Understanding fungicides

FUNGICIDES USED for turfgrass disease control can be categorized as contacts and systemics. Many older fungicides are contact fungicides that are typically applied to foliage to prevent pathogenic fungi from infecting leaves. However, these fungicides are also effective in killing pathogens on thatch and leaf clippings in the turfgrass canopy. Contact fungicides act by killing both dormant spores and dormant and active mycelium of pathogenic fungi. However, they must be reapplied frequently, so that newly formed foliar tissue remains protected. In order for contact fungicides to be effective foliar protectants, they must be allowed to dry on the plant surface after application. Therefore, in order to achieve the most effective control of foliar diseases, they should never be watered-in or applied in the rain. If, on the other hand, they are to be used to control pathogen activity in thatch, they can be watered-in. Since contact fungicides are largely water-insoluble, their movement through thatch is limited and they may not be effective root protectants.

Common fungicides used for turfgrass disease control

	Active ingredient	Trade name(s)	
CONTACT FUNGICIDES			
	Anilazine	Dyrene®	
	Chlorothalonil	Daconil 2787®	
	Etridiazole	Koban®, Terrazole®	
	Mancozeb	Fore®	
	Quintozene	Turfcide®, Terraclor®	
	Thiram	Spotrete®, Thiramad®	
SYSTEMIC FUNGICIDES			
	CLASS—		Movement in plant
BROAD SPECTRUM	1. Benzimidazoles		
	Benomyl	Tersan 1991®	Upward
	Thiophanate Methyl	Fungo 50®	Upward
	Thiophanate Ethyl	Cleary 3336®	Upward
	2. Dicaboxides		
	Iprodion	Chipco 26019®	Upward
	Vinclozolin	Vorlan®	Upward
	3. Sterol Inhibitors		
	Fenarimol	Rubigan®	Upward (limited downward)
	Propiconazole	Banner®	Upward (limited downward)
	Triadimefon	Bayleton®	Upward
PYTHIUM-SPECIFIC	1. Carbamates		
	Propamocarb	Banol®	Upward
	2. Acylalanines		
	Metalaxyl	Subdue®	Upward
	3. Ethyl Phosphonates		
	Forsetyl Al	Aliette®	Upward and downward

Many of the modern fungicides used for turfgrass disease control are systemic fungicides. This means that they move in the plant vascular system from the original site of application to other distant plant parts. For example, a systemic fungicide applied to turf foliage may move through the plant to protect roots as well as leaves against infection by a pathogen. Most of the currently used systemics are translocated upward in the plant. A few have downward movement as well.

The way systemic fungicides move in the plant influences the manner in which they should be applied in order to get effective control of specific types of diseases. These properties should be taken into consideration in developing any sound disease control strategy that includes systemic fungicides. In general, foliar disease control with systemic fungicides is more prolonged when they are drenched into the root zone. For example, foliar applications of upward-moving systemic fungicides provide excellent short-term control of foliar diseases whereas drenching the fungicide into the root zone provides a much longer period of protection—as well as control against some root and crown diseases. Root disease control with upward-moving systemic fungicides is only possible if they are drenched into the root zone; whereas, downward-moving systemic fungicides can provide control of root diseases when applied as a foliar spray.

Systemic fungicides have the advantage over contact fungicides in that they

1) HAVE LONGER RESIDUAL ACTION,
2) CAN PROTECT ROOT AND CROWN TISSUES,
3) CAN ERADICATE PATHOGENS that have already infected plant tissues, and
4) CAN PROTECT newly-formed plant tissues.

However, there are some disadvantages to using systemics. Most of them do not actually kill pathogenic fungi, but simply suppress pathogen activity. This is usually accomplished through a very specific mode of action. Repeated application of fungicides with the same mode of action provides selection pressure that greatly enhances the opportunity for pathogens to develop resistance. Once resistance to a particular fungicide develops, that fungicide is no longer effective. Therefore, the same fungicide should never be used repeatedly over prolonged periods of time.

The development of fungicide resistance can be minimized by

1) ALTERNATING FUNGICIDES with different modes of action;
2) USING FUNGICIDES WITH DIFFERENT MODES of action in mixtures; or
3) ALTERNATING OR MIXING systemic fungicides with contact fungicides.

In the above table, systemic fungicides in the same class have the same mode of action. Those in different classes (numbered 1, 2, 3) have different modes of action. Therefore, broad-spectrum systemic fungicides should always be mixed or alternated with fungicides in other classes and never with those in the same class. Likewise, Pythium-specific fungicides should always be mixed or alternated between classes. ■