Fungicides: What You Should Know

Part III: Developing Disease Resistance Management Regimes

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Over the last couple of issues of The Grass Roots, I have provided a wealth of information relating to fungicides. I hope that it has been informative and helpful in selecting products for your disease control program. This is the third and final installment for Fungicides: What You Should Know; it will be covering fungicide resistance and resistance management regimes. I hope that you enjoyed this series and I am always open to suggestions for articles in the future.

Resistance Management

Resistance management is a vital part of any disease control program. One common misunderstanding about resistance is how it occurs. Resistant strains of a fungus are not a mutation caused by the fungicides that you apply, but rather a mutation that has occurred sometime in the past and the fungicides only enhance the resistant strains. With repeated applications of fungicides from the same chemical family, it will lead to resistant strains of the fungus eventually outnumbering the wild type strain. An example of how resistance occurs on a golf course is provided in figure 1.

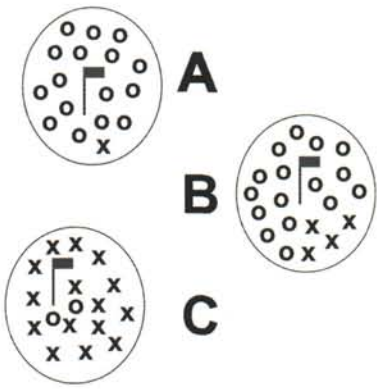

Figure 1. Development of resistance. (A) First application of a chemical in a certain family. (B) Following several applications of chemicals from the same family results in an increase population of the resistant strain (X). (C) After continual use of chemicals from the same family the wild type strain (O) is overcome by the resistant strain. This is full blown resistance.

Resistance Prevention

Currently there are two commonly accepted theories for resistance prevention. While there is a new one suggested in 1998, I will only touch on it briefly at the end of this section, as I feel that it is not very practical. The first of these is rotation of chemical families. With rotation, you alternate chemical families from application to application. You never want to apply the same chemical family more than twice in a row. Examples of possible rotations are provided below.

- XOXOXO
- XXOOXX
- XOOXXO

X = Chemical Family A
O = Chemical Family B

These are only an example using two chemical families. With knowledge of chemical families the possibilities of rotation patterns is endless.

Another method of resistance prevention is the use of reduced-rate mixtures. With reduced-rate mixture you have three components, each from a different chemical family, at a reduced rate. With reduced rates of individual components ranging from 1/16th to 2/3rd the labeled rate; in combination these mixes provide excellent control of diseases such as dollar spot. The theory behind this is that you want 1/3rd, 1/3rd and 1/3rd control from each of your components. This is not synergy (when chemicals are combined the additive effect is greater than each component when applied individually, i.e. 1+1=3) but an additive effect. You do not want one chemical to overpower, or provide the majority of the control, than the other two components or resistance may develop. If there are resistant strains present, one of the other chemicals will inhibit its growth.

The last one is "use it until you loose it," suggested by Dr. Joe Vargas. This method suggests using the same chemistry constantly until you develop resistance, switch to another chemistry. Even though this does have some merit, I cannot suggest it because of the nature of development of new chemistries. On average it takes at least 10 years for a new chemical to get to market, and could take longer with the new regulations in EPA. It also costs millions of dollars to get them to market. Even if the other methods do not delay resistance (the rotation method has been proven to delay, but not eliminate resistance, while three-way mixtures are proven to delay and the verdict is still out whether or not they eliminate resistance) this method is totally unfeasible with current state of the fungicide development.

For more information on reduce-rate mixtures, please refer to the *2000 Wisconsin Turfgrass Research Report.*

Literature Cited:

Vargas, J. M. Management of Turfgrass Disease. 1994. Lewis Publishers.

Vargas, Joe. 1998 Chipco Turfgrass Disease Seminar. 1998. Rhone-Poulenc AG Co.