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## Turf Management

### Fungicides: The Good, The Band and The Ugly Peter H. Dernoeden, Extension Turfgrass Specialist

Arriving at the decision of whether to apply a fungicide to any turf area is difficult and generally based on economic considerations. For over 50 years, and prior to the popularization of the IPM concept, turfgrass managers have been fighting diseases through cultural practices. With the advent of modern fungicides, extremely reliable control has been achieved for many turf diseases. Effective chemical control, however, hinges upon a rapid and accurate disease diagnosis. As a group, golf course superintendents are the most experienced turf managers in the area of disease recognition and control. Homeowners, however, often are unable to diagnose turf diseases, or they recognize a disease problem only after substantial injury has occurred. As a general rule, use of fungicides is discouraged in most homelawn situations because (a) proper diagnosis and proper fungicide selection is difficult, (b) it is generally too late to achieve the economic and aesthetic benefits of a fungicide once extensive injury has occurred, (c) homeowners capable of only dry or granular applications do not have the proper spray equipment or they cannot obtain small amounts of the desired fungicide(s) for the disease situation, and (d) it may be less expensive, and better in the long-run to overseed a damaged turf area with disease resistant cultivars.

Where extremely high quality turf is required (e.g. golf course putting greens and other professional sports turfs) fungicides will be needed in most years, particularly in the transition zone. The indiscriminate use of fungicides or employment or numerous, preventative applications of fungicides for many diseases should be discouraged. Other than economic restraints, reasons why repeated fungicide applications may not be desirable include:

1. Fungicide may reduce the population of beneficial microorganisms in the soil.
2. Fungicides may disturb a delicate balance among microorganisms that compete with and antagonize disease causing fungi. This may explain why some diseases recur more rapidly and cause more injury in turfs previously treated with fungicides.
3. Continuous usage of a single fungicide may lead to the development of fungal strains that are fungicide resistant.
4. A fungicide may control one disease, but encourage other diseases.
5. Possible phytotoxic or undesirable hormonal effects.

When used repeatedly, certain fungicides have been shown to enhance thatch accumulation. Benzimidazole fungicides (e.g. Tersan 1991, Bromasan and Duosan) and sulfur containing fungicides such as mancozeb (Dithane M-45), maneb (Tersan LSR), and thiram (Tersan 75 and Spotrete), cause thatch to accumulate by acidifying soil. The effect of these fungicides is indirect, that is they inhibit the thatch decomposition capacity of beneficial microorganisms by lowering pH. Cadmium fungicides and iprodione (Chipco 26019) also enhance thatch accumulation. In the case of these latter two compounds, thatch build-up is attributed to direct toxicity of microorganisms that degrade thatch. Fungicides may also contribute to thatch build-up by being toxic to earthworms. Earthworms help reduce thatch by mixing soil with organic matter. Benomyl, mancozeb, anilazine (Dyrene) and chlorothalonil (Daconil) have been

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shown to be toxic to earthworms.

Turf managers have observed that some disease may recur in turfs previously treated with fungicides, but not in adjacent untreated areas. Dollar spot is probably the most common disease to exhibit this phenomenon. Data, recently recorded in a test conducted by the University of Maryland, have shown that red thread was more severe in the spring of 1983 in Manhattan perennial ryegrass plots last treated with benomyl in July, 1982. These phenomena are attributed to non-target effects of fungicides, i.e., the fungicide(s) were toxic to microorganisms which antagonize and help keep disease causing fungi in abeyance.

The development of fungal strains resistant to fungicides has been well documented. Resistant strains of the dollar spot fungus first developed as a result of repeated usage of cadmium based fungicides and benomyl. Thiophanates (e.g. CL3336, Fungo and Duosan), anilazine and iprodione resistant strains of the dollar spot fungus have also been reported. Benomyl resistant strains of fungi causing Fusarium blight and powdery mildew, and iprodione resistant strains of the pink snow mold organism have also been reported. The development of resistant strains of fungi likely occurs in response to a selection process that eventually enables a small, but naturally occurring population of resistant biotypes to predominate in the fungicide-treated turf-grass microenvironment.

Fungicides applied to control one disease, may encourage other diseases. Tests conducted in Maryland have shown that benomyl and maneb can encourage red thread. Benomyl has also been shown to enhance Helminthosporium leaf spot, Pythium blight and superficial fairy rings. Thiophanate-methyl may increase crown rust in perennial ryegrass, iprodione can increase yellow turf, and maneb may enhance dollar spot. In 1983, in University of Maryland tests, two common-type Kentucky bluegrass cultivars treated on monthly intervals with chlorothalonil were injured more severely by Fusarium blight and heat and drought stress than untreated turf. Encouragement of disease in these situations may again be attributed to offsetting the delicate balance between antagonistic and pathogenic microorganisms in the ecosystem. It is also conceivable that some fungicides may physiologically alter the capacity of a plant to resist a particular pathogen or withstand environmental stress.

The phytotoxicity that accompanies usage of some fungicides is generally not severe. Most phytotoxicity problems occur when fungicides are applied to bentgrasses, particularly during periods of high temperature stress. Fungicides that can cause yellowing of bentgrass include benomyl, cycloheximide (Acti-dione), PCNB (Terraclor and Acti-dione RZ) and the mercurials (e.g. Calo Clor and PMAS). Benomyl has been reported to inhibit growth and stolon production in bentgrass, and may cause a tip dieback in Merion Kentucky bluegrass. Etaconazole (Banner and Vanguard), fenarimol (Rubigan), triadimefon (Bayleton) and PMAS treated bentgrass may develop an objectionable blue-green color if used repeatedly or when applied at high rates. PCNB also may elicit a purplish color when applied to Turcote bermudagrass in the autumn.

these potential problems. The importance of rapid and accurate disease diagnosis, and the judicious use of fungicides are integral in management problems where fungicides are commonly employed.

**Credit — The Agronomist  
University of Maryland, November, 1983**