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Turfgrass Diseases

Identification and Control

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Identifying turf problems requires expertise, experience, and sometimes, good detective work. An experienced turf manager might correctly identify a turf problem 60 percent of the time. The expert might correctly identify a problem 70 or 80 percent of the time, but neither will be correct 100 percent. Some problems and their interactions are too numerous and complex to correctly identify.

Early recognition and identification of a problem is essential to the maintenance of fine turfs. Early symptoms of a turf problem rarely attract the attention of a non-professional. A subtle change in color or growth rate, wilting or footprinting earlier in the day than normal, cottony growth on the grass in the early morning, birds or other animals actively feeding in the turf or a combination of these symptoms may be an early indication of a serious turf problem. After the turf thins out or brown patches appear in the turf, the opportunities for effective control are greatly reduced.

The turf manager must make regular inspections of his turf to establish a reference by which abnormalities can be readily recognized. For example, difference in soil conditions may cause the grass in one area to wilt sooner than in another area. Also, changes in the color or growth rate of a turf may indicate a nutrient deficiency and require frequent observation to detect. The height of the grass before mowing, the number of baskets of clippings removed from a golf green or lawn, or the frequency of mowing required all provide a reference to detect changes in growth rate. Color changes require even closer observations, but they can be an early warning to a serious turf problem. A subtle change in color may signal a nutrient deficiency, a disease occurrence or an insect infestation. A turf manager who is familiar with the normal color and growth rate of a particular turf is most likely to recognize these early symptoms of a problem.

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Maintaining a daily log in enough detail to show what, when, why and how with respect to management practices performed is helpful. Fertilization records can help explain changes in turf color or growth rate. Cultural practices such as mowing, watering, aeration, vertical mowing, and topdressing should also be included in the daily records. Insect, disease and weed control treatments must be recorded along with the response obtained. The turf manager trying to identify a problem without these records is at a serious disadvantage. For example, a recent application of nitrogen to a turf that appears chlorotic and stunted along with a soil test report that shows adequate levels of other nutrients suggests that nutrition is not the problem.

In addition to the records of daily operations, keep soil tests, water and plant analyses for several years for reference purposes. In critical situations these analyses could provide helpful information.

Extension publications, conference proceedings, trade journal articles and turfgrass newsletters can provide valuable reference information.

Classifying Problems as to Origin

Turf problems should first be identified as to their nature – cultural (man-made), environmental or pest-related. Often two or more of these factors contribute to the problem. For example, a grass that has limited shade tolerance (environmental) should not be mowed too close (cultural). Likewise, a nitrogen deficiency (cultural) can be a contributing factor to an outbreak of dollar spot (pest), or shade (environmental) and over-fertilization (cultural) can contribute to an occurrence of leaf spot (pest). When two or more factors contribute to the problem, all factors must be identified before the problem can be effectively corrected.

Too often we identify only one factor contributing to a turfgrass problem, when, in fact, several factors

contribute to the problem. For example, many pest problems are a result of environmental conditions and cultural practices. In fact, pest-related problems such as dollar spot may be controlled most effectively by changing the cultural practices that contributed to the problem. Pest management programs must consist of more than the shotgun application of pesticides to turf. Accurate identification of factors contributing to the problem and timely application of pesticides are better alternatives.

Disease problems require accurate identification to obtain effective and safe control. In addition to the symptoms expressed by the grass, environmental conditions, grass species, and previous cultural practices should be considered when identifying pest-related problems. Turfgrass diseases are particularly difficult to identify. Often, environmental conditions modify the disease. Also, after the grass has been killed, it becomes increasingly difficult to identify the cause. In many cases, microscopic examination by experts is required to accurately diagnose a turfgrass disease problem.

A Key to the Identification of Common Turfgrass Diseases

Grass affected in distinct patches

◆ INDIVIDUAL PATCHES 2 TO 3 INCHES IN DIAMETER, LEAF LESIONS PRESENT.

Diseased spots are light tan or straw-colored. Light tan lesions may be found near the top of the grass blade. Fine, cobwebby, mycelial growth can be seen covering the spots in the early morning when dew is present. ..... **Dollar Spot**

◆ INDIVIDUAL PATCHES USUALLY LARGER THAN 2 TO 3 INCHES IN DIAMETER, LEAF LESIONS NOT PRESENT.

Dark green "halo" or circular or crescent-shaped patches present; mushrooms may be present in circular pattern outside of dark green "halo," grass appears normal in the center of the patch. ..... **Fairy Ring**

◆ DARK GREEN "HALO" OR MUSHROOMS NOT PRESENT IN CIRCULAR PATTERN.

1. Grass blades matted together in affected area; greasy, water-soaked appearance, fading to a light tan as grass blades dry and shrivel; cottony appearance in early morning hours; blighted areas may merge to form large irregular areas or long streaks. ..... **Pythium Blight**
2. Outer edge of circular patch may be yellowish-brown in color occasionally giving it a "smoke-ring" appearance; grass blades at the margin of patch can be easily pulled from the stolon; green grass may appear within the patch. ..... **Brown Patch**
3. Outer edge of irregular patch is chlorotic to straw-colored, grass within the patch is straw-colored and "crisp;" leaves not easily pulled from the stolon. ..... **Take-all Patch**
4. Circular, doughnut-shaped patches of chlorotic, tan or straw-colored grass; patches no more than 3 feet in diameter with green grass in the center producing the "frog-eye" pattern, chiefly on cool season grasses. ..... **Fusarium Blight**
5. Circular patches of grass appear brown in early spring, grass does not recover from winter dormancy (bermudagrass only). ..... **Spring Dead Spot**

Grass not affected in distinct patches

◆ SPOTS DISTINCT ON LEAF BLADES.

1. Orange or red bumps on leaf surface, rust-colored spores readily rub off the leaf surface. ..... **Rust**
2. Leaf blades show chlorotic mottling (St. Augustine grass and centipedegrass only). ..... **St. Augustine Decline**
3. Oval-shaped spots with tan or gray-colored center and brown margin surrounded by chlorotic tissue, spots apparent on leaves and stems. ..... **Gray Leaf Spot**
4. Small, elongated spots with dark brown or purple margins; spots increase in size and the centers fade to a brown or straw color; where leaf spots are numerous, leaves may be completely killed; spots apparent on leaves and stems. ..... **Bipolaris and Exserohilum (Helminthosporium) Leaf Spots**
5. Small superficial patches of white to light-gray dusty fungus growth on leaves, lower leaves often completely covered; leaf tissue under the mildew becomes yellow and fades to brown; heavily infected leaves gradually dry up and die. ..... **Powdery Mildew**

◆ SPOTS NOT DISTINCT ON LEAF BLADES AND GRASS APPEARS CHLOROTIC.

1. Affected areas appear yellow, thin and generally unhealthy; grass roots appear normal. ..... **Curvularia Fading Out, Nigrospora Stolon Rot, Centipedegrass Decline**

2. Affected areas appear yellow, thin, not responsive to treatment; grass roots stunted, swollen or blackened. ..... **Nematodes**

3. Grass appears chlorotic, seedstalks abundant, growth rate noticeably slower than normal, no distinct boundaries to the affected area (except possible fertilizer distribution pattern), root system appears normal. ..... **Nitrogen** or **Iron Deficiency** (check soil analysis for other possible nutrient deficiencies)

◆ SPOTS NOT DISTINCT ON LEAF BLADES AND GRASS NOT GENERALLY CHLOROTIC.

1. Leaf tips frayed, grass not wilted, turf has a brown appearance several days after mowing. ..... **Mower blade dull** or **not properly adjusted**

2. Grass wilted in localized spots, turf has a gray cast in wilted areas and turns brown as condition persists, leaves rolled, soil dry or compacted (sloping site). ..... **Drought stress, soil compaction** or **hydrophobic soil** (common on sandy soils)

3. Grass wilted in localized spots, soil moist, water stands in places after rain or irrigation, weak root system. ..... **Wet wilt, poor drainage**

4. Grass appears burned in spots or streaks, leaf blades are first to turn brown, occurs shortly after application of soluble fertilizer. ..... **Fertilizer burns**

5. Grass not wilted and has a brown appearance shortly after mowing; grass stems or crown exposed. ..... **Grass scalped, excessive thatch accumulation**

6. Grass not wilted and has healthy color, but leaf tips appear burned; grass grows rapidly after mowing. ..... **Excessive nitrogen**

Dollar Spot

Dollar spot, a disease of turfgrasses caused by the fungus *Sclerotinia homeocarpa*, attacks most turfgrasses grown in the South. Bentgrass, hybrid bermudagrasses and zoysia are most susceptible to dollar spot. The disease occurs from spring through fall, and is most active during moist periods of warm days (70-85° F) and cool nights (60° F) in the spring, early summer and fall. The disease is spread from one area to another by water, mowers and other equipment, or shoes.

Symptoms

On fine textured and close-cut turf, the disease appears as round, brown to straw-colored and somewhat sunken spots approximately the size of a silver dollar (Fig. 1); thus, the common name "dollar spot." In coarse textured grasses maintained at taller cutting heights, the dead spots are larger and more diffuse. Under these conditions dollar spot can be confused with Rhizoctonia brown patch. Dollar spot is readily distinguished, however, by characteristic lesions on the leaf blades of live plants near the border of the affected area. Lesions are light tan with a reddish-brown border, and usually radiate from the margins of the leaf blade. On fine bladed grasses such as bentgrass, the lesions usually girdle the leaf blade.

If the turf is examined when the disease is active early in the day before the dew dries, cobweb-like mycelium of the fungus can be seen growing on affected areas. During early stages of the disease, affected plants may appear water-soaked and wilted, but spots quickly fade to a characteristic straw color.

Disease Development

Several factors influence the occurrence and severity of dollar spot. Bentgrass, hybrid bermudagrass and zoysia are most susceptible, while St. Augustine and centipede are less frequently attacked by dollar spot.

Low soil moisture has been reported to enhance dollar spot activity, but moisture from dew, light rain or irrigation must be present on the foliage for the disease to develop.

The dollar spot fungus is capable of growth over a wide range of temperatures (50 to 90° F), but disease development is greatest at temperatures between 70 and 80° F. The dollar spot fungus survives unfavorable temperature and moisture conditions in plant tissue and thatch as dormant, compact masses of mycelium, called sclerotia.

Low nitrogen and potassium levels in the soil have been reported to increase the severity of dollar spot. Some rather severe outbreaks of dollar spot have been brought under control by the application of soluble nitrogen fertilizer. However, the beneficial effect of nitrogen is thought to be due to rapid recovery of the grass during periods of reduced disease activity.

Control

Cultural practices that promote healthy turf help to reduce the occurrence and severity of dollar spot.

- ◆ Remove excess thatch.
- ◆ Keep fertility levels adequate.
- ◆ Avoid light, frequent watering, and mow frequently at recommended heights.
- ◆ Aerate compacted soils.

To prevent dollar spot apply a fungicide labeled for the disease at recommended rates and intervals. Applications are most critical during moist weather

in the spring and fall when day temperatures are between 70 and 80° F.

Fairy Ring

Fairy rings may appear in any lawn, golf course or other turf area during spring and summer months. The rings appear as either dark green or brown circular bands ranging in size from a few inches to 50 feet in diameter. The fairy ring fungus grows outward from a central point at a rate varying from a few inches to as much as several feet a year. Where several distinct rings converge, fungus activity stops at the points of contact. As a result, the circular shape of the original rings is replaced by a scalloped effect (Fig. 2).

Mushrooms frequently develop in a circle outside the dark green or brown ring during spring and fall after a period of heavy rainfall or irrigation.

Disease Cycle

The disease is caused by a number of soil-inhabiting fungi. The causal fungi feed on organic matter in the soil and grow outward in all directions from a central point. Fungal strands (mycelium) spread throughout the soil to a depth of 10 to 12 inches. As the fungus grows, the first visible evidence of a new fairy ring may be a cluster of mushrooms (the fruiting structure of the fungus) or a tuft of stimulated dark green grass. Later, as the fungi spread outward from the point of origin, the ring-like pattern develops.

The initial tuft of dark green grass and the ring of stimulated grass that develops later result from the nitrogen released after the fungus breaks down the organic matter in the soil. A ring of brown or dead grass may also develop, caused by the depletion of soil moisture in the area where the fungus is concentrated. If you dig into the area of brown or dead grass, you will find a dense growth of white mycelium. Water will not penetrate this zone of dense mycelial growth.

During periods of unfavorable conditions, low temperatures and drought, mushroom production and fungal activity stops and may not be resumed for months or years.

Control

Fairy rings are very difficult to control with fungicides since the soil in the infected area is almost impervious to water. Some success has been achieved by aerating the soil and drenching the infected area with a fungicide. However, results have been sporadic and generally unsuccessful.

The only methods of eliminating fairy rings are (1) to remove the soil to a depth of about 18 inches in the affected area and replace it with fresh soil or (2) sterilize the soil in the affected area with a soil fumigant. Both methods are laborious, expensive and not always successful. Also, the area can become reinfected within a short period.

Masking the symptoms of fairy rings is most effective. Aerating and drenching the soil with a wetting agent will help prevent the development of the zone of brown or dead grass in the area of dense mycelial growth. Keeping the fertility level of the turf adequate will also help to mask the appearance of the ring of stimulated, or dark green growth. Regular mowing removes the mushrooms.

Pythium Blight and Root Rot

Pythium blight, also called cottony blight or greasy spot, is a fungal disease of both warm and cool-season turfgrasses that causes both a foliar blight as well as a root and crown rot. The disease is most severe during hot, humid conditions and where there is limited air circulation. Poorly drained soils also favor the occurrence of the disease.

Symptoms

Pythium blight of the foliage is most readily recognized as small spots or patches of blighted grass that suddenly appear during warm, wet periods (Fig. 3). In the early stages, the leaves appear water-soaked, slimy (greasy) and dark. As the disease progresses, the leaves shrivel and the patches fade from green to light brown. When observing these patches in the early morning, cottony fungal growth may be seen on the foliage.

Sometimes these patches develop into diffuse streaks that follow water drainage patterns or mowing patterns. These streaks are caused by water or equipment picking up the causal fungus and spreading it along its path. Under favorable conditions for disease development, these streaks may coalesce to form large areas of dead grass. If a sudden drop in temperature or humidity or the application of a fungicide halts the development of pythium blight, distinct straw-colored patches develop.

Pythium root rot causes a general decline of turfgrass stands and is more of a problem than is generally recognized. Affected turf may appear thinned, off-color, slow growing and non-responsive to fertilizer. It is most common on highly managed golf greens and home lawns. Symptoms may become visible at any time during the growing season. Pythium root rot is one of the major causes of a poor transition from overseeded grasses to bermudagrass in the late spring. Damage to the crown and roots of bermudagrass during the early spring severely weakens the grass and slows its recovery. Such injury often goes unnoticed until it is too late to prevent.

As temperatures rise, large areas of turf may wilt, turn brown and die. Unlike pythium blight of the foliage, no cottony mycelium is evident during infection periods, and rarely can pythium root rot be diagnosed from field symptoms alone. Pythium root rot is difficult to diagnose. Although infected roots and crowns may be extensively discolored, microscopic examination of the tissue is required to detect the presence of pythium in the root tissue.

Pythium spp. also cause a pre-emergence and post-emergence seedling blight or "damping-off" of overseeded grasses resulting in small patches of dead seedlings or a general thinning of overseeded grasses.

Disease Development

Pythium spp. are commonly present in soils and thatch. Under favorable temperature and moisture conditions, the fungus resumes growth and initiates infection. With pythium foliar blight, disease development can occur rapidly by a cobweb-like mycelial growth of the fungus from leaf to leaf. The foliar blight develops most rapidly under humid conditions when air temperatures are above 80° F. As temperatures approach 90° F, only a short time is required to destroy a stand of turfgrass. With pythium root and crown rot, the environmental conditions for disease development are not well defined.

Control

Cultural practices can do much to prevent pythium blight. Good water management is very important in reducing disease potential. Remove thatch on a regular basis through frequent verticutting and topdressing, avoid lush growth produced by overfertilization and overwatering, improve air circulation by pruning or selectively removing trees bordering on the site, and improve drainage through aeration and the use of soil amendments. Increasing the mowing height and other practices that promote root growth may lessen the damage from pythium root rot.

During extended periods of warm, humid weather, a preventive fungicide program may be advisable to check the development of pythium. Fungicide control of pythium root rot is less consistent than control of foliar blight. On overseeded bermudagrass greens, Apron- or Koban-treated seed can be used to limit pythium seedling blight during the establishment period. Fungicide applications may be needed 7 to 21 days after planting to protect the young seedlings.

Brown Patch

The name brown patch is not very descriptive of the varied symptom expression caused by *Rhizoctonia* sp. on turfgrass. Symptoms differ on cool- and warm-season grasses and vary depending on environmental conditions and cultural practices.

Symptoms

Turfgrass affected by brown patch will generally exhibit circular or irregular patches of blighted grass. On cool-season grasses during periods of warm, humid weather, a darkened border or "smoke ring" may develop at the outer margin of the patches. This smoke-ring symptom occurs when the pathogen is actively causing a uniform and rapid wilting of the newly infected leaf blades. It frequently does not occur, but when it does, it is usually observed only in the morning when dew is still present or during very wet weather. The smoke-ring symptom is not reliable for diagnosis. Mowing height will also affect symptom expression.

On warm-season grasses, symptoms are different than on cool-season grasses. Circular to irregular patches of blighted turf up to several yards in diameter develop commonly in the fall, winter and spring when these grasses are approaching or emerging from dormancy, evening temperatures are below 68° F, and rainfall usually increases (Fig. 4). The smoke-ring symptom sometimes observed on cool season turfgrasses is usually absent, but active infections may be noticeable by yellowish leaves at the margins of the patches. Often infected basal leaf sheaths become rotted, and a gentle tug on the leaf blade easily separates the leaf at the base of the leaf sheath. The roots of turfgrass with brown patch usually are not discolored. Brown patch develops most rapidly when air temperatures are between 75 and 85° F and wet conditions are present. The disease progress generally subsides when air temperatures rise much above 90° F.

Control

The severity of brown patch may be reduced by irrigating only on an as-needed basis, watering early in the morning to remove dew and allow the grass to dry quickly as opposed to watering in the evening, and avoiding heavy applications of nitrogen during the spring and fall. A number of fungicides are recommended for brown patch control. The fungicides are most effective when used on a preventive basis as compared to their use after the disease has become well established.

Take-all Patch

Take-all patch, caused by the fungus *Gaeumannomyces graminis* var. *graminis*, is a serious disease of St. Augustinegrass and can also cause problems on bermudagrass. It seems to be active during the fall, winter and spring when there is abundant moisture and temperatures are moderate. The disease has the

ability to destroy large sections of turfgrass if left uncontrolled, and has proven to be a difficult disease to control.

Symptoms

When the disease is active, the first symptom is often a yellowing of the leaves which may eventually die and turn brown. The area of discolored and dying leaves may be circular or irregular in shape and at least up to 20 feet in diameter. A thinning of the turfgrass within the affected area occurs as roots, nodes and stolons become infected and the plants decline (Fig. 5). Unlike brown patch, the leaves of take-all infected plants do not easily separate from the plant when pulled. The roots are sometimes so rotted that damaged stolons are easily pulled from the ground. Regrowth of the grass into the affected area is often slow and unsuccessful as the new growth becomes infected. During the stressful high temperatures of the summer months, the weakened, infected turfgrass will continue to decline.

Disease Cycle

The pathogen survives on infested debris and on infected parts of living perennial grass plants. When conditions are favorable (cool, moist weather), the fungus grows on the surface of roots, stolons, rhizomes, crown and leaf sheaths of the grass and then penetrates and infects the tissues. As the weather becomes warmer and dryer, the infected plants are stressed, and symptoms become more evident. The pathogen can be spread over long distances when infected plants or plant debris are transported mechanically. Infected sod may serve as a source of inoculum even if it shows no immediate symptoms of the disease.

Control

Controlling take-all patch is not easy and much has yet to be learned about the disease. Control efforts should consider both cultural and chemical methods. Good surface and subsurface drainage is important. Excessive watering can also be favorable to development of take-all patch. Irrigating only when required to maintain good plant growth and vigor is suggested, and infrequent but thorough watering is preferred to frequent shallow watering.

Since the pathogen can survive on infested thatch, prevention of thatch build-up is suggested. Efforts to dethatch and to prevent thatch accumulation may prove helpful. If soil compaction exists, aerification will help to alleviate this condition and allow the grass to establish a deeper, more vigorous root system.

Balanced fertility is important. If possible, adjust the soil pH in the upper root zone so that it is slightly acidic, preferably within a range of pH 6.0 to 6.5. The use of ammonium sulfate as a source of nitrogen fertilizer will help acidify the soil. There is evidence that the use of ammonium sulfate as the source of nitrogen fertilization can significantly reduce the incidence of take-all patch if used over a long period of at least two years. However, to avoid thatch build-up, it is not advisable to apply more that 4 pounds of nitrogen per 1,000 square feet per year or more than 1 pound of nitrogen per application per 1,000 square feet when ammonium sulfate is used on St. Augustinegrass. More frequent but low-rate applications would be preferable. Application of elemental sulfur at the rate of 3 to 5 pounds per 1,000 square feet in several split applications can also help to acidify the soil.

The fungicides Rubigan and Bayleton are labeled for the control of take-all patch caused by *Gaeumannomyces graminis*. Since infection is thought to occur primarily in the fall, with disease progression continuing during the fall and winter months under cool, moist conditions, fall applications may be the best time for fungicides to be applied for preventive purposes. Their efficacy in controlling the already established disease may be disappointing.

Fusarium Blight

Fusarium blight is caused by the widespread fungi *Fusarium* spp. The disease is most troublesome on cool-season grasses such as bentgrass, bluegrass and tall fescue, but occasionally attacks the warm-season grasses as well. The disease is most serious during hot, humid conditions when the turfgrasses are under drought stress.

Symptoms

Initially, affected grasses show light green patches 2 to 6 inches in diameter. The shape of the affected areas may appear as circular patches, elongated streaks or crescents. At high temperatures, the patches quickly change from light green to reddish-brown, then tan and finally straw-colored (Fig. 7). Sometimes at this stage, a doughnut-shaped area up to 3 feet in diameter with healthy grass in the center will give a "frog-eye" pattern to the disease area. When conditions of high temperature and high humidity persist for an extended time, these diseased areas become numerous and may overlap. Thus, large areas of turf may appear blighted. As the disease progresses, the grass dies as a dark-brown to black dry rot of roots, crowns, rhizomes and stolens occurs.

Sometimes, on individual leaves, irregularly-shaped tan spots with light brown to purplish-brown margins occur mostly on the older leaves.

Disease Cycle

The fungi that cause fusarium blight survive the winter in the thatch layer and on infected grass roots, crowns and rhizomes. *Fusarium* spp. cause leaf spots and abundant sporulation during warm, wet weather. High temperatures and drought seem to favor development of the crown and root rot expression of the disease, which occurs primarily in areas that are fully exposed to sunlight. The pathogen shows little activity when air temperatures are below 70° F.

Control

Conditions that favor fusarium blight include excessive nitrogen application in the spring or summer, excessive thatch, and mowing at lower than recommended heights. Reducing plant stress aids in managing fusarium crown and root rot. Watering should be as infrequent as practical to avoid stress, but thorough and deep. Several fungicides are labeled for control of fusarium blight.

Spring Dead Spot in Bermudagrass

One of the most noticeable and destructive diseases of bermudagrass is known as Spring Dead Spot (SDS). SDS has been observed in most states where bermudagrass is grown. The prevalence and severity of the disease have been increasing for several years, and it may be the most destructive disease of bermudagrass in some states. In Texas, SDS has been observed in all areas except extreme South Texas. The disease has been particularly severe in North Texas and the Texas Panhandle.

In North America, three fungi have been shown to cause SDS: *Leptosphaeria korrae*, *Ophiosphaerella herpotricha*, and *Gaeumannomyces graminis* var. *graminis*.

The symptoms of SDS are small circular dead areas of bermudagrass 6 inches to several feet in diameter in the spring as bermudagrass resumes growth from winter dormancy (Fig. 8). The bermudagrass roots and stolons in affected spots appear dark and rotted. The grass recovers very slowly during the summer months from stolons creeping in from the border of affected areas. Bermudagrass stolons that grow into the affected areas usually produce short, stubby roots. In Texas it is usually mid-summer before the affected areas are covered by bermudagrass, and the areas can be seen throughout the summer because of thin turf and weeds. The disease develops again the following year in the same areas. The spots enlarge each year and after 2 to 3 years may develop into circular areas where bermudagrass survives in the center. At this stage the symptoms can be confused with those of fairy ring.

All varieties of bermudagrass are susceptible to SDS. Hybrid varieties such as Tifgreen appear to be the most commonly affected. The disease does not usually develop until 3 to 4 years after establishment and may be associated with moderate thatch accumulation.

In California and Australia the disease has been controlled by repeated applications of fungicides such as Banner, Tersan 1991, and Rubigan. The applications must begin in late summer or early autumn when the fungus is thought to be most active. Judicious use of nitrogen fertilizer helps to reduce disease severity. Ammonium-based nitrogen fertilizer combined with potassium helps reduce SDS over time.

Rust

Rust diseases are found throughout the U.S. on most species of grasses. Bluegrass, ryegrass and zoysiagrass are most commonly affected. Rust diseases are favored by warm humid conditions and develop most frequently on grasses subject to stress such as droughty conditions, low nitrogen fertility and shade. Low mowing heights, particularly on Kentucky bluegrass, also increase the susceptibility of grasses to rust.

Symptoms

The disease first appears on grass leaves as small orange to reddish-brown flecks that enlarge to form raised pustules on leaves and stems (Fig. 9). Individual pustules are usually oval or elongated and contain a powdery mass of orange to reddish-brown spores. As the pustules mature they turn brown to black. Heavily infested turf becomes thin with an overall yellow-orange to reddish-brown color. Infected leaves turn yellow, wither and die.

In southern states, ryegrasses are highly susceptible to rust in the spring, particularly where nitrogen fertility is low. Zoysiagrasses are most often affected by rust in the fall as the growth rate of grass slows and environmental conditions favor disease development.

Control

Cultural practices which improve the vigor of the turf also help prevent rust. To reduce the incidence of rust, keep nitrogen levels adequate for turf growth, avoid moisture stress or overwatering and adjust mowing heights according to the grass needs. In the case of Kentucky bluegrass and perennial ryegrass, use varieties that have good resistance to rust where the disease is a problem.

Fig. 1 Dollar Spot on bermudagrass

Fig. 2 Section of a Fairy Ring on lawn

Fig. 12 Leaf lesions caused by Bipolaris sp. on bermudagrass

Fig. 6 Characteristic infection pads (hyphopodia) of Take-all Patch fungus on stolon of infected St. Augustinegrass under 400 x magnification with a compound microscope

Fig. 11 Gra
St. A

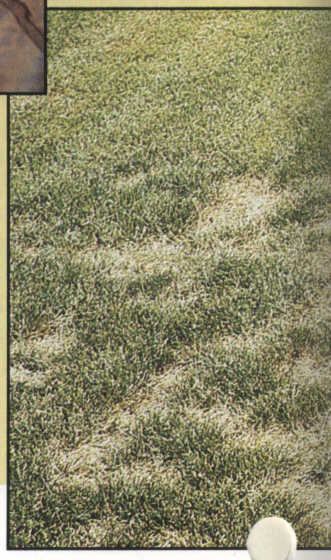

Fig. 7 Fusarium

Fig. 5 Take-all Patch on St. Augustinegrass during the summer

Fig. 4 Advanced Rhizoctonia Brown Patch on St. Augustinegrass

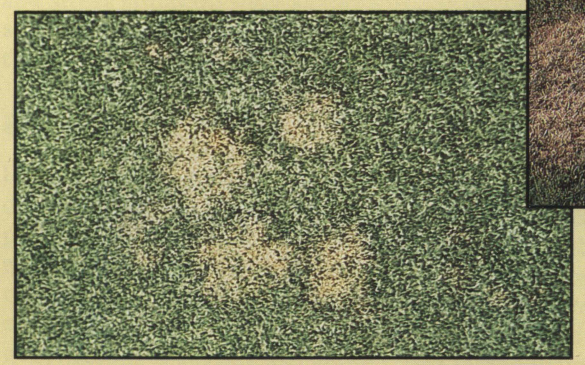

Fig. 3 Pythium Blight

Spot on
tinegrass

Fig. 10 Leaf symptoms of St. Augustinegrass Decline

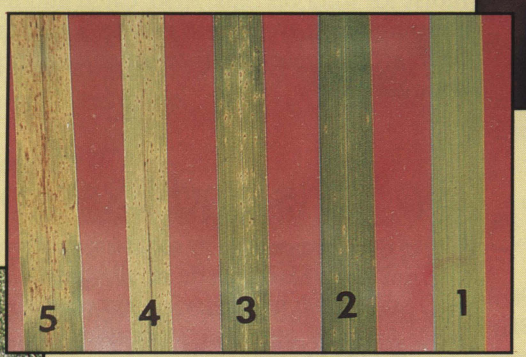

Fig. 9 Rust pustules on St. Augustinegrass

on Poa pratensis

Fig. 8 Spring Dead Spot on bermudagrass

Where these measures fail to provide adequate control of rust diseases, fungicides are available for its control.

St. Augustine Decline

St. Augustine Decline (SAD) is a virus causing a chlorotic mottling or stippling of St. Augustinegrass leaves. St. Augustinegrass and centipedegrass are the only turfgrasses that the virus is known to affect. The virus is widespread in Texas and has been reported in Louisiana and Arkansas.

Description

In the early stages of infection, St. Augustinegrass leaves show a chlorotic mottling or stippling (Fig. 10). As the mottling progresses, leaves develop a chlorotic appearance. Usually 3 or more years after the early symptoms are observed St. Augustinegrass becomes weakened to the extent that bermudagrass invades the lawn. Also, grass infected with SAD and growing under shade or other stress conditions will begin to thin out and be replaced by weeds.

St. Augustinegrass infected with SAD is also slower to recover from dormancy than healthy grass. In the spring following an unusually cold winter, much of the diseased St. Augustinegrass does not recover.

Lawns infected with SAD will respond to fertilization, but the symptoms remain. Early fall and late spring applications of complete fertilizer and summer applications of iron will help maintain good color of SAD-infected lawns.

Early stages of SAD are often confused with iron chlorosis, but the two can be readily distinguished. Leaves showing chlorosis caused by iron deficiency are either uniformly yellow or show characteristic yellow stripes parallel to the mid-vein of the leaf. Iron chlorosis also appears first in the new, or young leaves, whereas SAD produces the mottling in young and older leaves. Iron chlorosis is readily corrected by a foliar application of iron sulfate or iron chelate.

Control

The SAD virus is mechanically transmitted by mowing equipment, edgers and other tools. Mowing companies that mow several lawns with the same equipment can transmit the virus from an infected lawn to a healthy lawn. Cleaning the mowing equipment with steam or a 10 percent chlorine bleach solution will help prevent the spread of the virus, but complete disinfestation is difficult to obtain.

However, the best control for the virus is to introduce resistant varieties of St. Augustinegrass into the lawn. Presently, Floratam, Floralawn, Raleigh and Seville are SAD-resistant varieties of St. Augustinegrass.

Gray Leaf Spot on St. Augustinegrass

Gray leaf spot, caused by the fungal organism *Pyricularia grisea*, develops rapidly with abundant moisture and warm weather in the spring and early summer on St. Augustinegrass lawns. The disease is especially troublesome in shaded areas.

Symptoms

Gray leaf spot causes oval or circular, tan colored lesions with brown or purplish borders on the leaf blades of St. Augustinegrass (Fig. 11). In severe cases of gray leaf spot, lesions develop on leaf sheaths and stems and the leaves wither and die. Under these conditions the disease causes serious thinning of St. Augustinegrass turf. Unless the disease is controlled, a stand of St. Augustinegrass may be lost.

Control

To reduce the severity of gray leaf spot, avoid applications of soluble nitrogen fertilizers on moderately shaded lawns during summer months. Herbicide applications which may weaken St. Augustinegrass should also be avoided on shaded lawns. Apply water to the lawn in early morning only when water is needed. Avoid late afternoon and evening watering which keeps the leaf surface moist for long periods. Also, catch and remove grass clippings in lawns where gray leaf spot is a problem. Several fungicides are recommended for gray leaf spot control.

Bipolaris and Exserohilum Diseases

The *Bipolaris* and *Exserohilum* spp. of fungi were once grouped under the name *Helminthosporium*. They cause leaf spots, crown rots and root diseases mostly on warm-season turfgrasses.

Symptoms

Small purplish to black spots may appear on leaves, stems or crowns of infected plants. The spots may eventually fade to brown and then tan to whitish (Fig. 12). Severely infected leaves may die and appear light tan to straw colored. Extensive damage occurs when the pathogen attacks crown, stolons, rhizomes or roots. This results in a thinning or "melting out" of large areas of turfgrass in irregular patterns.

Disease Cycle

The disease-causing fungi survive the winter as mycelium in the tissue of infected plants and the

thatch layer of the turfgrass. As temperatures warm in the spring, the disease first appears as small spots on the leaves or stems. The disease severity increases with increasing temperature and humidity and is often greater when the grass is maintained at low levels of nitrogen and potassium fertility. Also, any stress situation such as drought, herbicide injury, soil compaction or heavy traffic seems to increase the severity of the disease.

Control

Healthy turfgrass is the best protection against this disease. Maintain moderately vigorous turf through proper fertilization, giving special attention to maintaining adequate, but not excessive, levels of nitrogen and potassium. Try to reduce plant stress by eliminating any soil compaction problems, providing good surface and sub-surface drainage, watering adequately but not excessively or too frequently, and avoiding herbicide applications during periods of disease activity. Disperse traffic in high traffic areas, such as golf greens, by moving the cup frequently. Fungicides can help protect the turf during high disease activity. Preventive applications are much more effective than treating a severe outbreak.

Powdery Mildew

Powdery mildew is primarily a problem on Kentucky bluegrass turf growing in partial shade or in areas with poor air circulation. The disease is most often found in the spring and fall when days are cloudy and nights are cool and damp.

Symptoms

The disease appears as a white light gray powdery growth on the upper surfaces of leaves and leaf sheaths. It spreads rapidly in shaded areas and the powdery growth becomes increasingly dense. The lower leaves of Kentucky bluegrass may be completely covered by the powdery growth. Infected leaves turn yellow, become tan or light brown and gradually shrivel and die.

Repeated infestations of the disease result in greatly reduced growth and eventual death of plants. Surviving plants often remain in a weakened condition.

Control

Reduced shading and increased air circulation will help control powdery mildew. Where these conditions cannot be changed, fungicides are available for control.

Nigrospora Stolon Rot

Nigrospora stolon rot can result in a general thinning and patchiness of infected St. Augustinegrass. Dark brown lesions occur on the stolons. The lesions eventually girdle the stolon, cutting off the flow of water and nutrients, and causing the tillers at the end of the stolon to wilt, turn yellow and die. Any new growth on the terminal end of infected stolons is typically thin and yellow, reflecting a limited supply of nutrients to the growing point. Overall symptoms are similar to those caused by chinch bugs on St. Augustinegrass.

The disease is most prevalent during the spring and early summer on St. Augustinegrass. *Nigrospora sphaerica* is considered a weak pathogen that can effectively attack St. Augustinegrass only after the grass has been weakened by stress. Environmental conditions such as low winter temperatures, severe drought, very high temperatures during the spring and summer, soil compaction, and dry or infertile soils can predispose St. Augustinegrass to infection. The pathogen apparently does not infect grass that has not been first weakened by stress.

Following good turfgrass management practices to lessen severe stress on the turf is recommended. Balanced fertility, raising the mowing height, watering deeply but infrequently to avoid moisture stress, and avoiding the use of herbicides or installing new sod during extended periods of hot, humid weather should all help to manage the disease. Two applications of the fungicide Chlorothatonil at 1 ounce active ingredient per 1,000 square feet at 14- to 21-day intervals have provided good control of the disease.

Centipede Decline

In mature centipedegrass lawns (3 or more years old) problem areas appear in the spring and enlarge throughout the summer. These problem areas usually develop in thatchy turf, compacted soils, droughty spots or areas under some stress. Since a specific disease organism has not been identified as the causal agent, the problem has been broadly named "centipede decline."

Symptoms

Centipede decline is descriptive of the problem as the grass gradually deteriorates and is replaced by weeds or other grasses. Frequently, the grass greens up in early spring and gradually turns off color, wilts and dies. These areas may initially be less than 1 foot in diameter, but by mid-summer may have expanded 3 to 6 feet in diameter. Individual areas may coalesce to produce large irregular shaped patterns of wilted and discolored turf. Such areas resemble centipedegrass suffering from drought conditions.

Examination of turf in these declining areas reveals very little root development. In fact, many of the stolons have no root attachment to the soil. Some small discolored roots may be found in the thatch, or the organic layer. The grass may be dead in the center of the area with discolored, often dark green, leaves radiating into the healthy grass.

Control

Cultural practices provide the most effective means of preventing centipede decline. Mowing practices have been shown to affect the development of the disease. Mowing heights above 2 inches tend to promote centipede decline; while mowing heights of 1 1/2 inches or less at weekly intervals lessen the problem. Mowing height does not provide absolute control, but reduces the potential for centipede decline.

Application of nitrogen (N) at rates above 2 pounds per 1,000 square feet per year have been shown to increase problems with centipede decline. Ideal N fertilization of centipedegrass would be 0.5 pounds N per 1,000 square feet in April, June, August and October. If rates of 1 pound or more are applied, slow release nitrogen sources should be used. The addition of iron as ferrous sulfate or iron chelate will improve the color response to nitrogen.

Both mowing height and fertilization affect thatch accumulation in centipedegrass lawns. Mowing heights above 1 1/2 inches and fertilization rates above 2 pounds of N per 1,000 square feet per year increase thatch accumulation. Thatch is believed to be a major contributor to the centipede decline problem. The absence of thatch in newly established lawns might explain the waiting period of 3 or more years for centipede decline to appear. Where thatch is greater than 1/2 inch in depth, cultivation practices may help prevent disease development. Vertical mowing, aeration and topdressing have all been shown to aid in thatch control. The same practices also help water penetration in thatchy soils.

Since the disease resembles drought stress in centipedegrass, watering practices may affect the expression of centipede decline. Thorough and infrequent irrigation is ideal where soil characteristics and depth of rooting allow such scheduling. But in thatchy turf or on compacted soils, light and frequent irrigation is needed to avoid drought stress in centipedegrass.

FUNGICIDE DIRECTORY

Common Name	Some Trade Names*	Brown Patch	Dollar Spot	Gray Leaf Spot	Bipolaris Leaf Spots	Pythium Blight	Fusarium Blight	Rusts	Take-All Patch	Spring Dead Spots
benomyl	Tersan 1991, many others	X	X				X			
chloroneb	Pro Turf Fung. V, Teremec Sp					X				
chlorothalonil	Daconil 2787, Thalonil, Ortho Multipurpose Fung., Hi-Yield Daconil Lawn Fung., Security Fungi-Guard	X	X	X	X			X		
chlorothalonil and fenarimol	Broadway, Twosome	X	X	X	X			X		
cyproconazole	Sentinel	X	X	X				X		
ethazole	Koban, Terrazole					X				
fenarimol	Rubigan	X	X				X		X	X
flutolanil	Prostar	X								
fosetyl-Al	Chipco Aliette					X				
iprodione	Chipco 26019, Pro Turf Fung. X	X	X		X		X			
mancozeb	Fore, Penncozeb, many others	X	X		X	X	X	X		
metalaxyl	Subdue, ProTurf Pythium Control					X				
PCNB	Penstar 75, Terraclor, Turfcide	X	X		X					
propamocarb	Banol					X				
propiconazole	Banner	X	X	X	X			X		
thiophanate-methyl	Fungo, Cleary's 3336, ProTurf Systemic Fung.	X	X				X			
thiophanate-methyl and mancozeb	Duosan	X	X	X	X			X		

FUNGICIDE DIRECTORY (continued)

Common Name	Some Trade Names*	Brown Patch	Dollar Spot	Gray Leaf Spot	Bipolaris Leaf Spots	Pythium Blight	Fusarium Blight	Rusts	Take-All Patch	Spring Dead Spots
triadimefon	Bayleton, Pro-Turf Fung. VII		X				X	X	X	
vinclozolin	Vorlan, Touche		X		X					X

*All labeled trade names are not listed in this table. Reference to commercial products or trade names is made for educational purposes and is not intended as an endorsement by the authors, the Texas Agricultural Extension Service or Texas A&M University. Follow manufacturer's recommendations and precautions on all product labels. The above mentioned products were labeled as of the date of publication. Labels change unexpectedly, so it is important to always read the label.

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