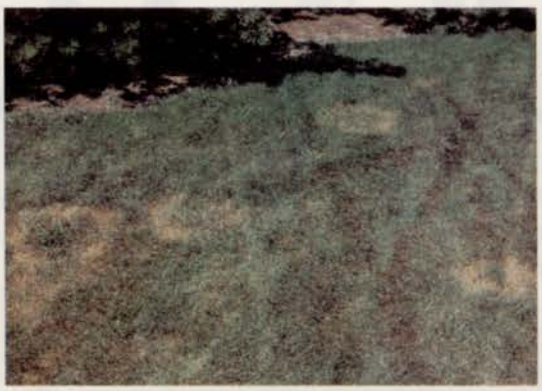
Turfgrass disease control for cooler areas of the U.S.

Fusarium blight (summer patch)



Rhizoctonia brown patch is one disease worsened by poor drainage.

Proper cultural practices prevent and manage diseases; fungicides are a management tool.

■ When designing a program to combat turfgrass diseases, it is important that the cool-season turf manager know the plant disease triangle—the three factors which determine susceptibility to disease.

For a disease to occur, these three conditions are necessary: a pathogen (agent that causes disease), a susceptible host (in this case, turfgrass), and favorable environmental conditions (cultural practices or weather factors that increase plant stress).

The pathogen—Dr. J.M. Vargas Jr. of Michigan State University, in his text "Management of Turfgrass Diseases," notes that five groups of organisms cause plant diseases: fungi, bacteria, viruses, nematodes and mycoplasma. In descending order, fungi, nematodes and viruses are the three most important causes of disease in turfgrass. The vast majority are caused by fungi.

The host—Different turfgrass cultivars and species are more susceptible to different turfgrass diseases. For example, Drs. W.H. Daniel and R.P. Freeborg, in their "Turf Manager's Handbook," say that take-all patch primarily affects bentgrass and bluegrass while red thread primarily affects red fescues.

Susceptibility of the host many times depends on the amount of stress placed on the turf. Healthy, vigorous turf is less susceptible to disease. Stress can be caused by a variety of factors, including:

- Either inadequate or excessive nitrogen fertility.

Certain diseases like dollar spot, red thread, pink patch and rusts are more prevalent under low fertility. Diseases that are favored by high fertility include leaf spot, brown patch, pythium blight, stripe smut and the snow molds.

- Improper cultural practices, including mowing.

Grass should not be mowed shorter than its minimum competitive mowing height (see table). And no more than 1/3 of the leaf blade should be removed at any one mowing to minimize stress.

- Improper irrigation practices, improper drainage, excessive rainfall, excessive traffic, thatch build-up, soil pH and other abnormal conditions.

Environmental conditions—Temperature, water, atmospheric water vapor, light, soil and wind are the environmental conditions affecting the development of turf diseases, according to Dr. J.B. Beard.

Temperature is a major factor. Each pathogen has its range of optimal temperatures for development, which may or may not coincide with the optimal temperatures for growth and hardiness of the plant host. Dr. Beard, in his book "Turfgrass Science and Culture," notes that "the optimum temperature for development of a turf disease can range from as low at 35 to 40 degrees Fahrenheit to as high as 95 degrees."

Free water is needed to begin germination of most fungal spores. Also, water stresses or excesses can weaken the turfgrass plant and cause it to be more susceptible to the disease pathogen. Since watering turf in the late afternoon or early evening allows fungi to germinate, grow and infect all night, the best time to water is just before sunrise, according to Dr. Vargas.

"Good drainage is just as important as proper watering," Dr. Vargas continues. "Diseases made worse by poor drainage are pythium blight, rhizoctonia brown patch and gray leaf spot."

Cultural controls—According to Dr. Noel Jackson of the University of Rhode Island, cultural factors which may contribute to reducing the incidence of disease are:

- judicious changes in irrigation and fertilizer practice;

PROPER MOWING HEIGHTS

SPECIES	MIN. HEIGHT	PREFERRED HT.
Annual bluegrass	⅛"	¼"-1"
Creeping bentgrass	⅛"	¼"-1"
Fine fescue	½"	2"-3"
Kentucky bluegrass	¾"	2"-3"
Tall fescue		2½"-3½"
Zoysiagrass	¾"	2"-3"

Source: Dr. J.M. Vargas Jr.

SOME TRADE NAMES OF TURF FUNGICIDES*

COMMON NAME	TRADE NAME	COMPANY
anilazine	Dyrene	Miles
benomyl	Tersan 1991	DuPont
chloroneb	Teremec	PBI-Gordon
	Terraneb	Kincaid
	Fungicide V	O.M. Scott
chloroneb/thiophan.-methyl	Fungicide IX	O.M. Scott
chlorothalonil	Daconil 2787	ISK Bio
	Thalonil	Terra
ethoprop	Mocap	Rhone-Poulenc
etridiazole	Terrazole	Uniroyal
fenamiphos	Nemacur	Miles
fenarimol	Rubigan	DowElanco
fenarimol/chlorothalonil	Broadway	DowElanco
iprodione	Chipco 26019	Rhone-Poulenc
	Fungicide X	O.M. Scott
maneb	Dithane	Rhome & Haas
mancozeb	Tersan LSR	DuPont
metalaxyl	Subdue	Ciba-Geigy
	Pythium Control	O.M. Scott
metalaxyl/mancozeb	Pace	Ciba-Geigy
pentachloronitrobenzene	Turfcide	Uniroyal
propamocarb	Banol	Nor-Am
propiconazole	Banner	Ciba-Geigy
thiophanate-methyl	Cleary 3336	W.A. Cleary
	Fungo 50	Grace-Sierra
	Fungo 85	Grace-Sierra
	Systemic Fung.	O.M. Scott
thiophan.-methyl/ipridione	Fluid Fung.	O.M. Scott
triadimefon	Bayleton	Miles
	Fungicide VII	O.M. Scott
triadimefon/metalaxyl	Fluid Fung. II	O.M. Scott
thiram	Spotrete	W.A. Cleary
thiram/triadimefon	Fluid Fung. III	O.M. Scott
vinclozolin	Vorlan	Grace-Sierra
	Curalan	BASF
	Touché	Lesco

*Many fungicides are sold under trade names other than the ones listed. Check with your pesticide dealer for alternative products.

Sources: LM Buyer's Guide 1993; Farm Chemicals Handbook, 1992

- modification of soil pH;
- improvement of soil aeration and drainage;
- removal of thatch and clippings;
- adjustments in mowing height and mowing frequency;
- dew dispersal and improved air drainage;
- restraints on the amount of wear;
- incorporation of organic amendments;
- weed control;
- insect control;
- nematode control; and
- using resistant varieties of grass.

"But even the most skilled turf manager cannot rely entirely on cultural tactics to eliminate the risk of disease in high quality turf," Dr. Jackson admits.

Chemical controls—Turfgrass fungicides are either contact or systemic.

Contact fungicides are generally applied to the leaf and stem surfaces of turfgrasses, according to Dr. Peter Landschoot of Penn State University. Because they don't move appreciably within the plants, they may be washed or mowed off the plant surfaces and so are generally effective for only 7 to 14 days.

Contact fungicides are usually used to control foliar diseases and not root/crown diseases, Dr. Landschoot notes.

Systemic fungicides are absorbed and translocated within the plant, he adds. Systemics may protect the plants for a period of two to four weeks. "Most systemics will control both foliar and root/crown pathogens," he says, "but do not have as broad of a spectrum of control as contact fungicides."

There are many approaches to minimizing resistance of fungi to fungicides. Though some plant pathologists recommend mixing contact with systemic fungicides, Landschoot does not. "A more logical approach is to combine two or more systemic fungicides with different modes of action. Unfortunately, mixtures of systemics at full label rates are costly and may result in turf injury.

"Turf managers should take the threat of resistance seriously and avoid continuous and repeated use of fungicides with narrow modes of action."

Turf experts agree that the best way to control diseases of turfgrass is to use the proper cultural techniques as a preventive means, supplemented with the proper chemical controls to assist the management of a disease.

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COOL-SEASON TURF DISEASES

(Before using any pesticide, read and follow all label directions.)

DISEASE	SUSCEPTIBLE TURFGRASS	CULTURAL CONTROLS	CHEMICAL CONTROLS
algae	all turfgrasses	reduce shade avoid excessive fertilization improve soil drainage	mancozeb
anthracnose *(Colletotrichum graminicola)*	annual bluegrass bentgrass fine fescue	fertilize and water syringing may help minimize free water on leaves	benomyl(1), triadimefon, thiophanate-methyl(1), propiconizol, fenarimol, chlorothalonil
brown patch	**(see rhizoctonia blight entry)**		
dollar spot *(Lanzia* and *Moellerodiscus)*	all cool-season grasses	avoid N deficiency remove dew from greens choose resistant grasses	chlorothalonil, mancozeb, benomyl(1), anilazine(1), fenarimol, iprodione(1), spp.) propiconizol, thiophanate-methyl(1), thiram, triadimefon, vinclozolin(1),
fairy rings *(Basiodomycete* soil fungi)	all turfgrasses	replace infested sod & soil improve water penetration increase N fertilization	methyl bromide or formaldehyde fumigation
fusarium blight *(Fusarium poae, F. vulmorum, F. crookwellense)*	bluegrasses bentgrasses fescues	light, infrequent watering do not cut blues or fescues under 2 inches reduce excessive thatch	triadimefon, fenarimol, benomyl(1), iprodione, thiophanate-methyl(1),
fusarium patch (pink snow mold) *(Fusarium nivale)*	bluegrasses bentgrasses fescues	avoid late fall fertilization rake leaves and cut short control drifting snow	triadimefon, benomyl(1), fenarimol, iprodione(1), mancozeb, mercury chlorides, pentachloronitrobenzene, thiram, thiophanate-methyl(1), vinclozolin
gray snow mold	**(see typhula blight entry)**		
leafspot/blight/ melting out *(Drechslera* & *Bipolaris* spp.)	Kentucky blue bentgrasses fine fescue ryegrasses	use resistant varieties raise cutting height avoid excessive N avoid light frequent watering	iprodione, anilazine, chlorothalonil, maneb, mancozeb, vinclozolin
nematodes	all turfgrasses	maintain growth with fertilization and irritation	fenamiphos, ethoprop
necrotic ring spot *(Leptosphaeria korrae)*	Kentucky blue annual bluegrass ryegrasses fine fescue	avoid low mowing heights reduce excessive thatch use Kentucky blue, ryegrass mixtures maintain even soil moisture	fenarimol, propiconizol, vinclozolin, benomyl
pink patch *(Limonomyces roseipellis)*	bentgrass fine fescue perennial rye	balanced fertilization	vinclozolin, mancozeb,
pink snow mold	**(see fusarium patch entry)**		
powdery mildew *(Erysiphe graminis)*	Kentucky blue fine fescue	reduce shade increase air circulation by removing surrounding vegetation use resistant varieties	triadimefon, fenarimol, propiconizol
pythium blight *(Pythium aphanidermatum, P. graminicola)*	bentgrasses annual bluegrass perennial rye Kentucky blue	improve soil drainage increase air circulation avoid mowing wet grass avoid excess watering	chloroneb, etridiazole, propamocarb, mancozeb, metalaxyl
red leaf spot *(Drechslera erythrospila)*	bentgrasses	remove clippings fertilize to maintain vigor	iprodione, anilazine
red thread *(Laetisaria fuciformis)*	perennial rye fine fescue bentgrass annual bluegrass Kentucky blue	balanced fertility program	vinclozolin, cadmium chlorothalonil, mancozeb, thiophanate-methyl, triadimefon, propiconizole
rhizoctonia blight (brown patch) *(Rhizoctonia solani, Thanatephorus cucumeris)*	bentgrass annual bluegrass tall fescue Kentucky blue fine fescue ryegrasses	avoid excessive nitrogen increase air circulation avoid excessive watering improve soil drainage	anilazine, chlorothalonil, mancozeb, benomyl(1), maneb, propiconizole, pentachloronitrobenzene, triadimefon, thiophanate-methyl(1), anilazine, iprodine, benomyl, vinclozolin
rust *(Puccinia* spp.)	perennial rye Kentucky blue	avoid nitrogen deficiency use resistant varieties promote growth with fertilization and irrigation	mancozeb, propiconizole, chlorothalonil, fenarimol, triadimefon
slime molds *(Myxomycete)*	all turfgrasses	remove by mowing, raking	zineb, mancozeb
snow mold	**(see fusarium patch and typhula blight entries)**		
stripe smut *(Ustilago striiformis)*	Kentucky blue bentgrasses	avoid drought stress avoid excessive nitrogen use resistant varieties	propinconizole, triadimefon, benomyl
summer patch *(Magnaporthe* spp.) Kentucky blue	annual bluegrass reduce excessive thatch fine fescue	avoid low mowing height vinclozolin, propiconazol, light, frequent watering use slow-release nitrogen improve drainage	fenarimol, triadimefon, benomyl
take-all patch *(Gaeumannomyces graminis* var. *avenae)*	bentgrass	avoid topdressing with pH greater than 6.0 avoid lime use ammonium chloride or ammonium sulfate fert.	PMA (not labelled)
typhula blight (gray snow mold) *(Typhula* spp.)	bentgrass annual bluegrass Kentucky blue tall fescue perennial rye	avoid heavy fall nitrogen rake leaves and cut short control drifting snow	triadimefon, cadmium, chloroneb, anilazine, pentachloronitrobenzene, mercury chlorides, thiram
yellow patch *(Rhizoctonia cerealis)*	bentgrasses bluegrasses	reduce excessive thatch avoid excessive watering	none
yellow tuft *(Sclerophthora* spp.)	bentgrass	improve drainage maintain adequate fertility	metalaxyl

(1) Continued or sole use of these materials may favor build-up of resistant fungal population.

Diseases of warm-season turfgrasses

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■ Diseases of warm-season turfgrasses usually occur either in the spring and fall, or in the summer.

Spring dead spot—Spring dead spot and winter damage are the first problems observed in the spring in the northern range of adaptation of bermudagrass. Spring dead spot appears as circular dead spots from six inches to several feet in diameter in highly-maintained bermudagrass three to four years after planting. Winter damage and spring dead spot can be confused. However, winter damage usually occurs in large areas and is often associated with winter shade or north-facing slopes.

Several different fungi have been associated with spring dead spot.

Gaeumannomyces graminis causes a root and stolon rot during the fall and winter that results in circular dead spots in the spring. The bermudagrass grows over the spots slowly during the summer, and the spots are often invaded by weeds that also reduce the spread of the grass into the spots.

Lower levels of nitrogen and good aerification programs will help reduce the severity of this disease. Some research has indicated that ammonium-type nitrogen fertilizers with sufficient potassium will help reduce damage.

Once the disease is present, fungicides are not effective in the spring. Rubigan fungicide has a label for spring dead spot control; it should be applied in September or October to help control the disease the following spring.

Areas with spring dead spot in the spring should be mapped and treated with the fungicide in the fall.

Brown patch—Brown patch is usually seen in the spring during—or soon after—green-up, especially in cool-wet springs. It is caused by the fungus *Rhizoctonia solani*, and probably is the most serious disease of warm-season turfgrasses.

Symptoms are circular brown patches as large as 20 feet. Some live leaves usually remain in the patches. The infected shoots at the edge of the patches turn yellow and are easily pulled from the stolons. Symptoms will be evident throughout the winter and the following spring. These patches may be the first to show symptoms of the disease becoming active the next spring.

Heavy fertilization with nitrogen and wetter environments increase the severity of brown patch. Moderate fertilization with nitrogen, proper irrigation, and good air circulation will help reduce the severity of brown patch. The grass should be irrigated enough to wet the soil 6 to 8 inches at one time and not irrigated again until several days later when drought symptoms become evident.

Removing trees, shrubs or fences can help manage this disease. Drying of the leaves can be increased by growing the grasses in more open areas with good sunlight and air circulation.

A number of fungicides are labelled for brown patch, but it has been difficult to control once symptoms become severe. Fungicides should be applied when early symptoms are seen or preventive fungicide applications may be needed where there is a history of brown patch. Fall applications may be best.

Fairy rings—Symptoms of fairy rings include green rings of grass, dead rings of grass, rings of mushrooms or puffballs, or a combination of signs.

The rings may be from several feet to hundreds of feet in diameter. They enlarge each year and often persist for many years.

Many different mushroom and puffball-type fungi are known to cause fairy rings.

Sources of organic matter such as stumps should be removed before planting. Once fairy rings are present, aerification and heavy irrigation may help to overcome turf damage. Renovation or soil fumigation can control fairy rings.

Some fungicides may help to control the rings. But control may not be warranted because of the expense and the fact that symptoms may be masked with fertilizer in some cases.

Leaf spot—Helminthosporium leaf spots are often a problem on bermudagrass and zoysia during wet weather in middle to late summer. The fungi that cause Helminthosporium are divided into three genera: Bipolaris, Drechslera or Exserohilum. Symptoms vary by genera; they can range from brownish-black to light tan lesions on the leaves to crown and root rot.

Gray leaf spot, caused by *Pyricularia grisea*, occurs primarily on St. Augustinegrass. The disease begins as tiny brown lesions that enlarge to large tan lesions with purple to brown borders. The spots may be covered with a gray fungus during warm-moist weather. It is more severe in recently sprigged plantings.

Proper amounts of fertilizer and irrigation practices that reduce the length of leaf wetness periods will help reduce the damage from gray leaf spot. In extreme cases, fungicides can be used.

Pythium diseases—Pythium species cause crown and root rot diseases, usually in very wet soils. Most that are severe on cool-season grasses are not severe on warm-season grasses.

The best controls are good management practices and avoiding poorly drained soil. Some pythium-specific fungicides can be used.

Dollar spot—Dollar spot often occurs on bermudagrass, centipedegrass and zoysiagrass with low levels of fertility during late summer. Light tan leaf lesions with dark margins first appear on leaves. Small tan patches from 2 to 3 inches in diameter develop. The patches on zoysia may be darker and up to 6 inches in diameter. Applications of fertilizer with nitrogen will usually dive adequate control; fungicides should not be needed.

Centipede decline—This complex may involve a number of factors: cold damage, soil pH, nutritional deficiencies, improper fertilization, herbicides, diseases and ground pearls among them.

Centipede grows best at a 5.5 pH; iron deficiency that causes the centipede to turn yellow and become weak often develops at higher pHs. Nutrients like sulfur and potassium should be used according to soil test results designed specifically for centipedegrass. Also, low levels of nitrogen (not more than 1 lb. N/1000 sq.ft./yr.) has helped to avoid the decline.

Some broadleaf weed herbicides have been associated with centipede decline. Label directions should be followed care-

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fully. Diseases such as fairy rings and brown patch may contribute to the decline of centipedegrass. Where ground pearls are present, another type of turf, such as bermuda, may grow better.

Nematodes—The selection of the best adapted grasses and good management must be used to manage nematode damage. The few remaining nematicides are labelled only for golf course and commercial turf use, and not on residential lawns.

Good fertilization and irrigation programs will help overcome some nematode damage. Some products that contain crab and shrimp shells may help control nematodes, as will incorporating organic matter in the soil at the time of planting and as topdressing.

Rusts—Rust diseases usually occur in late summer or fall. These diseases cause yellow to orange pustules. Zoysiagrasses are most severely damaged by rust, particularly in shaded areas without adequate fertilization.

This disease can be managed by using good turf management practices. Some of the newer systemic fungicides have also given very good control.

St. Augustine decline—This disease is caused by a virus. The symptom resembles a nutrient deficiency or damage from some types of insects. The chlorosis slowly spreads until the infected lawn appears uniformly chlorotic and becomes thin. Entire lawns may be killed by this virus disease as early as three years after its first symptoms appear.

The best control is to use new varieties that are resistant to the virus.

DISEASE CONTROL, WARM-SEASON GRASSES

Disease	Fungicide, formulation	Oz./1000 sq.ft.	Interval/days
Brown patch	Banner 14.3%EC	2 to 4	10 to 21
	Bayleton 25WP	1 to 2	15 to 30
	Chipco 26019 50WP, 23.3%	1.5 to 2, 3 to 4	14 to 21
	Cleary's 3336 50WP	1 to 2	7 to 10
	Curalan DF	1 to 2 or 1.75 to 6.5	14 to 28
	Daconil 2787 F40.4%, 75WP, 90WDG	3 to 11 or 2 to 8	5 to 14
	Duosan 75WP	4 to 6	10 to 14
	Dyrene 4F	4 to 8	5 to 10
	Fore 80WP or Dithane M-45	4	5 to 14
	Fungo 50WP	2	7 to 14
	Proturf Fluid Fungicide 39.3F	1.3 to 2.6	7 to 14
	Rubigan AS	1.5	5 to 14
	Tersan 1991 50DF	2	7 to 10
	Two Some F	3 to 6	14 to 28
	Touché F	1 to 2	
Centipede decline	None known effective		
Dollar spot	Banner 14.3%EC	0.5 to 2	7 to 28
	Bayleton 25WP	1 to 2	30 to 60
	Chipco 26019 50WP, Flo 23.3%	1.5 to 2, 3 to 4, 1.75 to 6.5	14 to 21
	Cleary's 3336 50WP	1 to 2	7 to 10
	Curalan DF	1 to 2	14 to 28
	Daconil 2787 F40.4%, 75WP or 90WDG	3 to 11, 2 to 8	7 to 14
	Duosan 75WP	3	5 to 14
	Fore 80WP or Dithane M-45	6 to 8	7 to 14
	Fungo 50WP	1 to 2	10 to 14
	Proturf Fluid Fungicide 39.3F	1.3 to 2.6	7 to 14
	Rubigan AS	0.75 to 1.5	10 to 28
	Tersan 1991 50DF	1	10 to 14
	Vorlan 50WP, Flo 41.3%	1 to 2	14 to 28
Gray leaf spot	Daconil 2787 F40.4%, 75WP, 90WDG	3 to 11	7 to 10
	Banner 14.3%EC	2, 2 to 8, 1.75 to 6.5	14
Leaf spots	Chipco 26019 50WP, Flo 23.2%	1.5 to 2, 4 to 8	14 to 21
	Daconil 2787 F40.4%, 75WP, 90WDG	3 to 11, 2 to 8	7 to 14
	Duosan 75WP	4 to 6	5 to 7
	Fore 80WP or Dithane M-45	4	7 to 14
	Manzate 200DF	3 to 4	7 to 12
	Proturf Fluid Fungicide 39.3F	1.3 to 2.6	7 to 14
	Tersan LSR 80WP	3 to 6	5 to 10
Rust	Banner 14.3%EC	1 to 2	14 to 28
	Baylteon 25WP	1 to 2	15 to 30
	Daconil 2787 F40.4%, 75WP, 90WDG	6 to 11, 4 to 8, 3.75 to 6.5	7 to 14
	Duosan 75WP	4 to 6	5 to 14
	Dyrene 4F	4 to 8	7 to 14
	Fore 80WP	4	7 to 14
	Tersan LSR 80WP	3 to 4	7 to 10
Spring dead spot	Tersan 1991 50WP	6 to 8	Oct.-Nov.
	Rubigan AS	4 to 6	Sept.-Nov.

Source: Dr. Leon T. Lucas, N.C. State Univ.