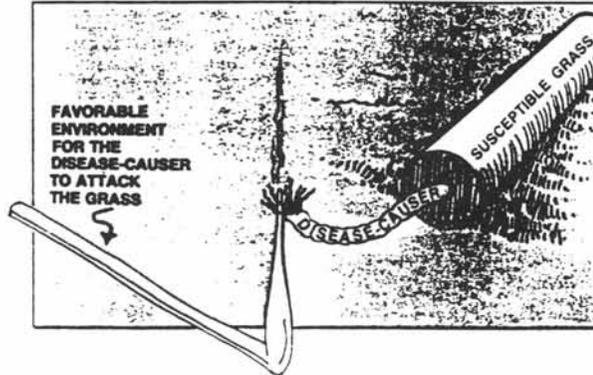


DIAGNOSIS AND MANAGEMENT OF TURFGRASS DISEASES  
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WHAT IS TURFGRASS DISEASE?



Disease or sickness in turfgrasses, as in other plants, develops from an interaction between a susceptible plant, a disease-producing organism (usually a fungus), and an environment favorable for the disease-causing organism to attack. The sick turfgrass plant then gives evidence that something is wrong -- and the evidence of disease that we can see -- we call symptoms. This is the same situation that occurs in human disease. For example, the disease-causing bacterium, *Streptococcus*, produces the symptoms (fever, sore throat, and rash) that physicians diagnose as the disease, scarlet fever. The diagram above depicts the three factors that interact to cause the "explosion" that we call turfgrass disease. Scientists who work with turfgrass diseases (turfgrass pathologists) sometimes use a disease triangle to illustrate the concept of disease. The three sides of the disease triangle represent the three factors that interact to produce turfgrass disease: the disease-causer, the susceptible grass, and a favorable environment.



**DISEASE TRIANGLE**

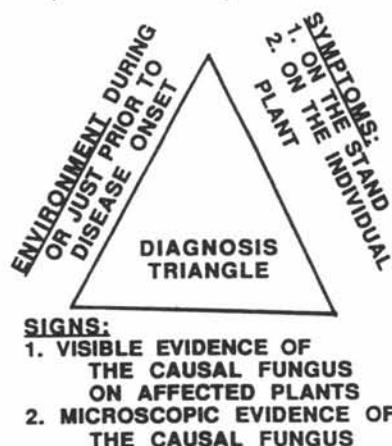
Since three factors combine to cause turfgrass disease:

1. WE MUST OBSERVE ALL THREE FACTORS TO GATHER INFORMATION FOR DIAGNOSIS OF THE PROBLEM.

2. WE CAN **COMBAT THE DISEASE** BY CHANGING ANY OR ALL OF THESE THREE FACTORS.

### **THE IMPORTANCE OF CORRECT DIAGNOSIS**

The first step in turfgrass disease management is the identification of the true nature of the problem. Diseases are only one cause of turf loss, and disease control measures will do nothing to alleviate damage from other causes such as insect attack or drought stress. It is therefore essential to determine whether the problem is disease, and, if so which disease? Disease management strategies that are effective against one disease may have no effect on or may even worsen another disease. This is particularly true when, because of incorrect diagnosis, the wrong fungicide is selected. The best result that can be hoped for in this situation is nothing lost except time, effort, and money. A worse possibility is the the disease problem may be increased by application of an inappropriate chemical.



The three disease factors (grass, disease-causer, and environment) provide the sources of information for diagnosis. The environment during the onset of the disease problem is one source of diagnostic information. What were the temperature, the light intensity, and the moisture conditions just prior to and during disease development? The nature of the disease site is also important. Air and water drainage, soil conditions, sun/shade, slope, and nearness of other plantings or buildings all may be important in development of turfgrass diseases. Prior chemical applications, including pesticides and fertilizers, to the site may be contributive. Heavy thatch accumulation and poor mowing practices that stress the turf may trigger or amplify certain disease problems in turf areas.

The nature of the symptoms on the grass is a very important source of diagnostic information. Two kinds of symptoms should be looked for in diseased turfgrass areas -- symptoms on the stand and symptoms on individual plants. Stand symptoms are the visible patterns of the disease on the planting. They are extremely important in disease diagnosis on turf areas because different diseases affect turfgrass stands differently, and the visible differences

are often critical factors in identifying particular diseases. Diseases can appear on the stand as spots, patches, rings, circles, or may be unpatterned. Certain diseases never appear as rings, while others always appear as rings. Symptoms to look for on individual plants include leaf spots, leaf blighting, wilt, yellowing, stunting, and root discoloration or rot. Leaf spots can be very good diagnostic clues since the leaf spots of different diseases are usually unique in shape, color, and size. Leaf blighting is different from these unique leaf spots because leaf blighting is rot of the leaf that has no definite form. Leaf blighting can be any size or shape, and may involve the entire leaf.

Certain life stages of turfgrass disease-causers can be seen without magnification. The fungi that cause most turfgrass diseases are microscopic, but in stripe smut, powdery mildew, and rust diseases, the spores of the causal fungi pile up in such numbers that they become visible as black, white, or orange powder on grass leaves. In red thread disease, the fungus sticks together and forms the pick or red antlerlike threads that typify the disease. When the causal fungus can be seen, its appearance is often the most important clue for diagnosis.

### DISEASE MANAGEMENT ON TURFGRASSES

Because the three components of disease development all play a part in the onset of turfgrass disease, disease management on turfgrasses involves manipulation of these three -- the environment, the grass, and/or the disease-causing organism -- to favor the grass and inhibit the causal fungus.



### **MANAGEMENT TRIANGLE**

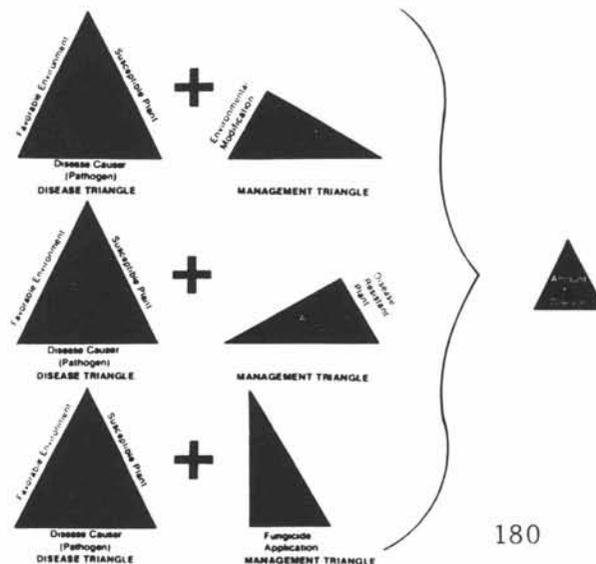
The environment can be altered in many ways, depending on the disease to be managed. For example, some diseases require free water for development. Effective strategies to reduce free water include morning irrigation, removal of dew, reduction in amount and/or frequency of irrigation. Water manipulation can be a valuable tool in disease management. Improved air and water drainage, improved soil conditions by aeration, thatch reduction, manipulation of light conditions, regulation of fertilization levels, and proper mowing practices may be appropriate methods for reducing damage from particular diseases and ensuring vigorous turf for recovery from disease damage.

When establishing new turf areas or when renovating disease-damaged turf, it is important to select grasses that are resistant to diseases known to be common in the use area or that have damaged the existing stand. The seeding of disease-resistant grasses is an excellent way to minimize turf loss from disease. For example, certain varieties of Kentucky bluegrass are resistant to spring leaf spot, a disease that is devastating on many Kentucky bluegrass turfs. Varietal resistance to other common diseases of bluegrass is available. For diseases to which varietal resistance is weak or not available, it may be possible to seed a grass species that is resistant to a prevalent disease problem. For example, ryegrass may replace bluegrass in an area damaged by necrotic ring spot, or bluegrass might replace ryegrass in an area where Pythium blight is a problem. Disease severity can often be reduced by appropriate changes in the grass that is being grown. It is bad practice to continue to replant the same grass that has been killed by the same disease year after year -- if there is another option.

In selecting grasses for turf establishment or renovation, it is always preferable, where possible, to use mixture of different grasses or blends of different varieties, rather than seeding a single kind of grass. Seeding mixtures or blends produces a diverse population of grass plants. Such turf is usually more successful in surviving stress and attack by disease. It doesn't take much imagination to envision what would happen in a uniform planting if a disease occurred that was able to cause severe disease on the planted species. Diversity in a planting almost always increases odds of survival.

The third method of disease management is reduction of the causal organism by applying chemicals that will either kill the organism or keep it from growing. Most fungicides do not actually kill fungi; they work by preventing growth. Again, it is important to have identified the causal organism correctly, so that an appropriate fungicide can be selected. Arbitrary selection and application of fungicides without knowledge of the disease cause can do as much harm as good. Using the wrong fungicide wastes money and may involve the risk of exacerbating the disease, as well as causing other unwanted side effects.

With rising prices, declining budgets, and increasing environmental awareness, those who manage turfgrasses are faced with the necessity of making reasonable and defensible choices. Planning an effective disease management program, therefore, involves not only 'spraying something, but selecting cost-effective and environmentally sound disease control strategies. The financial, environmental, and aesthetic costs of disease management strategies must be taken into consideration, and it is only sensible to consider all avenues of disease management when dealing with particular disease problems.





**DISEASE TRIANGLE**

**DIAGNOSIS TRIANGLE**

**MANAGEMENT TRIANGLE**

65-75° F  
HIGH HUMIDITY  
SLOW GROWTH  
LOW NUTRIENT STATUS  
DROUGHT

RYEGRASES, FESCUES, BLUEGRASSES

**RED THREAD & PINK PATCH**

LAETISARIA FUCIFORMIS  
LIMINOMYCES ROSIEPELLIS

65-75° F  
HIGH HUMIDITY  
FREE WATER ON LEAVES  
SLOW GROWTH  
LOW NUTRIENT STATUS  
DROUGHT

IRREGULARLY SHAPED PATCHES OF VARIOUS SIZES WHEN IN GRASS IS WET AND DRY APPEARS BLEACHED WHITE WHEN DRY

INDIVIDUAL PLANT LEAVES APPEAR BLEACHED WHEN WET AND DRY

STAND

**RED THREAD & PINK PATCH**  
(LAETISARIA FUCIFORMIS  
LIMINOMYCES ROSIEPELLIS)

SIGNS: IN RED THREAD, RED FUNGAL STRANDS ARE VISIBLE ON AND BETWEEN INFECTED LEAVES

IN PINK PATCH, PINK COTTONY MYCELIUM IS VISIBLE ON INFECTED AREAS. WHEN DRY, THIS MYCELIUM MAT HAS A PAPER MACHE-LIKE APPEARANCE.

MAINTAIN ADEQUATE FERTILITY (ESPECIALLY N)  
IRRIGATE TO AVOID DROUGHT  
AVOID NIGHT WATERING

KRG LESS SUSCEPTIBLE THAN PRG  
FESCUES PRO-DURER, Blue, Clifton, Score  
RESISTANT FESCUES: Wintergreen, Goldrod, Bluej, Centaurea, Titania

**RED THREAD & PINK PATCH**

COLLECT AND DESTROY CLIPPINGS DURING ACTIVE DISEASE

APPLY FUNGICIDES IF OTHER CONTROL STRATEGIES ARE INSUFFICIENT

azoxystrobin	chlorothalonil	trifluromethylpyridoxazole
benomyl	iprodione	vinclozolin

70-85° F  
FAVORED BY:  
LOW SOIL MOISTURE  
HIGH MOISTURE ON LEAVES

ALL COOL-SEASON TURF GRASSES, BUT BENTGRASSES VERY SUSCEPTIBLE

**DOLLAR SPOT**

SCLEROTINIA HOMOEOCARPA

70-85° F  
HIGH MOISTURE ON LEAVES  
LOW N

ON CLOVE-CUT GRASS SMALL, SPINDLE-DOLLAR-SIZE INFLECTION CENTER DRY GRASS, BLEACHED WHITE AREAS APPEAR IN CIRCULAR AND AREAS APPEAR IN SHAPE

ON HIGH-CUT GRASS, BLEACHED WHITE SPOTS WITH LIGHT BROWN THE MORE IRREGULAR IN SHAPE

INDIVIDUAL PLANT, TYPICAL LEAF MATING OF THE LEAF, GIVING A KNOCKED-LEAF SHAPE

**DOLLAR SPOT**  
(SCLEROTINIA HOMOEOCARPA)

SIGNS: COTTONY WHITE MYCELIUM ON INFECTED AREAS WHEN HUMIDITY IS HIGH AND FREE WATER IS PRESENT

MAINTAIN ADEQUATE SOIL MOISTURE  
AVOID NIGHT WATERING  
FROM LEAKS  
DUSTIGATION WATER

NO RESISTANT BENTGRASSES AVAILABLE  
USUALLY NOT A SIGNIFICANT PROBLEM ON OTHER COOL-SEASON GRASSES

**DOLLAR SPOT**

APPLY FUNGICIDES TO PROTECT SUSCEPTIBLE GRASSES

azoxystrobin	benomyl	chlorothalonil	iprodione	trifluromethylpyridoxazole	vinclozolin
carbendazim	cyproconazole	fenarimol	propiconazole	trifluromethylpyridoxazole	vinclozolin

\* RESISTANCE HAS BEEN A PROBLEM

70-85° F  
DROUGHT STRESS

KENTUCKY BLUEGRASSES, BUT FESCUES, BENTGRASSES & ANNUAL BLUEGRASS MAY ALSO SHOW SYMPTOMS

**NECROTIC RING SPOT**

LEPTOSPHAERIA KORRAE

80-90° F  
DROUGHT STRESS

STAND: PRESENT CIRCLES AND PROGRESSES AND DIE  
OF WETTED GRASS THAT COLLAPSE

NO DIAGNOSTICALLY IMPORTANT INDIVIDUAL PLANT SYMPTOMS

**NECROTIC RING SPOT**  
(LEPTOSPHAERIA KORRAE)

SIGNS: DARK BROWN TO BLACK RUNNER HYPHAE OF THE CAUSAL FUNGUS ON THE ROOTS AND CROWNS OF AFFECTED GRASS PLANTS

PROMOTE ROOT GROWTH BY:  
FALL FERTILIZATION  
WATER DEEPLY & INFREQUENTLY (PH1)

OVERBRED KRG WITH PRG  
RESISTANT KRG: Atlantic, Midwest, Penn

**NECROTIC RING SPOT**

PREVENTIVE MONTHLY FUNGICIDE APPLICATIONS, BEGINNING IN EARLY MAY

WATER IN

fenarimol	propiconazole
benomyl	iprodione

80-90° F  
LUSH GROWTH  
ALTERNATE WET DRY  
LOW MOWING HEIGHT

ALL COOL-SEASON TURF GRASSES

**SUMMER LEAF SPOT**

HELMINTHOSPORIUM SOROKINIANUM  
(DRECHSLERA SOROKINIANUM)

80-90° F  
HIGH MOISTURE  
FREE WATER  
LUSH GROWTH

STAND: NON-ATTENDED RED-BROWN MELTING—OUT OF GRASS

INDIVIDUAL PLANT: TYPICAL LEAF SPOTS WITH RED-BROWN MARGINS

**SUMMER LEAF SPOT**  
(HELMINTHOSPORIUM SOROKINIANUM  
DRECHSLERA SOROKINIANUM)

NO SIGNS PRESENT

WHILE DISEASE IS ACTIVE  
AVOID N APPLICATIONS  
RAISE MOWING HEIGHT  
AVOID NIGHT WATERING

RESISTANT KRG: 20-30 August, Blue, Bluej, Centaurea, Clifton, Goldrod, Penn, Score, Titania, Wintergreen

PRG: Atlantic, Midwest, Penn, Score, Titania, Wintergreen, Clifton, Centaurea, Bluej

**SUMMER LEAF SPOT**

APPLY FUNGICIDES ON SUSCEPTIBLE GRASSES WHEN LEAF SPOTS APPEAR IN SUMMER

azoxystrobin	chlorothalonil	trifluromethylpyridoxazole
benomyl	iprodione	vinclozolin

**DISEASE TRIANGLE**

**DIAGNOSIS TRIANGLE**

**MANAGEMENT TRIANGLE**



**FAIRY RING**

**BASIDIOMYCETE SPP.**  
( MUSHROOM FUNGI)



**SIGNS:** FUNGAL STRANDS OR MYCELIUM IN THE SOIL AND/OR THATCH AT THE OUTER EDGE OF THE RING



LIMITED & ERRATIC SUCCESS WITH:  
SOIL FUMIGATION  
FUNGICIDE DRENCHES



**BROWN PATCH (RHIZOCTONIA BLIGHT)**

**RHIZOCTONIA SOLANI**

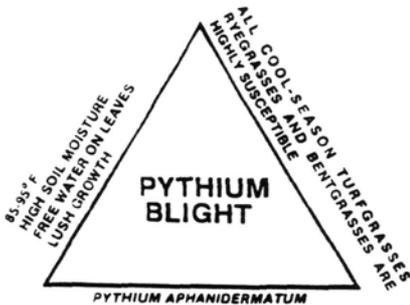


**SIGNS:** COTTONY MYCELIUM ON AFFECTED AREAS WHEN HUMIDITY IS HIGH AND FREE WATER IS PRESENT



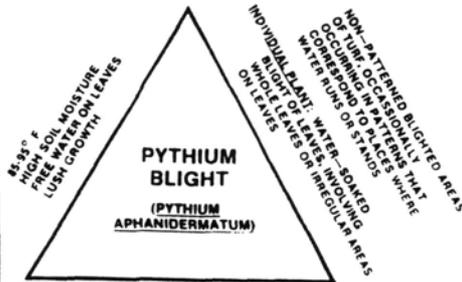
APPLY FUNGICIDES TO PROTECT SUSCEPTIBLE GRASSES

azoxystrobin	propiconazole	trifloxystrobin
benlate	triazolam	triazophos
chlorantraniliprole	propiconazole	triazophos
fenoxystrobin		

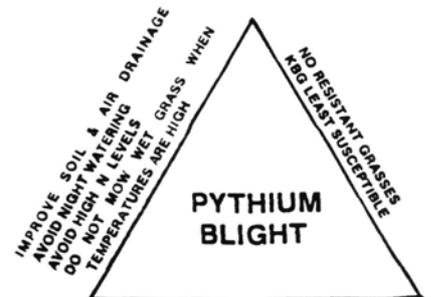


**PYTHIUM BLIGHT**

**PYTHIUM APHANIDERMATUM**



**SIGNS:** WHITE, COTTONY MYCELIUM ON AREAS OF ACTIVE DISEASE WHEN HUMIDITY IS HIGH AND FREE WATER IS PRESENT



APPLY FUNGICIDE AT FIRST SIGN OF DISEASE

chlorantraniliprole	metaxyl
stradiazole	phosphoryl aluminum
	propamocarb

\*RESISTANCE HAS BEEN A PROBLEM



**SUMMER PATCH**

**MAGNAPORTHE POAE**



**SIGNS:** DARK BROWN TO BLACK RUNNER HYPHAE OF THE CAUSAL FUNGUS ON THE ROOTS AND CROWNS OF AFFECTED GRASS PLANTS



PREVENTTIVE, MONTHLY FUNGICIDE APPLICATIONS, BEGINNING IN EARLY MAY

WATER IN

propiconazole
fenoxystrobin