennial ryegrass fairway will put fear into a golf course superintendent. A holistic approach to disease control is the best method for managing, or at least delaying, fungal resistance to currently available fungicides.

weather stress. This includes increasing mowing heights and not mowing grass when conditions are too wet. If free water exists on the surface of a green, skip mowing that day, or mow later in the day when the green is drier. Also, switch from grooved to solid rollers to reduce wounding and mower stress in the summer.

● **Free of Chemical Stress.** Interactions among growth regulators and fungicides can be an element of plant stress, especially during a hot and humid summer. Heavy use of growth regulators also can slow recovery. Some preemergence herbicides have been linked to chemically stressing the turf, too. In many situations, superintendents in the Mid-Atlantic region avoid applying preemergence herbicides to greens (unless absolutely necessary) and rely upon postemergence control programs or the old standby, hand weeding. This is IPM using a BMP at its best!

These are some of the elements of stress management over which a turf

manager has some control. Weakened, stressed grass ultimately can result in difficult-to-control disease problems, especially anthracnose and summer patch, even though a sound fungicide spray program is in place. In fact, when we visit a golf course with a good fungicide spray program and where disease problems are still occurring, we look beyond the chemicals being applied. We consider other stress factors that may be reducing the health of the turf and reducing the effectiveness of the chemical applications. Plant health is the key factor in complementing a fungicide spray program. Other health factors include:

FERTILITY

Putting greens need fertilizer. As practiced in the Mid-Atlantic region, most greens are fertilized on a light and frequent basis — not too much nitrogen, but not too little. This program involves weekly to biweekly applications of soluble fertilizers at rates ranging from

0.10 to 0.20 lb. of actual nitrogen per 1,000 sq. ft. per application. Micro-nutrients such as iron also are added. The goal is to keep the grass plant green, healthy, and growing during the summer. In using this program, always check compatibilities between fertilizers and fungicides. Most soluble fertilizers can be tankmixed with most fungicides, but *read the label*. In my opinion, these applications of soluble fertilizers improve turf health and make fungicides work better. Dr. Peter Landschoot, of Penn State University, makes the point that anthracnose is a low-nitrogen disease. Keep this in mind.

SPRAY VOLUMES

Re-read the labels on the fungicides you use. I'll wager that you may not be using enough water as a carrier when fungicides are applied. If too little water is used, fungicide sprays can become concentrated in the upper canopy of the turf. The fungicide can be more rapidly mowed off than if the entire

grass plant were to be thoroughly wetted with the spray solution. This lack of water as a carrier can diminish control and ultimately waste money. Also, penetrant fungicides enter the grass plant and are translocated from the point of contact upward, and they seem to need this extra water.

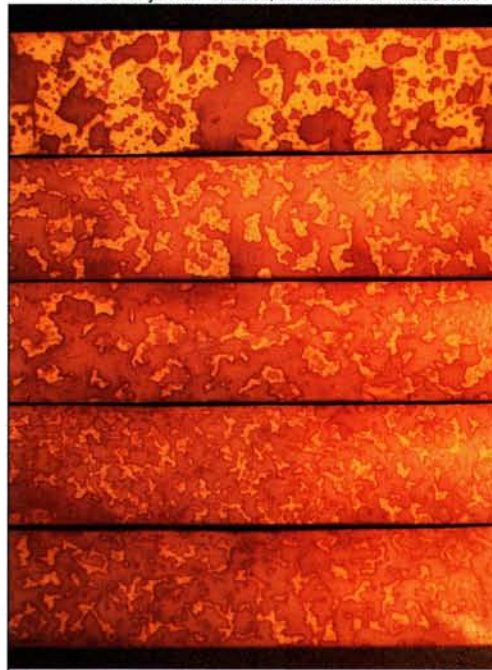
How much water? While a contact fungicide alone may require only 1–2 gallons of water per 1,000 sq. ft., most fungicide combinations seem to need 2–3 gallons per 1,000 sq. ft. as a minimum. For penetrants on fairways, 100 gallons/acre is a standard recommendation. Yes, this extra water may involve more time to spray greens (or fairways), but higher spray volumes may improve control, reduce the number of chemical applications, manage resistance, and save money.

Note: Fosetyl aluminum (Signature and Prodigy) is the only true systemic fungicide — it can move upwards or downwards in plants. These products may be the one exception to the spray volume guidelines.

NOZZLE TYPE

The nozzle you use should be of a type that provides good coverage and the correct spray volume as per the fungicide label. All too often, one nozzle is used for fungicides and herbicides. This may not be the best procedure. Similarly, sprayers should be calibrated on a regular basis, and worn nozzles, regardless of their type, should be replaced on a regular basis, but at least once per season. Increasingly, there is a trend to use flat fan or similar type nozzles to *drive* the fungicide spray deeper into the grass canopy, using higher (but not too high) spray pressure. This seems to make good sense. Dr. Peter Dernoeden from the University of Maryland and Dr. Houston Couch of VPI, both state, “Flat fan type nozzles are preferred for disease control applications.”

Here is the bottom line. All nozzle types can be used to provide good coverage and disease control, although



This image compares nozzle spray patterns using water-sensitive paper. More yellow color represents less coverage. Good coverage helps ensure better disease control. From top: XR Tee Jet, Twin Jet, Turbo Tee Jet, Flood Jet, and RA Raindrop.

some engineering is involved to achieve the proper sprayer configuration, including boom height, partial to 100 percent overlap, proper nozzle angle, etc. There is an absolute need to have the proper nozzle, calibration, pressure, and water to provide the best coverage and the best disease control.

FUNGICIDE SELECTION

Why are fungicides finally mentioned near the end of this article? In reality, if you view disease control and the management of resistance using a holistic approach, fungicides are but one part of the disease control equation. Plant health is first, followed by managing those stress factors that can be controlled, followed by using the best spray techniques to complement the mode of action of the fungicides being applied.

All too often, superintendents seem to use fungicides as a crutch. That is, they rely upon chemicals as their primary means of disease control, and discount factors like maintaining plant health and reducing stress. This is an all

too common mistake. When a fungicide spray does not seem to provide effective control, the common curse is that the fungicide is not working or that fungal resistance has occurred. *Could it be that the grass is so weak that even the best fungicides won't revive dying grass?*

Fungicides are an important part of an effective disease management program in the Mid-Atlantic region. Most putting greens in this region are sprayed on a preventive basis beginning in the spring and continuing into the fall. For a long list of reasons, most golf greens (except on new golf courses or those with rebuilt or regrassed greens) have a combination of bentgrass and *Poa annua*. This mix of grass species is one curse of older courses in the Transition Zone. There always seems to be some disease that needs to be preventively treated, like anthracnose and dollar spot, leaf spots, pythium blight, brown patch, and those pesky root diseases like summer patch and take-all patch. Then there are snow molds, yellow tuft, etc. See what I mean? There always is a disease problem to be managed. When fungicides are applied, the following guidelines are offered.

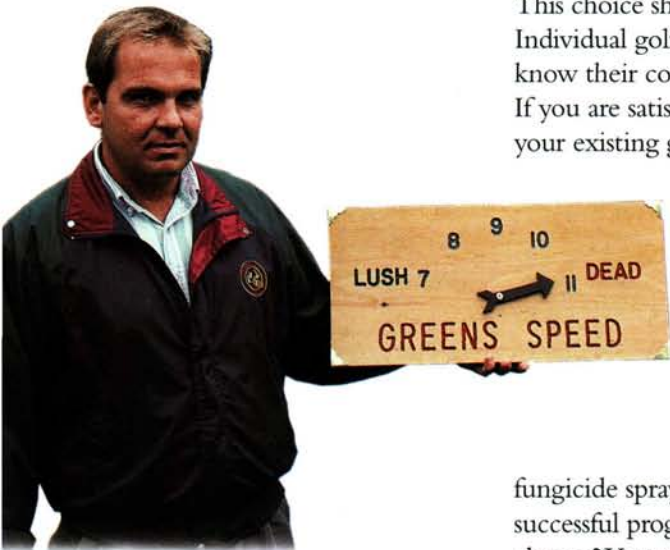
TANK-MIX AND ROTATE CHEMISTRIES

This technique is first choice for many superintendents in the Mid-Atlantic region. They tank-mix a contact fungicide with a penetrant fungicide. For the next spray, they again include a contact fungicide with another penetrant that has a different chemistry and mode of action. Part of this spray rotation includes our industry's only true systemic fungicide, fosetyl-aluminum (Signature or Prodigy), tank-mixed with a contact fungicide. This is a continual process throughout the spray season, i.e., always rotating between penetrant fungicides (acropetal or local), while normally including a contact fungicide in each spray mixture. There is now research support for this technique.

In a disease epidemiology model developed by Dr. Paul Vincelli of the

University of Kentucky, research suggests that “fungal resistance was delayed best with a tank-mix of contact and systemic fungicides or contact and penetrant fungicides.”

Yes, this program is more expensive, but it seems to work best. This model also is supported by what superinten-



Reductions in mowing height to achieve green speed have agronomic consequences. Superintendent Rhys Arthur from Indian Spring Country Club (Silver Springs, Md.) has a sign that says it all.

dents and other plant pathologists in the Mid-Atlantic region have experienced. In an article of this type, it is difficult to recommend specific products for specific diseases. Contact your state cooperative extension specialists or your regional USGA agronomists for answers to disease control questions you may have. In the final analysis, tank-mixing of fungicides along with soluble nitrogen (when compatible) seems to make a wonderful fungicide spray blend to promote plant health, control disease, and manage (delay) fungal resistance.

ALTERNATE CHEMISTRIES

This seems to be a second choice approach to disease control, but it still is an effective program. An individual fungicide chemistry is applied, then alternated to another chemistry for the next spray. This approach seems to work best in a preventive spray program. The addition of soluble fertilizers (when compatible) also works well using this program.

Note: If a curative fungicide application is needed with either approach,

spray intervals should be compressed, rates increased from preventive to curative rates, and a tank-mix program using a contact with a penetrant fungicide should be scheduled until disease control has been achieved.

YOUR EXPERIENCE

This choice should never be discounted. Individual golf course superintendents know their courses better than anyone. If you are satisfied with the results from your existing green management and

fungicide spray program, why change a successful program for the sake of change? You could be one of the fortunate courses that has yet to experience difficult-to-control disease problems on greens. In the long run, however, one of the previous choices most likely will be more effective in delaying fungal resistance.

LUCK

One last aspect of resistance management and disease control should be mentioned. It is luck, both good and bad. Yes, luck enters into this issue. Here's why. All fungi are not exactly the same. There are individual races or biotypes of each pathogen, each of which exhibits different levels of virulence. Golf courses don't necessarily share the same pathogen biotypes. That is, one golf course may have certain biotypes of the same disease while other golf courses may have different biotypes. There is no way of knowing for sure which race or biotypes you have on your golf course. Dr. Peter Landschoot of Penn State University, when referring to anthracnose, states, “There are benign races of anthracnose and there are weapons-grade types.”

Dr. Paul Vincelli, from the University of Kentucky, in studying gray leaf spot resistance to strobilurin fungicides, seems convinced that the resistance gene in the fungus pre-existed on the course before the first fungicide was ever applied! Perhaps this fact helps to explain why one golf course may experience a disease problem and another golf course does not . . . why one superintendent's fungicide spray program works and a similar program on another course does not . . . why one fungicide may provide an excellent level of control on one golf course while on a neighboring course the same product does not work as well. The realization that not all of our pathogens are necessarily the same may help explain why one course may be luckier or less lucky in its disease control efforts than another course.

SUMMARY

To effectively control disease and delay fungal resistance, turf managers should take a holistic approach to disease control. Controlling disease while delaying fungal resistance involves much more than using chemicals alone. Maintaining plant health and improving the growing environment are essential aspects of managing putting green turf. Then, when chemicals are needed, they should be correctly applied. In the final analysis, which product to use and how to use it ultimately comes down to a decision that individual golf course superintendents must make.

Our industry is light years away from the old days when the most commonly used fungicide spray was a mix of PMA (phenyl mercuric acetate) and Thiram, sprayed weekly, beginning in the spring and continuing into the fall. Come to think of it, wasn't this a tank-mix?



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