



WE ARE FAMILY

A look at fungicide families

By Jeffrey S. Gregos, TDDL, Department of Plant Pathology,
University of Wisconsin-Madison

The last time I heard We Are Family, I was seven years old and living in the City of Champions (that happens to be the theme song for the Pittsburgh Pirates, and the self-proclaimed title of Pittsburgh after the Pirates won the World Series and the Steelers won the Super Bowl for the fourth time). But, back then you didn't have to worry much about disease resistance management. Now that I am 24 and living in a state that prides itself on the Green and Gold, and not the Black and Gold, we are concerned with fungicide resistance.

I have only been in the State for five months, during which time I have met with over 100 superintendents. Several posed the question, "My chemical control program doesn't seem to have the efficacy that it used to have; do you think I might have developed resistance?" Well, I can say one thing: there is a possibility. In order to be totally sure whether or not you have resistance, there are a few laboratory tests that can be conducted to identify a resistance problem.

Fungicide resistance is a serious problem as I had mentioned in my article in the March/April issue of *The Grass Roots*. The effective life of a chemical is dependent on how you use it. If you continue to use it in your spray program time and time again, you have a greater chance of developing resistance than if you alternate or use a reduced-rate mixture.

The systemic fungicides on the market today have only a single site mode of action. If there is a resistant strain of the pathogen in your popula-

tion, it will continue to dodge the control provided by this chemical. But, if you develop a disease management program that targets several different metabolic sites, you will have a better chance of controlling all the members of the population.

So the best place to start is to understand a little about the way that chemicals of each of the fungicide families work. Most of the time fungicides are either termed as systemic or contact, but this is not precise enough. When I think of a systemic fungicide, I divide it into three distinct groups; localized systemic, acropetal systemic, and systemic. Dr. Houston Couch defines these as the topical modes of action, or the way the chemical interacts with the plant to provide protection from the pathogen. For my discussion, I will term this the "classification of the chemical" (Table 1). With a contact a protective barrier is provided on the surface of the plant. A localized systemic provides the surface barrier plus it is absorbed into the plant and provide protection within the general vicinity of absorption. An acropetal systemic provides the surface barrier along with movement upwards in the plant from the site of absorption. Finally the true systemic has both upward and downward movement within the plant along with the surface barrier.

Biochemical mode of action, or simply mode of action, is the specific site that the chemical interferes with the metabolic processes of the pathogen. In other words, this is how the chemical kills the pathogen. Due

to the complexity of these processes, I will only briefly describe the mode of actions (Table 1). This type of information is beyond the scope of this article and is not really required knowledge. What is important is to understand that pathogens have the ability to mutate and to become tolerant to the mode of action of the fungicide. This should be considered when you are developing a fungicide program for your golf course, so you will want to consider using fungicides from different families.

With a closer look at the chemical classification, we will see how this is important in your disease management program. We can tailor our fungicide applications to a particular pathogen. Say for instance that you are battling summer patch; you wouldn't want to be applying a contact fungicide, but instead you would want to apply one of the systemics and water your application in since summer patch is caused by a root infecting pathogen. If you choose an acropetal systemic and water it in, the chemical will be absorbed by the roots and translocated upward in the plant, providing protection of the entire plant.

On the other hand, if you are dealing with a foliar disease you wouldn't want to water it in, unless you are applying preventively and have a couple days for the chemical to translocate upwards in the plant. A better choice may be to apply a contact or a localized systemic. This will provide immediate control. But if you desire longevity of control, an acropetal systemic should be applied.



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With the examples provided above, it is evident how important it is to select the correct fungicide. Not only does the application method play a big part, but so does your targeted pathogen. Pathogens are grouped into families just as the chemicals. Every chemical only controls certain pathogen families; this is one of the

reasons that you must read the crop protectant label before applying. In Table 1, I have listed some of the diseases that the chemicals control. This is a reference and is not intended to substitute for the fungicide label.

As you can see the fungicide classification, fungicide family, pathogen family, and mode of action of a fungi-

cide all play a major rule in establishing a disease management program. Careful selection of chemicals will provide excellent control of most pathogens that may be invading your turf. Also, with the use of one of the resistance management strategies, you will be assured years of efficacy from any one of the chemicals. 🌱

Classification	Family	Family Members	Mode of Action	Diseases Managed
Contact	Aromatic Hydrocarbons	chloroneb, ethazole, PCNB	– affects DNA synthesis – inhibits respiratory enzyme activity	– chloroneb: pythium blight, gray snow mold – ethazole: pythium blight – PCNB: brown patch, dollar spot, snow molds, leaf spots
Acropetal Systemic	Benzimidazoles	benomyl, thiophanate methyl	– inhibits DNA synthesis – inhibits nuclear division	– brown patch, dollar spot, anthracnose, necrotic ring spot, summer patch, pink snow mold, stripe smut, powdery mildew, pink patch/red thread
Contact	Carbamates	thiram, mancozeb, propamocarb	– interference with respiratory activity	– thiram: brown patch, dollar spot, snow mold – mancozeb: brown patch, leaf spots, rust, dollar spot, pink patch/red thread, pink snow mold, pythium blight – propamocarb: pythium blight
Acropetal Systemic	Carboximides	flutolanil	– inhibit respiratory enzymes	– brown patch, pink patch/red thread, gray snow mold
Acropetal Systemic	Demethylation Inhibitors (DMI)	triadimefon, propiconazole, cyproconazole, fenarimol	– inhibit sterol synthesis	– dollar spot, powdery mildew, pink patch/red thread, brown patch, anthracnose, stripe smut, summer patch, gray snow mold, pink snow mold, take-all-patch, rust
Localized Systemic	Dicarboximides	iprodione, vinclozolin	– inhibit respiratory enzymes	– iprodione: dollar spot, brown patch, leaf spots, necrotic ring spot, gray snow mold, pink snow mold, pink patch/red thread – vinclozolin: dollar spot, leaf spots, pink patch/red thread, pink snow mold
Contact	Nitriles	chlorothalonil	– disrupts cell function regulation – inhibits sulfur-dependent enzymes	– dollar spot, leaf spots, brown patch, pink patch/red thread, anthracnose, gray snow mold, pink snow mold
Acropetal Systemic	Phenylamides	metalaxyl	– inhibits RNA synthesis	– pythium blight, yellow tuft (downy mildew)
Systemic	Phosphates	fosetyl AI	– involves direct and indirect mechanisms	– pythium blight, yellow tuft (downy mildew)
Acropetal Systemic	Strobilurins	azoxystrobin	– interference with respiratory activity	– anthracnose, brown patch, gray snow mold, pink snow mold, leaf spots, necrotic ring spot, pythium blight, pink patch/red thread, summer patch, take-all-patch
Contact	Triazines	anilazine	– reacts with amino groups	– brown patch, leaf spots, dollar spot, pink patch/red thread