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Understanding Fungicides

Photo courtesy of BASF

Dollar spot.

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Before you can successfully implement fungicides into your disease management program, you've got to get to know them.

TABLE 1.

Factors That Can Affect Turf and Pest Management

1. Mowing
2. PGR (growth inhibitors)
3. Clippings
4. Topdressing
5. Irrigation
6. Fertilization
7. Overseeding
8. Sodding
9. Herbicides
10. Shading
11. Surfactants
12. Nematicides
13. Insecticides
14. Aerification
15. Compaction
16. pH
17. Seed mixtures
18. Seed blends
19. Weeds
20. Drainage
21. Organic amendments
22. Soil amendments
23. Biological agents
24. Growth stimulators
25. Heat
26. Irradiation
27. Humidity/wetness
28. Fungicides

What are fungicides? The popular definition: fungicides are any chemical that can inhibit the growth or development of a fungus. The technical definition: fungicides are any chemical that kills a fungus. *Fungistats* are chemicals that *inhibit*, but do not kill, the fungus. In the turfgrass industry, the term fungicide is commonly used for any chemical that reduces or prevents the development of a fungal disease, but this is much different than the true action of a fungicide. There are many ways chemicals can inhibit or kill a fungus, and there are many different fungi, each of which can react differently to the various fungicides you apply to turf. Further, the effectiveness of a fungicide is determined by much more than just its chemical nature. In short, there is a lot to understand about fungicides if you want to maximize their effectiveness.

Fungi Hit List

There are about 25 different fungi that cause serious turfgrass diseases. There are many more fungi that can attack or infect turfgrasses, but they seldom cause noticeable damage. Why does nature allow the Big 25 fungi to attack turf? The simple reason is nature's balance: The fungi that "eat" the turf are food for other microbes that "eat" them. Beyond the Big 25 that attack your turf, there are thousands of other fungi that rot thatch, debris, other plants and microbes, all of which become organic nutrients for the turfgrass. We call these *beneficial fungi*. Every turf manager loves the beneficial fungi, but did you know that most of the Big 25 also are members of the beneficial class of fungi? Pythium (warm-temperature foliar blight): a great rotter of dead plants. Colletotrichum (anthracnose): another beneficial, debris-rotting fungus. And of course, all of the fairy-ring fungi live to rot thatch and dead plant material. In fact, only the obligate parasites (ones that must have a live plant to grow), which cause diseases like powdery mildew, smut and yellow tuft, are non-rotters.

So the question for turf managers is: How do I manage the fungal pathogens in my turf without stopping their beneficial rotting activity? If we did not mow, fertilize and groom the turf to fit our objectives, the answer would be very simple: walk away and leave the management to nature. This is not possible for turf managers. Turf is a population of natural plants growing

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in a population of soil microbes, forced by man to grow abnormally. You, the turf manager, are the reason that turf diseases become severe problems. Each year you manage a turf, most of the Big 25 diseases will occur. That's right, most of them develop in your turf each year. However, only occasionally do any of them become severe enough for you to even notice them, much less treat them. Diseases in turf are considered serious only if they are conspicuous and last for a considerable period of time. When asked, most turf professionals estimate that a disease is noticed only if it develops in 3-5% of the total turf. The goal of turfgrass disease management is to limit the severity of a disease to less than that. This is an enlightened goal because it acknowledges that disease is necessary and should not be eliminated from the ecology of the turf. In fact, turf with at least a low level of disease severity is more protected from severe disease outbreaks compared to turf without any disease development. The reason: *biological buffering*. When your soil has many different and active microorganisms in it, they tend to control one another. If you eliminate one of the players in this system, then the others must adjust. For example, if you were to selectively kill the fungi that naturally control pythium, then pythium fungi might grow unchecked and attack your turf. Nothing in turf is this simple, but it does illustrate biological buffering. *Biological control* is quite different than biological buffering. *Biological control* is the action by one living organism to suppress the activity of another. It is a natural process and, collectively, all the one-on-one episodes of biological control add up to biological buffering.

Adjusting the biological buffering of turf is a slow process. You should not attempt to rapidly change the biology of a turfgrass ecosystem. The ecosystem is very strong and resists changes because so many organisms are involved in it. However, you *can* change it; but if you change it too fast, you imbalance the entire system and havoc results. Here are two cases of how turf managers can upset the biological balance.

- **Case One:** Fumigation with methylbromide kills nearly all microbes, animals and plants. When you treat a soil with this chemical, all biological balance is eliminated. When you seed grass plants into such a soil, it will take months—maybe years—to reestablish biological balance. In the process, diseases like pythium blight, rhizoctonia blight and take-all patch will rapidly attack the young turf because there are few other microbes to inhibit them.
- **Case Two:** You apply a therapeutic or curative rate of a fungicide to control dollar spot fungus. Initially, the severity of dollar spot is reduced, but what you do not see are the many other changes in the microbial community that also are taking place. Nontarget fungi are also being inhibited, while other fungi are racing to fill the void created by these inhibited fungi. In short, the turf ecosystem is imbalanced and responds to the change brought about by the fungicide. Generally, fungicidal activity is greatly diminished two to four weeks after application, but some effects last much longer than that. At the University of Illinois, we have seen the effects of fungicides last more than 12 months following application for the control of dollar spot on bentgrass.

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Balancing Act

As turf managers, you are expected to produce a uniform and perfect turf, but all the forces of nature are going to fight you unless you harness them. So how do you approach turfgrass management using the concepts of biological buffering and ecological balancing? Can fungicides be a part of such a program? Good turfgrass management does not start with a fungicide. There are 28 factors you should consider when managing turf (see Table 1). These factors are not intended for

SELECTING SYSTEMICS

First and foremost, use a fungicide that is effective against the fungus that is causing the disease in your turf. They do not work equally against all fungi. It is very important that you develop your own information on the effectiveness of fungicides for your particular turf. One of the main differences among the active ingredients of systemic fungicides is mode of action—whether the chemical behaves as a contact or systemic. Before making your chemical selection, take into consideration the chemical's resistance risk—how likely it is that turf will develop a resistance to the chemical (see Table 2). Other things you should consider before deciding on a fungicide include:

- What disease do you want to control?
- What fungicides have good activity against "your" disease?
- Order the fungicides according to their resistance risk.
- Initially choose the most effective fungicide.
- If repeated applications of fungicide are needed during a single season, use another product with a different mode of action.
- If you are not achieving adequate disease control, review your situation with a turfgrass pathologist before you select or use other fungicides.

EFFECTIVE USE OF FUNGICIDES

- Realize that fungi are a necessary part of your turf ecology; you do not want to eliminate them, just manage them.
- Realize that disease management is just one component of turf management, and think seriously about integrated turf management.
- Make every effort to use as many of the first 27 management factors listed in Table 1 before moving to factor 28.
- When choosing a fungicide, think of it as a short-term solution to reestablishing the balance in your turf.
- Stop using a fungicide as soon as you can.
- Choose fungicides that are appropriate for the disease problem you have.
- *Always* use fungicides according to the manufacturer's recommendations. *Follow the label.*
- Consult a plant pathologist and review your disease management program.

only disease management, but should be considered for all aspects of turf management. I have purposely listed fungicides last (no. 28), as they should be the last factor you consider for disease management. Fungicides are only "needed" because of the lofty expectations for turf quality. However, the availability of fungicides and the increasing demand on turf managers for "perfect" turf has led many managers to rely on fungicides. I describe this as "fungicide addiction," and it will ultimately lead only to poor grass and anxiety.

• **Chemicals that are used as fungicides.** A number of fungicides are currently registered for use on turfgrass. Table 2 lists the resistance risk of systemic fungicides, which indicates the likeliness that a fungicide will perpetuate a genetic change (i.e., develop chemical resistance) in a fungus.

• **Contact fungicides for turfgrass.** Contact fungicides are an older type of fungicide. They are also known as protectants because they are intended to intercept a fungus and prevent it from attacking or infecting (getting inside) a grass plant. They do not penetrate plant tissues. They inhibit fungi by interfering with the growth and development of fungi in a number of ways, i.e., they are multiple-site inhibitors. As such, they create a very low risk that fungal resistance will develop. For a fungus to rapidly overcome the inhibition that a fungicide causes (develop resistance), it must change its DNA. In nature, changes in fungal DNA are brought about by several mechanisms. Most genetic changes that occur in fungi kill them, and these changes occur very infrequently. It has been estimated that only one in a million DNA changes (mutations) is not lethal, and most of these are rapidly eliminated from the fungus anyway. When a fungus has to change its DNA not just once, but two, three or four times, the chances of it accomplishing this are so rare that it will not happen. Contact fungicides remain effective even if you use them over and over again.

• **The repetition of contact fungicides.** Contact fungicides are toxic to many different fungi, including many of the nontarget fungi that are beneficial to your turf. In order to work, they must cover the plant surfaces before fungi attack. If the fungal pathogen attacks the leaves, it is easy to apply the contact fungicide to the leaves; but the leaves are growing and the new leaf tissue will be unprotected, so you'll have to apply the fungicide frequently. In the spring, this could be every week or even more often. If the fungal pathogen attacks the crown, rhizomes, stolons or roots, you'll encounter the same problem due to the growth of these tissues, but it is further complicated by the fact that they are surrounded by soil. Soil and organic matter will filter and bind many chemicals to their surfaces. This forces you to use more compound to achieve disease control.

• **Systemic fungicides for turfgrass.** Systemic fungicides are a newer class of fungicide, but they still have been around for 20 years. They are described as systemic because they "move" once applied to the turf and redistribute inside the plant. "Systemic" implies that the compound will move into *all* cells of the plant. If you apply it to the leaves it would end up in the roots; and if you applied it to the

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soil, it would end up in all the roots and the leaves. However, this is not always the case. Some fungicides are described as *locally systemic,* meaning they only move a few cells away from the point of entry. This is most likely the case for the majority of systemic fungicides. The application, delivery, incorporation, redistribution and action of systemic fungicides are a complicated science. Fungicides not only have different active ingredients, they also have different carriers. A *carrier* is the material upon which the active ingredient is loaded for the purpose of application. The carrier itself can have fungicidal activity and can greatly affect how the active ingredient reacts and enters a plant. Generally, companies that develop fungicides test many different carriers to determine which works the best. However, each type of grass has different surface chemistries, and each will react somewhat differently to a carrier. Sometimes, one fungicide is more effective than another because of the carrier, not the active ingredient.

As for translocation or systemic properties, don't overestimate this characteristic. In most cases, the movement of the compound, once applied, appears limited to very short distances within the plant. This is evident because fungicidal protection is quickly lost if the grass plant is actively growing or the pathogen is very aggressive. Another limitation with systemics is the time needed for full effectiveness to be realized. Generally, once applied, systemic fungicides require three to five days to become fully effective. The reason is simple: They must move into a plant, redistribute within the plant and build up enough active ingredient in the plant to have an effect. Each of these processes takes time, adding up to three to five days. I have observed systemic fungicides seemingly fail to control a disease that they are known to be effective against. If your disease pressure is increasing or at a high level when you apply the systemic fungicide, then during the three to five days required to reach full effectiveness, the pathogen can overrun the plant. Combine this with rapid turf growth or very poor turf growth and it will appear that the fungicide failed. This is often the case with the failure of systemic fungicides to control gray leaf spot. For a systemic fungicide to be effective, the disease severity at the time of application must be low. This does not mean you should use them preventatively; it means you have to scout your turf and look for the start of disease. This is why it is important to use as many of the 28 management factors (Table 1) as possible to slow down the rate of disease development.

TABLE 2.

Resistance Risk of Systemic Fungicides

Common Name	Resistance Risk
(benzimidazoles):	
benomyl	high
thiophanates	high
(phenylamide):	
metalaxyl	high
mefanoxam	high
(1,2,4-triazoles):	
myclobutanil	moderate
propiconazole	moderate
tebuconazole	(experimental)
triadimefon	moderate
triticonazole	(experimental)
(pyrimidinemethanol):	
fenarimol	moderate
(strobilurins):	
azoxystrobin	moderate
pyraclostrobin	moderate
trifloxystrobin	moderate
(dicarboximides):	
iprodione	moderate
vinclozolin	moderate
(analides):	
flutolanil	low
boscalid	moderate
(polyoxin):	
polyoxin D	moderate
(carbamate):	
propamocarb	low
(phosphonate):	
fosetyl-aluminum	low

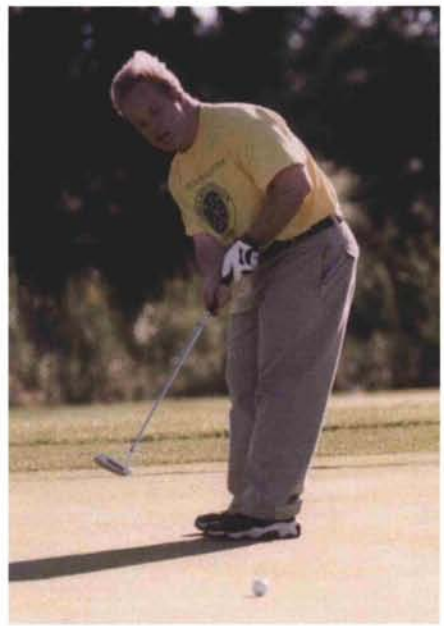
* Some are single-site inhibitors (SSI); a few are multisite inhibitors (MSI). SSIs have moderate-to-high risk of fungicide resistance development.

The application, delivery, incorporation, redistribution and action of systemic fungicides are a complicated science.

Dave Braasch *Glen Erin Golf Club*

Golf Without Boundaries

You don't know what you have until it's gone!



You don't know what you have until it's gone. What if you never had it; would you miss it? Or maybe you did have it and now it's gone.

I'm talking about opportunity. The opportunity to do things you wouldn't otherwise be able to do without a helping hand from others. This usually derives from a donation of sorts, whether it is money, land, material items or time, simply your presence to assist those who need it.

What are my inspirations for writing this piece? One is my seven-year-old nephew, Tony, who was born with the disease spina bifida—generally defined, an incompleteness of the spine. He is a determined boy who doesn't quite know why he can't do the things that all the other kids are doing, but will keep on trying. Golf and fishing are two hobbies that he wants to pursue, but who and what facility or programs can accommodate him? The other inspiration came from reading an article in the November 2003 issue of *Golf Course Management* titled "Back to John's Golf Course." This was a follow-up to a May 2001 story about Steve and Juana Espinoza, whose son John was born with Cornelia DeLange Syndrome, which can cause developmental disabilities. A course was built and "gives John and other disabled individuals a comfortable outlet to golf without the pressures of a traditional facility." So—what does the Midwest have to offer?

Sunshine Through Golf Foundation

Seated, some of the 700-plus "members" of the CDGA's new Three-Hole Sunshine Course.

In fact, a number of programs are offered throughout the year in this region. The CDGA's Sunshine Through Golf Foundation, through facilities at Midwest Golf House, is one of the key players that has much to offer. I recently had the opportunity to speak with Todd Alfred, the CDGA's director of foundation operations, and gain some insight into their mission. Fact: the Sunshine Through Golf clinics, based out of the Midwest Golf House, comprise the largest grassroots golf program for individuals with disabilities in the country; this year alone, the foundation is putting on some 50 clinics to reach some 700 individuals. Three words summarize this program; therapeutic, recreational and rehabilitative. The program's primary focus is on juniors with

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mental disabilities with a minor in physical rehabilitation. Physical disabilities are a secondary emphasis as there are not enough funds to keep a physical therapist on staff. Each clinic is generally five one-hour sessions, providing golf instruction, equipment and the fundamentals of golf, courtesy of the organizers—most clinics are cosponsored by a municipality or park district's Special Recreation Association (SRA) and held at various CDGA member clubs throughout the Chicago District—and volunteer PGA professionals. At the end of each clinic, the more advanced players enjoy the opportunity to play some top golf courses, including Cog Hill, Cantigny, Phillips Park, Oak Brook, Medinah and Glen Oak; everyone partakes in awards and a cookout

The Sunshine Through Golf program entered a new era on Sunday, June 6, when Midwest Golf House hosted the official formal-dedication ceremonies for the Three-Hole Sunshine Course and its I*Mag*Jen Clubhouse, a completely handicap-accessible facility. Designed by Joe T. Jemsek and built by Wadsworth Construction in 2002, the Three-Hole Sunshine Course is now open to people with disabilities, as well as beginners, juniors, minorities and the economically disadvantaged. It will be home to the Sunshine Through Golf program. Dedication day also marked a name change as the CDGA Foundation became the Sunshine Through Golf Foundation, tying the identity more closely to the flagship clinics.

As most MAGCS members know, the Three-Hole Sunshine course has a dual purpose; it is also a living laboratory for those certain demented individuals (plant pathologists) who welcome any disease they can strum up along with the plant varieties that can resist them. This is obviously very exciting for our profession, to have such a resource in our own backyard. Todd Alfred tells me that the foundation operates on donations. Some of the major contributors include the Jemsek family, which donated the acreage upon which Midwest Golf House and the Sunshine Course are located, as well as Fortune Brands, the parent company of Titleist and Footjoy. Many other corporations and individuals make donations throughout the year. These donations not only help support the Sunshine Course, but they also cover the cost of holding programs at other facilities as well. Participation in the Sunshine Through Golf program is free of charge, making donations a necessity.

Formal dedication of the Three-Hole Sunshine Course took place June 6.

The Sunshine through Golf Foundation will hold its fourth annual fundraiser on Monday, September 13 at Rich Harvest Farms with Ben Crenshaw as its keynote speaker. This day will also celebrate the 90th anniversary of the CDGA and the 60th anniversary of the CDGA (now Sunshine Through Golf) Foundation. For more information, contact Todd 630-257-2005 or e-mail him at talfred@cdga.org.

Also in the Mix

The Sunshine Through Golf Foundation works with two other organizations I would like to highlight. One is the Marianjoy Foundation and the other is Cantigny Youth Links.

Founded in 1972 by the Wheaton Franciscan Sisters, the Marianjoy Rehabilitation Hospital, located in Wheaton, IL, provides rehabilitative medicine. The range of rehabilitation services is wide, so I will focus only on golf-related offerings. They offer two programs: one is therapeutic golf for people with physical disabilities, the other is golf medicine for people whose game is affected by injury or pain such as arthritis, sprains and joint replacement.

The therapeutic golf program is available to people with a physical disability and includes individuals who are disabled or recovering from an injury or pain that causes discomfort while playing golf. The focus is to educate people how to properly exercise to strengthen affected muscle groups, how to implement the use of adaptive equipment such as a single-passenger cart or a walking device, and how to adjust swing and stance to alleviate the pain while playing golf. Monthly clinics and play events are organized for those of any age or skill; these take place at multiple golf courses and driving range facilities, with a tournament capping off the year.

Golf medicine focuses more on the effect that pain and injury have on the golf game. The analytical process begins with meetings with physical therapists and physicians who will pinpoint the program for individual needs. Marianjoy does have a golf professional onsite who will examine and alter a golf swing to prevent playing with pain. Marianjoy staff also provide clinics to area PGA professionals on how to teach those with disabilities to play and/or adapt to the game of golf.

For more information on Marianjoy, call 630-462-5580 or e-mail Donna Strum at golf@marianjoy.org.

Mike Jones, Cantigny's PGA professional, and Cantigny Golf work

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Among the MAGCS members or affiliates attending the formal dedication were (L to R): Tom Voigt, Tom Fermanian, Bob Easter, Lee Miller, Jon Jennings, Mike Bavier, Dan Dinelli, Renny Jacobson, Carl Hopphan, Dave Nadler, Don Ferreri, Wally Fuchs, Rusty Stachlewitz, Randy Kane, Eric Nadler and Luke Cella.

with both the Sunshine Through Golf Foundation and the Marianjoy Foundation. Mike informed me of the many programs that they put on throughout the year. The programs are not limited to people with physical disabilities but are also offered to people with mental disabilities. One of the Sunshine Through Golf programs that Mike puts on is in conjunction with the local SRA. It consists of a five-series class that starts out with instruction and the basics of the game of golf. The participants are shown how to hold and swing a club and start out by hitting and putting tennis balls, gradually working down to hitting regulation golf balls. He educates them on club selection for each shot, how to read a green and basic golf etiquette. At the end of the clinic, Mike holds a scramble where at least two of the disabled participants' drives must be used during the round. Mike also provides instruction for those with physical disabilities on how to adapt to the game of golf with the aid of single-passenger carts and walkers. Cantigny does have a yearly charity event to help raise funds for the various foundations with which they partner. For more information regarding the Cantigny offerings, contact Mike Jones at 630-260-8191.

Outside the Links

Golf not your gig? Let me introduce you to "Fishing Has No Boundaries Inc." It is a nonprofit organization "whose goal is to open up the great outdoors for people with disabilities through the world of fishing." FHNB was founded in 1986 as a single group in Hayward, WI and has grown into a national organization with more than a dozen chapters in nine states. I was not aware that such an organization existed until my intern hit me up for a week off in May last year. He told me that he had been a volunteer for this event for the past 16 years. This is one of many events that cater to people with any disability, physical or mental. The Hayward chapter holds its event every spring and relies on volunteers for boats, fishing gear, dock hands, fishing guides and so forth. I know what you're thinking, how does a person with no arms fish? They do it with the assistance of an electric reel. Fundraisers take place throughout the year, ranging from chili cookoffs (which I entered for the first time last winter) to raffles, with one of the strongest supporters being the Lions Club. For more information on FHNB, e-mail info@fhnbinc.org.

Support These Causes!

The common denominator for the success of all of the above programs is ample donations and the spirit of volunteerism. Don't do it because you want to make yourself feel good, do it because you want to! There may be a time when you will be walking in their shoes.

References

"Back to John's Golf Course." *Golf Course Management,* November 2003

Marianjoy Foundation Web site

FHNB Web site