

in cool-season turfgrass

The goal of every turfgrass manager should be to create a healthy turfgrass ecosystem. This can be a challenge since growing seasons in the northern latitudes are never the same.

By JOHN E. WATKINS/
Ph.D. University of Nebraska

Anyone that has ever taken a soil microbiology course comes away with a new appreciation of the abundance of microbes in the plant/soil rhizosphere.

The rhizosphere is that microenvironment in soil influenced by plant roots. One pound of soil and roots may contain over 900 billion organisms—bacteria, fungi, actinomycetes, nematodes, insects, etc. With that many organisms within the root zone of your turfgrass plants, you often wonder how anything survives. Fortunately for the turfgrass manager, only a few of the microbes in the rhizosphere cause disease; many benefit plant growth by keeping disease-causing microbes under control. There's a delicate coexistence between the good and the bad microbes in the turfgrass rhizosphere. When this balance is altered, disease can result.

Turfgrass diseases result from the complex interaction of pathogen, host and environment. Turfgrass management practices can affect all three, greatly influencing disease development. Those practices that favor vigorous, but not lush, grass growth and are detrimental to growth of the pathogen result in less disease injury to the turf. Good turfgrass management is an effective disease deterrent.

The goal of every turfgrass manager should be to create a healthy turfgrass ecosystem. This is a challenge since growing seasons in the northern latitudes are never

the same. In 1996 the Northern Plains were relatively cool and wet. 1997, however, was just the opposite—hot, dry and windy. Because each season is different and because the relationship of host, pathogen and environment are so ecologically interwoven, disease predictions are difficult.

Let's examine some of the more common and damaging diseases of cool-season turfgrasses.

Leaf spot and melting out are two fun-



Dollar spot injury to ryegrass is most prevalent when days are warm, nights are cool.

gal diseases within the old group known as "Helminthosporium" leaf, crown and root diseases. The leaf spot pathogen, *Bipolaris sorokiniana*, attacks bluegrasses, bentgrasses, ryegrasses and fescues. Melting out, caused by *Drechslera poae* is a serious disease of Kentucky bluegrass and also occurs on ryegrasses and fescues. Both diseases are favored by dry periods alternating with

prolonged cloudy wet weather. The range of pathogen activity is from 65°F to 85°F. Early disease symptoms are small dark brown spots on the leaf blade or leaf sheath. As the disease progresses, the spots enlarge causing the infected leaves to yellow and the affected turf to appear chlorotic and thin.

Widespread use of improved turfgrass cultivars with good resistance to leaf spot and melting out has significantly lessened the impact of these diseases on turfgrass quality. The dependency on rescue fungicide treatments can be drastically reduced through good cultural practices. These include a fertilization program that does not stimulate lush growth in May, thatch management and using a preventive fungicide program on susceptible turfs.

Dollar spot, caused by *Sclerotinia homeocarpa*, occurs when days are warm and nights are cool. The presence of dew and high humidity in the turf canopy are ideal conditions for dollar spot. On turfs maintained at 1 to 3 inches, symptoms are a mottled, light tan pattern made up of 4- to 6-inch patches of blighted turf. Individual leaf blades will develop a lesion that may be up to an inch long, is light tan with reddish-brown margins and often spans the width of the blade. If the turf looks as though it's covered with small cobwebs in the mornings, that's probably *S. homeocarpa* mycelium.

Dollar spot often can be prevented without the use of fungicides or with minimal fungicide application. Maintaining vigorous growth during the season helps the turf outgrow the infection and recover quickly when it is infected. If needed, a fungicide can be applied at the first appearance of dollar spot.

Two of the most destructive patch diseases of cool season turfs are **necrotic ring**

spot, caused by *Leptosphaeria korrae* and **summer patch**, caused by *Magnaporthe poae*. Necrotic ring spot generally occurs on Kentucky bluegrass during spring and fall, and summer patch during July and August. Summer patch devastated lawns in the central plains in 1997 because of record high temperatures and low rainfall. Distinguishing between the two diseases is difficult as both produce doughnut-like patches in affected turf. The dead grass is light tan and matted, and many of the patches will have a tuft of healthy grass in the center.



Summer patch in Kentucky bluegrass

The key to effective management of these two persistent diseases is in promoting root health through timely fungicide treatment and minimizing stress dur-

ing the hot periods of the summer. These diseases are like a bad headache. They go

away periodically but always return during periods of stress. On established turf, the key to prevention is to avoid management practices that promote rapid top growth at the expense of root development. Reduce thatch, fertilize properly and water more frequently when the disease is active. Apply a systemic fungicide with high volumes of water to drench the chemical into the root zone. Make the first application in May with a second one in June.

Brown patch, caused by *Rhizoctonia solani*, occurs on Kentucky bluegrass, tall fescue and perennial ryegrass during midsummer's heat and humidity. The disease is identified by the presence of patches of dead and dying grass. The

PREVENTIVE AND CURATIVE FUNGICIDE PROGRAMS FOR MAJOR DISEASES OF COOL-SEASON TURFGRASSES

Disease	Preventive/ Curative	Initial application	Products
Leaf spot/melting out	P	May	chlorothalonil, iprodione, mancozeb, propiconazole, vinclozolin
Stripe smut	P	April or October	cyproconazole, fenarimol, flutolanil, propiconazole, thiophanate-methyl, triadimefon
Necrotic ring spot	P	When soil temperatures reach 60°F at 2" depth	azoxystrobin, cyproconazole, fenarimol, iprodione, thiophanate-methyl
Fairy ring	C	At first symptoms of green ring	flutolanil
Dollar spot	P/C	June for ryegrass and bentgrass	chlorothalonil, cyproconazole, iprodione, mancozeb, propiconazole, thiophanate-methyl, triadimefon, vinclozolin
Brown patch	P/C	June for ryegrass and bentgrass	azoxystrobin, chlorothalonil, cyproconazole, flutolanil, iprodione, propiconazole, thiophanate-methyl, triadimefon, vinclozolin
Summer patch	P	When soil temperatures reach 65°F at 2" depth	azoxystrobin, cyproconazole, fenarimol, propiconazole, thiophanate-methyl, triadimefon
Pythium blight	P	June	azoxystrobin, chloroneb, ethazol, fosetyl-Al, metalaxyl, propamocarb
Rust	P/C	July	chlorothalonil, cyproconazole, mancozeb, propiconazole, triadimefon
Typhula blight	P	October/November	chlorothalonil, cyproconazole, fenarimol, flutolanil, iprodione, PCNB, propiconazole, triadimefon, vinclozolin
Microdochium patch	P	October/November	azoxystrobin, chlorothalonil, cyproconazole, fenarimol, iprodione, PCNB, propiconazole, thiophanate-methyl, triadimefon, vinclozolin

This list is presented for information only and no endorsement is intended for products listed nor criticism meant for products not listed. Check with local specialists for specific recommendations and read and follow label instructions.

patches are roughly circular. Green plants within the diseased patches have leaf spots that are long, gray lesions surrounded by a dark brown margin.

The presence of dew and high humidity in the turf canopy are ideal conditions for dollar spot.

Control thatch and maintain an adequate nitrogen fertility program during the growing season. Don't overdo it with the nitrogen, but don't starve the turf either. Apply a fungicide to susceptible turfs at the first appearance of brown patch symptoms.

Pythium blight is caused by several species of *Pythium* fungi. In turfgrass they survive in thatch and soil. All turfgrass species are susceptible to attack by these fungi. The two most important criteria for disease occurrence are poor surface drainage and a wet grass canopy. These along with high relative humidity and day temperatures above 90°F with warm nights, provide an ideal environment for an outbreak. Environmental conditions are key to this disease. When it's cool and dry, no disease, but when it's hot and humid, look out. Early symptoms are small brownish spots that suddenly appear, especially in drainage channels, within the turf. These many form into larger areas where the in-

TURFGRASS FUNGICIDES GROUPED BY CHEMISTRY

Fungicide class	Common name	Examples of some trade names
Aromatic hydrocarbons	Etridazole	Koban
	Chloroneb	Teremec SP
	PCNB	Turficide
Benzimidazoles	Thiophanate-methyl	Cleary's 3336 Fungo Systec 1998
Carbamates	Mancozeb	Fore
	Propamocarb	Banol
	Thiram	Thiram
Carboximides	Flutolanil	ProStar
Dicarboximides	Iprodione	Chipco 26019
	Vinclozolin	Curlan, Vorlan
Nitriles	Chlorothalonil	Daconil 2787 Daconil Ultrex Daconil Weather Stik
Phenylamides	Metalaxyl	Subdue Maxx
Phosphonates	Fosetyl-Al	Aliette Prodigy Aliette Signature
Sterol biosynthesis inhibitors (DMIs)	Cyproconazole	Sentinel
	Propiconazole	Banner Maxx
	Triadimefon	Bayleton
	Myclobutanil	Eagle
Pyrimidine (DMI)	Fenarimol	Rubigan
B-methoxyacrylate	Azoxystrobin	Heritage

This list is presented for information only and no endorsement is intended for products listed nor criticism meant for products not listed. Check with local specialists for specific recommendations and read and follow label instructions.

dividual spots have merged. Infected leaves appear water-soaked and feel slimy to the touch. In the early morning hours, the turf may contain masses of fungal mycelium resembling a fluffy cotton ball. Sometimes the affected turf will give off a fishy odor. Place a plug of the affected turf in a sealed plastic bag overnight and then smell the results.

No single control measure will provide complete protection against an outbreak of Pythium blight. Turf managers must employ a combination of good management, early disease detection, and preventive fungicide treatment to avoid serious turf injury. Provide good surface and subsurface drainage and promote good air movement across blight-prone areas by pruning landscape plantings. The best fungicide strategy is one of prevention. When temperatures

and humidities are forecast to reach into the 90's with warm nights, it's time to treat.

Rust diseases, caused primarily by *Puccinia* spp., occur on all commonly grown turfgrasses. The severity of rust outbreaks varies from year to year. Kentucky bluegrass, perennial ryegrass and tall fescue are the cool season grasses most affected by rusts. In the Great Plains and Rocky Mountains, rust usually occurs from mid to late summer until early October. It becomes severe when lack of water, low fertility or soil compaction reduce turf growth. Warm days and moderate night temperatures along with long dew periods create optimal environmental conditions for rust.

Heavily rusted turfs appear yellow or orange when seen from a distance. If still in doubt, put on a pair of white shoes and walk across the turf. If it's rusty, they'll



Melting out of Kentucky bluegrass

turn orange. Close examination of rusted leaf blades reveals the presence of orange to brick-red pustules. Spores within these pustules rub off easily when touched. Each pustule is capable of producing over a million rust spores. Under ideal conditions turf can become heavily rusted about 40 days after initial infection.



Fairy ring injury to a home lawn. Rings most severe in sandy, low-fertility soils.

Rust management begins with the use of improved rust-resistant cultivars. Maintaining vigorous growth throughout the growing season by supplying a consistent source of nitrogen and alleviating compaction will lessen the rust severity. Fungicides may be needed in certain years with the initial application in early July followed by one or two additional treatments at three-week intervals.

The life cycle of fairy ring-forming mushrooms is similar to that of other common mushrooms. Fairy ring fungi survive as dormant spores or mycelium. This mycelium becomes active during moderate, wet weather; and the ring continues to grow outward each year. Following rains, mushrooms appear within the dark green ring or at the edge of the dead area. Fairy rings usually are most severe in sandy, low fertility soils low in moisture. The mushrooms grow on decaying organic matter such as a thick thatch. Typically, fairy rings

are found as circular patterns of thin or dead grass within a dark green ring of lush grass. The concentric ring of thin or dead grass is the result of drought stress caused by the dense mat of fungal mycelium present just below the ring.

In established turfs, symptoms are "masked" by lightly fertilizing, punching holes into the soil at 1-foot intervals within the ring and irrigating. This procedure should be repeated every two or three weeks during the growing season. A more drastic approach is to kill the turf in the infested area with a herbicide and rototill the entire area in three or four different directions to mix the mycelium from the different rings. The area can then be seeded or sodded. The fungicide flutolanil (ProStar) is registered for the suppression of certain fairy ring fungi. It could be used to spot treat problem fairy rings.

Principle snow molds of the central and northern plains are *Microdochium* patch

(pink snow mold) and *Typhula* blight (gray snow mold). *Microdochium* patch, caused by *Microdochium nivale*, can injure turf anytime from mid October to April during prolonged cool, wet weather. Infection most often occurs with temperatures between 32°F and 50°F, during cold fogs, or in a light drizzle.

Symptoms of pink snow mold are roughly circular rusty brown patches with a salmon-pink moldy growth visible at the edges of the patches. The scattered spots are easily detected, even in midwinter, because of the contrast in color between the diseased spots and dormant turf.

Unlike *Microdochium* patch, *Typhula* blight is strictly a cold-weather disease. Caused by *Typhula ishikariensis* or *T. incarnata*, this disease can seriously injure turf during periods of extended snow cover. Turf injury is aggravated when the snow is compacted by skiing, snowmobiling or sledging. Symptoms of gray snow mold are patches of rough, dead, bleached-tan areas up to a foot in size becoming visible as melting snow recedes from diseased areas. When wet they are covered by a whitish-gray moldy growth. Tiny orange to red to black fungal sclerotia are embedded in infected leaves can be seen with a hand lens. **LM**

TURF DISEASE MANAGEMENT GUIDE

Disease	Resistant varieties	Proper fertilization	Thatch management	Aerification	Improved drainage	Improved air circulation	Snow fencing	Mowing until dormant	Proper irrigation	Preventive fungicides	Curative fungicides	Till the area
Leaf spot/melting out	x	x	x	x					x	x		
Dollar spot	x	x	x	x					x	x	x	
Brown patch	x	x	x	x		x			x	x	x	
Summer patch		x	x	x					x	x	x	
Necrotic ring spot		x	x	x					x	x	x	
Pythium blight		x	x	x	x	x				x	x	
Rusts	x	x						x	x	x		
Fairy rings		x	x	x							x	x
Snow molds		x	x	x			x	x		x		

in warm-season turfgrass

The common southern turfgrass diseases have distinctive symptoms, and are easy to predict based on temperature and moisture conditions. Reduce traffic, watering and thatch, and use appropriate control products for a combined defensive strategy.

by GARY W. SIMONE, PH. D.,
University of Florida

The fall overseeding period on bermudagrass in golf courses and other recreational sites has had an increasing incidence of *Leptosphaerulina* blight.

This disease has been a minor leaf blight affecting such cool season grasses as annual and perennial ryegrass, annual bluegrass, creeping bentgrass, fine leaf fescues, and Kentucky bluegrass. The causal

fungus, *Leptosphaerulina australis*, has commonly invaded senescent or stressed leaf tissue in the past. Recent years have seen an increased incidence of this disease on rye/bentgrass overseeds and not necessarily on old or stressed tissue.

Leptosphaerulina blight begins on leaf tips, producing a yellowing that pro-

gresses down toward the sheath. Affected tissue develops a reddish-brown color prior to the necrosis and shriveling of affected leaves. The fungus does not appear to invade the crown nor roots of the overseed. Affected turf areas have a patchy appearance, exhibiting a reddish color similar to that caused by cold wet soils and restricted phosphorus

uptake. Close examination with a hand lens will reveal the brown-to-black, embedded sexual reproductive structures in shriveled leaf tips. The fungus has been known to invade bermudagrass in the absence of an overseeded species. *Leptosphaerulina* likely survives as mycelia in thatch and in the sexual bodies (perithecia) in either debris or soil. Recent dramatic shifts in rainfall due to El Niño may have much to do with incidence of *Leptosphaerulina* in overseeded grasses and in bermuda.

St. Augustinegrass is still suffering from the widespread incidence of take all root rot caused by *Gaumannomyces graminis* var. *graminis*. However, an increasing number of summer decline samples from urban lawn sites are not associated with take all root rot disease. Samples processed in the Florida Extension Plant Disease Clinic are revealing the presence of *Rhizoctonia zeae* – a causal fungus of leaf and sheath spot on bermudagrass. This disease is similar in appearance to take all disease on St. Augustinegrass but with less root destruction. Turf professionals comfortable with visual identification of take all patch by appearance and timing, are encouraged to take an occasional sample and forward to a diagnostic clinic for verification. Turf sites invaded by *Rhizoctonia zeae* are treatable situations.

Some Familiar Foes

Algae – These are not truly pathogenic on turf but have an adverse impact on turf quality due to competition. The blue-green algae are the primary culprits, invading partially shady sites with high moisture and a freely available nitrogen source. Algal growth produces a slippery condition on the turf and may become so dense that it can prevent irrigation from reaching the root zone. Improving soil drainage and air circulation coupled with verticutting areas with algal mats will aid in management.

Anthracnose – Incidence has been low on centipede grass due to the mild winter conditions throughout much of the Southeast. Areas with disease are correlated to either poor fertility conditions or nematode populations. Minimizing stress conditions greatly reduces anthracnose development.



Bermudagrass with decline symptoms

(PHOTO COURTESY T. FREEMAN)

Bermudagrass decline – Pursue lab diagnosis to verify decline and separate this disease from similar appearing localized dry spots (fairy rings) and Rhizoctonia leaf and sheath spot disease. Raise mowing height by 50% to increase photosynthetic area and top dress greens frequently. Fungicide use is primarily preventative.

Brown Patch – This spring/fall disease is most aggressive between 75-85°F. Disease is favored by thatch, excessive soil moisture and readily soluble nitrogen sources. De-thatch severely affected areas, apply slow release N sources and water deeply but infrequently.

Cottony Blight – Excessive rainfall in the fall through spring period (1997-98) has resulted in a



higher incidence of cottony blight in overseeded situations. Many greens and tees developed patches or streaks of greasy-green invaded turf as the fungus

St. Augustinegrass with take all root rot disease.

FUNGICIDE MANAGEMENT FOR WARM-SEASON TURFGRASSES

Disease	Common Fungicides	Comments
Algae	Chlorothalonil, mancozeb, maneb	Reduce watering and verticut algal mats
Anthracnose	Chlorothalonil, cyproconazole, propiconazole, triadimefon	Minimize thatch
Bermudagrass decline	Azoxystrobin, fenarimol, myclobutanil, propiconazole, thiophanate methyl, triadimefon	Preventative use and azoxystrobin has curative potential for golf course and sod farms
Brown patch	Azoxystrobin, chloroneb, chlorothalonil, cyproconazole, fenarimol, flutolanil, iprodione, maneb, mancozeb, myclobutanil, PCNB, propiconazole, thiophanate methyl, thiram, triadimefon	Mow into infested sites last and collect clippings to minimize mower spread
Cottony blight	Chloroneb, etridiazole, fosetyl aluminum, mancozeb, mefanoxam, propamocarb	Minimize traffic and irrigation on infested sites
Dollar spot	Chlorothalonil, cyproconazole, fenarimol, iprodione, mancozeb, maneb, myclobutanil, PCNB, propiconazole, thiophanate methyl, thiram, triadimefon	Minimize thatch and achieve a balanced fertility for long-term control
Fairy ring	Flutolanil	Some success with puffball caused rings from shallow depths
Gray leaf spot	Chlorothalonil, propiconazole	Repeated applications during rainy period needed
Helminthosporium spots	Chlorothalonil, iprodione, mancozeb, maneb, myclobutanil, PCNB, propiconazole, vinclozolin	Minimize thatch
Leptosphaerulina blight	Chlorothalonil, iprodione, vinclozolin	
Pythium root rot	Chloroneb, etridiazole, fosetyl aluminum, mefanoxam, propamocarb	Avoid excessive irrigation; Foliar fertilization may help
Rhizoctonia leaf and sheath spot	Chlorothalonil, flutolanil, iprodione, mancozeb, PCNB, thiram	Can be confused with decline and fairy ring or take all root rot
Rust	Cyproconazole, mancozeb, maneb, propiconazole, triadimefon	Usually not needed for control
Take all root rot	Fenarimol, myclobutanil, propiconazole, thiophanate methyl, triadimefon	Preventative use only

moved readily with surface water or traffic movement. Improve air circulation and drainage and restrict traffic across infested sites.

Dollar Spot – Although considered a disease of cool to warm weather (60-80°F), heat-tolerant strains of the fungal pathogens do exist along the Gulf coast areas, which allows a long period of disease incidence. Low fertility sites receiving excessive irrigation or under high moisture weather periods are prime sites for disease development. Achieve balanced fertility and minimize thatch for long-term suppression.

Fairy Ring – These diseases are caused by the higher fungi (puffballs and mushrooms) and vary in their effects upon turf from grass stimulation to grass death. Many species of fungi are involved including highly poisonous types like *Chlorophyllum molybdites*. Use of flutolanil for fairy ring suppression has been variable in performance. The species of fungus involved and the depth of the fungus colony in the soil may be two reasons for fungicide performance variation. Fairy ring on bermudagrass can be confused with decline and/or *Rhizoctonia* leaf and sheath spot. A clinical



Fairy ring on bermudagrass (*Chlorophyllum molybdites*)

diagnosis can be very helpful here.

Gray leaf spot – This common spot on St. Augustinegrass is most damaging during the hot, rainy summer period. Sites poorly adapted to turfgrass often serve to over season the fungus. Shady urban lawn sites with persistent leaf spot problems should be redesigned and converted to shade-tolerant ground covers, bedding plants, or woody ornamentals. Affected lawns should be deeply watered in early morning hours. Avoid use of readily soluble N sources.

Helminthosporium blights – Primarily damaging in spring and fall on ryegrass and bermuda and is favored by thatchy sites with low fertility and frequent irrigation.

This disease can be mistaken for gray leaf spot on St. Augustine in late summer and early fall. Improve site fertility, reduce thatch, and irrigate for longer periods with less frequency.

Pythium root rot – Occurs on all grasses and is caused by a group of related fungal species spanning a

wide temperature range. Feeder root destruction occurs in sites with poor drainage or excessive irrigation causing turf yellowing and death with a characteristic bleached straw color. Improve soil drainage and restrict supplemental irrigation. Foliar fertilization may aid in recovery of slight to moderately damaged areas.

Rhizoctonia leaf and sheath spot – A summer disease of bermuda only, until recent isolations from St. Augustinegrass. The disease can appear as a small ring, arc or patch

making diagnosis difficult due to similarity of symptoms with fairy ring and decline diseases. Lab diagnosis is important in this situation.

Rust – Disease develops in the cooler periods, especially in partially shaded turf sites. Affected turf is thin and chlorotic with obvious yellow to orange-red blisters on leaf surfaces. Collect infected clippings during mowing. Fungicides are infrequently used.

Take all root rot (patch) – Stress-related disease on urban St. Augustine-, centipede-, bahia-, and zoysiagrasses. Develops in mid to late spring and continues through summer into early fall. Affected turf yellows, followed by a thinning to death. Feeder root systems are greatly reduced. Fungal pathogen invades following stresses from disease, insects, nematodes, cultural, or environmental factors.

The fungus cannot be reliably eradicated from the site, nor is pathogen-free sod available in the southeast U.S. **LM**

The author is an extension plant pathologist and professor at the University of Florida, Gainesville.



Abbreviated root system of St. Augustinegrass due to take all root rot.