Photo 1: Boxwood Dieback, caused by a fungus (Phomopsis), is encouraged by abundant irrigation. Application of fungicides may help manage the disease but drastically reducing the irrigation may be more effective.

The Plant Doctor's LANDSCAPE TIPS

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PLANT DISEASE MANAGEMENT WITH FUNGICIDES

INTRODUCTION:

Diseases can be managed by a variety of methods that are traditionally summarized under Integrated Pest Management (IPM) or perhaps more appropriately in this case, Integrated Disease Management (IDM). IDM involves the use of all tools to counter the activity of disease agents that may instigate disease development. For example, most diseases require moisture to reproduce, spread and infect plants; moisture in the form of excessive irrigation can exacerbate many diseases in the landscape. A vicious cycle is often perpetuated in the landscape and nursery when too much moisture results in disease development (Photo 1), necessitating the need for ever increasing applications of other management tools, especially chemicals. Most plant diseases are caused by fungi and hence, most chemical management involves fungicides, the focus of this article.

	Primitive Fungi	Advanced Fungi
Pathogen/ Disease Examples	Phytophthora (collar rot, etc.) Pythium (root rot) Downy Mildews	Diplodia, Needlecasts Powdery Mildews Scab, Tar Spot Many Others
Fungicide Management Example	Mefenoxam (Subdue Maxx)	Thiophanate Methyl (T-Methyl, Cleary 3336)

Table 1: Most fungal diseases can generally be divided into two major camps: Primitive and Advanced. Usually (not always), fungicides that control Primitive Fungi do not control advanced fungi, and vice versa.

Chemical Names	Trade Name	Systemic or Contact?
MBC, Thiophanate-Methyl	TM, T-Methyl, Cleary 3336	Systemic
Propiconazole	Propiconazole, Banner Maxx Alamo	Systemic
Fenarimol	Rubigan	Systemic
Myclobutanil	Myclobutanil, Eagle	Systemic

Table 2: Some examples of Systemic Fungicides. Note: This is not an exhaustive list of systemic fungicides but a summary of some common examples for ornamentals in the landscape.

FUNGAL DISEASES AND FUNGICIDES:

A plethora of disease agents may attack the wide variety of plants utilized in our landscapes. It is very important to understand the target diseases on particular plants, whether preventative or curative strategies are implemented.

The Two Major Classes of Fungal Diseases: In a very general sense, fungi and their fungal diseases can be categorized into two major groups, Primitive and Advanced (Table 1). The primitive fungi, assumed to be more closely related to filamentous algae, include such pathogens/diseases as Phytophthora (Bleeding Cankers, Collar Rots), Pythium (Root Rots) and the Downy Mildews. The advanced group of fungi largely covers everything else: Scab (Venturia), Tar Spot (Rhytisma), Tip Blight of Pine (Diplodia), Powdery Mildews, Root Rots (Armillaria, Xylaria), etc. Also in a very general sense (though not entirely), the fungicides that control the primitive group do not control the advanced group and vice versa. In Table 1, for example, Mefenoxam will have no effect on Diplodia Tip Blight of Pines, and Thiophanate Methyl will have no effect on Phytophthora Bleeding Canker of Maple. Hence, it is important to know the target organism and disease to be managed.

Broad Spectrum Disease Control – "The Elixir Mixture": For practical reasons, plant health care providers desire the best chemical treatment for the largest group of diseases they need to manage while not having to waste fuel and other resources making multiple trips to sites for disease and pest manage-

ment. In fact, there are numerous environmental and economic justifications to achieve the most (so-called) bang for the buck. One of the ways to achieve this is to use mixtures of chemicals (Tables 2 & 3). In my opinion, a systemic fungicide combined with a contact fungicide, perhaps called a magical "Elixir Mixture," represents a practical approach to achieve broader control than typically achieved with one chemical. Also, various fungi are more sensitive to specific fungicides than to other fungicides. The beauty of the "elixir mixture" of a contact and systemic fungicide is that, theoretically, multiple diseases can be managed quite efficiently. For example, because the timing of disease control often overlaps for many different diseases, the application of an "elixir mixture" can be utilized to obtain the broadest benefits possible. Hence, a single tank mix can be beneficial for Needlecast Diseases on Spruce, Pines and Fir, Diplodia Tip Blight on Pine, Scab on Apple and Crabapple, Tar Spot on Maple (if desired) and so forth. Add an insecticide or two, and the magical "elixir mixture" becomes even broader spectrum for pest control.

Chemical Names	Trade Name	Systemic or Contact?
Chlorothalonil	Chlorothalonil Daconil	Contact
Mancozeb	Pentathlon, Fore, Protect	Contact
Mancozeb + CuOH	Junction	Contact
Hydrated Lime + CuSO4	Bordeaux Mix	Contact

Table 3: Some examples of contact fungicides. Note: This is not an exhaustive list of contact fungicides but a summary of some common examples available for use in the landscape.

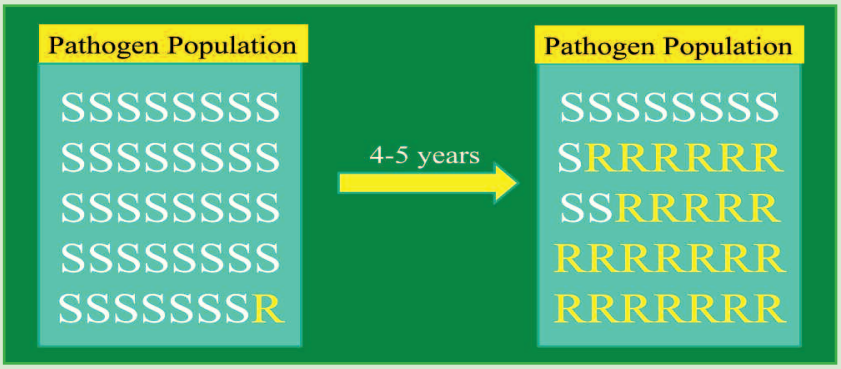

Figure 1: Science has demonstrated that "resistant" pathogens (R) and pests already occur naturally in nature. Continuous use of a systemic chemical will select for susceptible (S) types, allowing resistant types to proliferate, the reason why chemical control tends to be less effective with time. After a long rotation of 4-5 years, switching to an alternative chemistry will enable a plant health care provider to "start over" with mostly "S" types.

DISEASE MANAGEMENT:

When applying chemicals for managing plant problems it is vitally important that labels be followed. It is also important to consider options other than chemicals; these alternative options may be more effective and efficient for pest/disease management. As noted, the "Elixir Mixtures" may provide very broad spectrum disease/pest management capabilities. For assurance that chemical reactions and precipitation and other bad things don't happen in that spray tank, compatibility charts are available to determine which chemicals can be safely mixed.

Avoid Disease Resistance with "Long Rotations": Compared to other commodities, the landscape and nursery industries have relatively few chemicals available for disease control. The limited availability of chemicals is primarily due to limited market revenues and the expense of labeling chemicals. Hence, one of the greatest concerns with the use of limited-available chemicals is whether the pest or disease agent develops "resistance", a term used to describe when the pest or pathogen is no longer sensitive to the chemical being applied. We know several factors about resistance, either from experience or from research tests. First, we commonly encounter resistance to systemic chemicals and rarely to contact chemicals (due to narrow and broad modes of actions on pathogen genes). In turf studies, combining two systemic chemicals has resulted in resistance to both chemicals. Likewise, alternating systemic chemicals (application to application) within the same season will probably result in resistance development to both systemic chemicals. We also know from experimentation that resistant pathogens and pests are probably already present in our landscapes and nurseries (Figure 1). Hence, it seems logical that in order to avoid resistance development, the best approach is to apply systemic chemicals in long rotations, say 4-5 years, before subsequently switching to another systemic chemical. Please bear in mind that there are sometimes many trade names for the same chemical and similar chemistry; switching trade names will not result in resistance avoidance. Understanding these issues should provide reasonably effective disease control for decades to come.

For more information, please feel free to email David Roberts at robertsd@msu.edu or contact a professional plant health care provider. The author, MSU and MGIA do not endorse any particular products. If using pesticides, be sure to read and follow label directions.

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