

# PEST LIBRARY DISEASES

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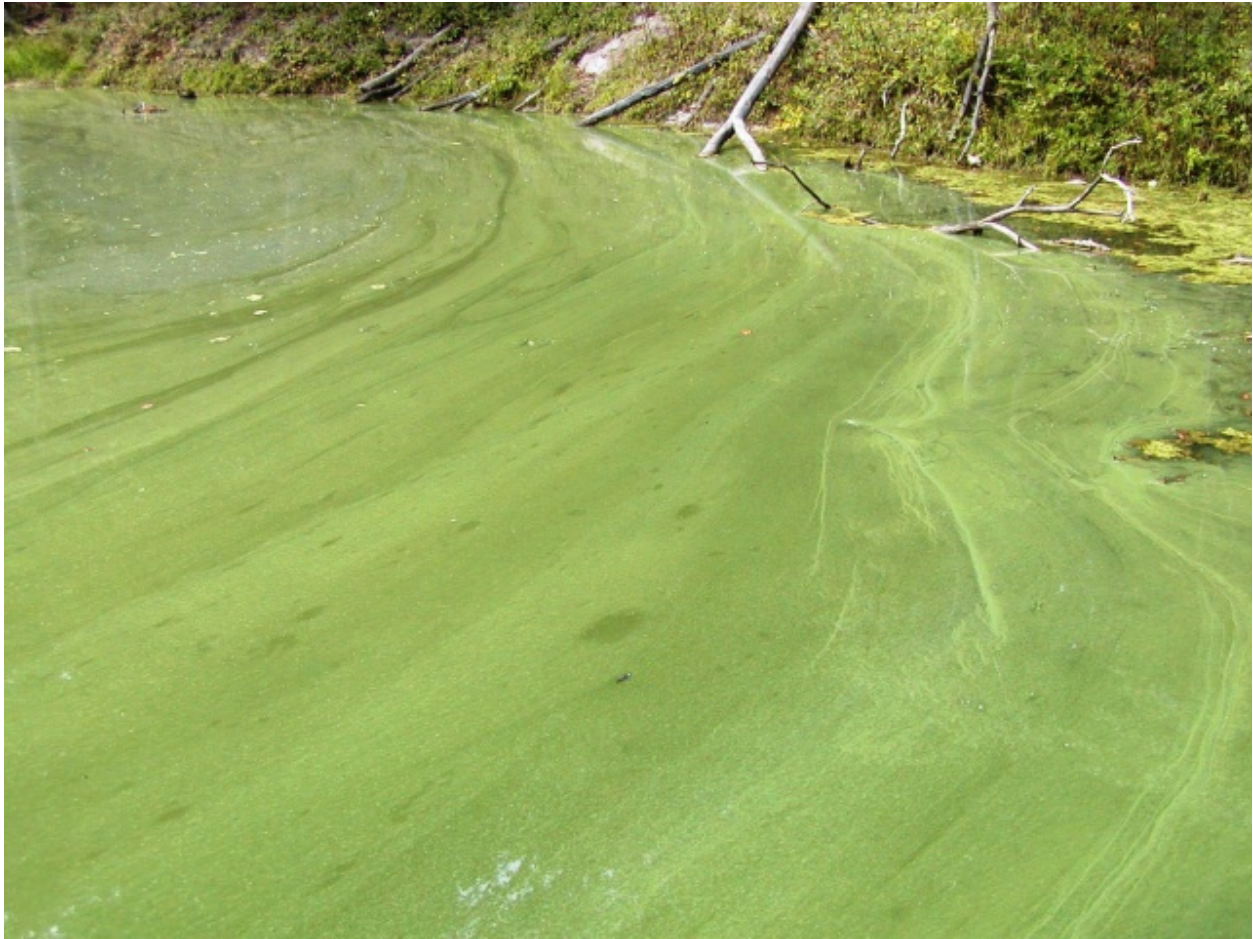
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# ALGAE, BLUE-GREEN



Cyanobacteria likewise known as (blue-green algae, blue-green bacteria, and Cyanophyta) is a phylum of bacteria that obtain their energy through photosynthesis. The name "cyanobacteria" originates from the color of the bacteria.

The ability of cyanobacteria to carry out oxygenic photosynthesis is believed to have converted the early reducing atmosphere into an oxidizing one, which significantly changed the make-up of life forms on Earth by stimulating biodiversity and leading to the near-extinction of oxygen-intolerant organisms. The endosymbiotic theory explains that chloroplasts in plants and eukaryotic algae have evolved from cyanobacterial ancestors through endosymbiosis.

We can find cyanobacteria almost everywhere, from oceans to fresh water to bare rock to soil.

They can occur as planktonic cells or form phototrophic biofilms in fresh water and marine environments, they occur in damp soil, or even on temporarily moistened rocks in deserts. A few are endosymbionts in lichens, plants, different protists, or sponges and give energy for the host. Some live in the fur of sloths, supplying a form of camouflage.

Aquatic cyanobacteria are probably best recognized for the extensive and highly visible blooms that can form in both freshwater and the marine environment and can have the appearance

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of blue-green paint or scum. The association of toxicity with such blooms has usually brought about the closure of recreational waters when blooms are observed. Marine bacteriophages are a significant parasite of unicellular marine cyanobacteria. When they infect cells, they lyse them, launching more phages into the water.

Numerous cyanobacteria also form motile filaments, called hormogonia, that travel away from the main biomass to bud and also create new colonies in other places. The cells in a hormogonium are often thinner than in the vegetative state, and the cells on either end of the motile chain may be tapered. A hormogonium often must tear apart a weaker cell in a filament, called a necridium so that it can break away from the parent colony.

Each individual cell of a cyanobacterium generally has a thick, gelatinous cell wall. They do not have flagella, but hormogonia and some species may move about by gliding along surfaces. Many of the multi-cellular filamentous forms of *Oscillatoria* are able to do a waving motion; the filament oscillates back and forth. In water columns some cyanobacteria float by forming gas vesicles, like in archaea. These vesicles are not organelles as such. They are not bounded by lipid membranes but by a protein sheath.

Some of these organisms contribute significantly to global ecology and the oxygen cycle. The tiny marine cyanobacterium *Prochlorococcus* was discovered in 1986 and accounts for more than half of the photosynthesis of the open ocean. Many cyanobacteria even display the circadian rhythms that were once thought to exist only in eukaryotic cells.



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# ANTHRACNOSE



Anthracnose is brought on by *Colletotrichum graminicola*, a fungus that survives and grows on dead and rotting organic matter. Although anthracnose may happen occasionally in turf preserved for athletic fields, professional landscapes, and residential lawns, it is mainly a disease of intensively managed annual bluegrass and creeping bentgrass used on golf courses. The anthracnose pathogen can result in two kinds of infections: a foliar blight (during stressful summer conditions), or a basal stem rot in annual bluegrass and creeping bentgrass (during cool, wet periods in spring). It is not clear how the foliar blight and basal stem rot diseases are related. The basal rot anthracnose is the more destructive phase of the disease. A variety of summer stresses, including heat, drought, nitrogen

deficiency, close mowing, and compaction predisposes turfgrass to the foliar blight phase of anthracnose. Stress leads to premature decline and senescence, and limits the potential for turf recovery.

There also is evidence that pre-emergence herbicides also stress plants, predisposing them to anthracnose infection. The anthracnose fungus readily colonizes dead leaf blades under stressful conditions. When conditions are especially favorable, green leaf tissues and possibly crown tissues are infected, resulting in serious damage to the turf stand. Foliar blight anthracnose spreads largely by rain-splashed spores. Infection does not result in any visible surface mycelium. From a distance, anthracnose-infected turf tends to have

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a yellow-orange cast and appears to lack its usual vigor. Affected areas are not well-defined, although they may occur in clusters. Irregularly shaped tan leaf spots may occur on infected leaves. Anthracnose leaf spots appearing on green leaf tissues indicate aggressive disease activity. Typically, infected leaves turn yellow and decay from the tips downward. Foliar blight usually follows normal summer senescence of annual bluegrass.

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# BACTERIA WILT



Bacterial wilt is an increasing condition of annual bluegrass (*Poa annua*) throughout New England. The condition is caused by the just known bacterial condition of turfgrasses in the United States. Initially determined as an illness of vegetative creeping bentgrass, bacterial wilt currently seems limited to annual bluegrass putting greens. The disease might likewise appear, however, on collars and/or approaches. Microbial wilt might appear during the spring, however, typically will certainly continue throughout the summertime. The disease is favored by periods of heavy rains or cloudy and gloomy weather. The disease may subside throughout sunny and dry weather yet can swiftly resurge following rain. In circumstances where the condition is chronically severe, improvement of annual bluegrass putting greens with creeping bentgrass may be necessary.

Microbial wilt has a tendency to be a lot more serious on shaded and/or poorly drained greens.

Due to their inability to directly permeate cells, bacteria need to enter the plant via an all-natural opening such as stomata or via wounds. Once inside the plant, the bacteria flood the cells and limit the all-natural circulation of water and nutrients with the vascular cells. Initial signs appear as wilt as well as individual contaminated yearly bluegrass plants quickly transform reddish-brown or yellow and die. Collapsed plants typically look like whitish-tan, dime-sized spots. During a serious infection, large areas can be killed in a non-uniform pattern within a few days.



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# BLACK SPOT



Blackspot disease, *Diplocarpon rosae*, is a common and serious fungal disease affecting rose plants. Dark brown or black spots begin showing up on infected plants at the beginning of the growing period. The spots appear on the lower branches and slowly spread upward. Eventually, the leaves turn yellow and fall off. The spots can also appear on the stalks, or canes, of rose shrubs.

This leaf disease attacks plants throughout the year, however, is most widespread throughout dry months. If left neglected, black spot spreads quickly as well as weakens plants severely. It is necessary to understand that Black Spot is a soil-borne fungus and is present at all times. Appropriate treatment and culture can

substantially decrease the instances of this disease.

To avoid blackspot, plant rose varieties that are immune. Or else, plant bushes in warm areas with good air circulation, because that will certainly decrease the time moisture lingers on the leaves. Infection can happen after only seven hours of continued leaf wetness. Stay clear of dense plantings and also watering late at night. Hosing down or misting leaves can also reduce the chances of blackspot. Instantly remove any infected leaves. They should not be composted because that can allow them to spread.

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# BROWN BLIGHT



## Trees and Ornamentals

Brown-spot needle blight, brought on by *Scirrhia acicola* (Dearn.) Siggers, negatively affects growth and causes mortality of longleaf pine (*Pinus palustris* Mill.). Brown spot lowers the total annual growth of southern pines by more than 16 million cubic feet (0.453 million cubic meters) of wood. The worst damage is on longleaf seedlings in the grass stage; i.e., those that have not begun active height development. Heavily infected seedlings may remain in the grass stage for a decade; even more.

## Turfgrass

Brown spot has likewise become a serious issue to specific varieties of Scots pine (*P. sylvestris* L.)

and other pines grown in Christmas tree plantations in the north and mid-central States (see photo). Thousands of dollars are lost every year by Christmas tree growers because this fungus causes needle drop, damaging trees and making them useless. Brown blight is a disease that takes place on perennial ryegrass during cool, damp, and gloomy periods in the spring or fall. Brown blight is a "Helminthosporium"™ disease, which is a complex of diseases caused by fungi that create large, cigar-shaped spores. Symptoms of brown blight start off as small, brown, round or oval spots on the perennial ryegrass leaves. As the disease advances, the lesions expand and increase in number, causing a brown or yellowish-brown dieback of entire leaves or plants. This foliar blight stage shows up in irregular



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patterns, although certain "hot spots"™ may be more significantly damaged than others.

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# BROWN PATCH



The signs of brown patch differ according to mowing height. In landscape situations, where mowing height is greater than 1", brown patch shows up as roughly circular patches that are brown, tan, or yellow in color and range from 6" to several feet in diameter. The affected leaves typically remain upright, and lesions can be seen on the leaves that are tan in color and irregular in shape with a dark brown border. When the leaves are wet or humidity is high, small amounts of gray cottony growth may be seen growing amongst affected leaves. This is called mycelium. In close-cut turfgrasses (1" or less), brown patch grows in roughly circular patches, ranging from a few inches to several feet in diameter, that are brown or orange in color. Distinct foliar lesions cannot

be seen and mycelium is not usually present, but a black or dark gray ring, called a smoke ring, may surround the brown patches. The smoke ring is evidence of active development of the disease and is only present when the turfgrass leaves are wet or humidity is near 100%.

Under desirable environmental conditions, brown patch symptoms may develop overnight. On creeping bentgrass and annual bluegrass greens and tees, brown patch development leads to circular olive green stains, ranging from 4 to 12 inches in diameter. Leaf blades within the patch turn brown after infection, while a gray-white band is normally apparent at the perimeter of active patches. The band (often called a smoke ring) is

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brought on by advancing mycelium and water-soaked infected leaves. Smoke rings may occur on taller mown turf but are much less evident. Figure 4 shows advancing mycelium surrounding brown patch on perennial ryegrass. Individual lesions on leaf blades with brown margins occur on all affected grass species but are most evident on tall fescue. Brown patch is a summer disease. The pathogen becomes active during hot, humid periods when dew periods exceed 10 hours and nighttime temperatures remain above 65F. Also, outbreaks will be much worse when nitrogen fertility is too much during disease-favorable weather.



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# COPPER SPOT



Copper spot is a foliar disease of bentgrass, with severest outbreaks occurring on velvet bentgrass. It happens sporadically on creeping bentgrass greens and higher cut creeping bentgrass tees and fairways. *Gloeocercospora sorghi* causes a leaf spot of bermudagrass and zoysiagrass as well.

Although *Gloeocercospora sorghi* causes a leaf spot on creeping bentgrass in the beginning, this stage of the disease is seldom observed in the field, because infected leaves are swiftly blighted. Typically, the first sign of the disease is the appearance of pinkish orange to copper-colored patches with irregular margins (Figure 1). The patches range from 1 to 3 inches in diameter, but under favorable

conditions for disease development, patches often coalesce. Symptoms can also occur in streaks, because the fungus is easily spread by water and equipment.

The color of the patches is more apparent under damp conditions that favor production of sporodochia (fruiting bodies). The conidia (spores) are created on the sporodochia in gelatin-like masses that can be observed with a hand lens. Search for pink to salmon-colored gelatinous spore masses protruding from leaf surfaces. The long, needle-like conidia within a spore mass are multicelled and generally curved.

Symptoms are easily mistaken for those of

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anthracnose basal rot, brown patch, dollar spot, Pythium blight or red leaf spot. Dollar spot occurs under somewhat cooler temperatures and the infection sites tend to be tan rather than pink. Temperatures favorable for optimum growth of Pythium foliar blight and red leaf spot coincide with those of copper spot. Red leaf spot patches on a putting green are not as defined as those of copper spot. Initial infection sites of Pythium foliar blight have the same color to those of copper spot as well, but Pythium foliar blight develops under higher temperatures and is rare on greens-height bentgrass. Copper spot infection sites are generally more discrete than those of anthracnose basal rot, which are more diffuse.



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# DOLLAR SPOT



The fungus pathogen which causes dollar spot was formerly referred to as *Sclerotinia homoeocarpa*. Dollar spot fungi now are considered species of *Lanzia* and *Moellerodiscus*.

Dollar spot initially was a major concern on bentgrass where it forms spots as big as silver dollars, hence the name "dollar spot." However, on Kentucky bluegrass lawns the fungi may infect large areas in a matter of days. Infected areas 4 inches or larger may fuse, therefore creating large patches. Irregular patches to 12 feet wide are not uncommon on bluegrass lawns. In Colorado, this disease complex also can be a dilemma on annual bluegrass, bermudagrass, fine-leaf fescues, perennial ryegrass and zoysiagrass.

Dollar spot fungi may be spread by mowers, traveling sprinklers and other maintenance equipment. Maintaining clean equipment may help prevent the spread of this disease. Strains of dollar spot fungi grow within a wide range of temperatures, so this turf disease may be active from late spring to late autumn. However, most problems happen when temperature levels are moderately warm and change rapidly, as with warm days and cool nights. Because this disease complex often is serious on bluegrass and other turf during hot weather, many homeowners feel the resulting bleached grass is brought about by lack of water. In an attempt to correct this, they overwater the grass which may make matters even worse. They don't realize the problem is caused by fungi.



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## Identification

In the beginning, affected leaves show yellow-green blotches or bands that normally go unnoticed. These lesions slowly bleach to a white or straw color. On finer-textured turfgrasses, individual lesions on the leaves usually cover the width of the grass blade, producing a constricted area that looks like an hourglass. On coarser grasses, the spots brought about by dollar spot may not cover the blade. Leaves infected by *Ascochyta* usually begin dying back from the tips. Lesions caused by *Ascochyta* leaf blight, which occur in the middle of a blade, usually do not have an hourglass shape or a border area between the white, dead tissue and the green, healthy tissue. See fact sheet 2.901, *Ascochyta* Leaf Blight of Turf, to learn more about this disease. Individual leaf blades may have a single lesion or a couple of small lesions or be completely blighted. Infected blades typically have a distinctive tan to purplish streak within the white and green portions of the blade. These white-banded blades are most evident between dead areas and green turf. The tip of the leaf blade may show the characteristic lesion, or the lesion may be in the middle of the blade, leaving the leaf tip green. When the grass is damp from early morning dew, a fine, white cobweb-like mycelial growth (strands of fungus) may be visible on leaves that are infected by the disease. As the grass dries, the mycelium disappears. Do not confuse this with spider webs or the downy seed tufts of cottonwood trees.

## Stress Factors

Turfgrass under stress is more prone to dollar spot compared to properly maintained turf. Low nitrogen fertility, incorrect mowing (frequency and height), too much soluble salt (alkali) levels, and improper watering all make turf more prone to disease. Newly sodded or seeded lawns that receive heavy watering are also attacked often. Due to root loss, turf damaged by white grubs or billbugs may require watering daily like newly laid sod. This type of treatment may increase the severity of dollar spot and require application of an appropriate fungicide. Extended periods of high humidity or free moisture within the foliar canopy may trigger severe outbreaks. Watering turf at the wrong time may prolong this susceptible period and increase the incidence of disease.

Heavy thatch layers may develop dollar spot because water, air and nutrients cannot penetrate to the underlying soil and grass roots. This results in shallow and poorly-developed roots that are quite susceptible to drought stress. Thatch also ties up and minimizes the effectiveness of pesticides.

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# FAIRY RING



It is said that Fairy Rings are caused by many (60) different soil-inhabiting fungi of the class Basidiomycetes. These fungi can cause the development of rings or arcs of deep green grass as well as unthrifty or dead grass. The sizes of the rings may vary from a few inches to 200 feet (60 meters) or more in diameter with an yearly radial growth of 3 inches (7.6 cm) to 19 inches (48 cm) depending on grass, soil and weather conditions. The term 'fairy ring' has its origin in myth and superstition as they were believed to be the result of a circle of dancing pixies (fairies). These rings were also thought to be the result of lightning strikes and where the devil churned his butter. Today's research community has revealed that the dark green circles are caused by fungi colonizing the soil, leaf litter or thatch.

The breakdown of organic matter by fungal activity releases nitrogen stimulating grass on the outside of the ring causing it to grow taller and darker than the grass around it. The band of stimulated grass is often associated with the fruiting bodies of the fungus. The fruiting bodies range in size from 3/8 inch (1 cm) to 12 inches (30 cm) in diameter. Beware of some of these so-called 'mushrooms', 'toadstools', and 'puffballs' because they are poisonous. Be sure to pick and disposed of them if young children frequent the area. Removing these fruiting bodies does not weaken the fungus but does help enhance the aesthetics of the location.

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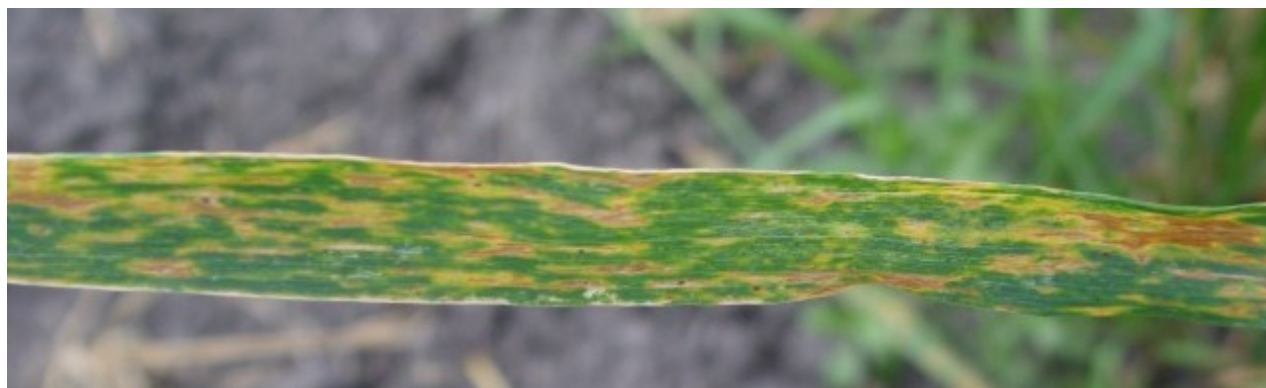
## Spread and Development

Fairy ring starts from a piece of mycelium or spore at a single point feeding as a saprophyte in the thatch layer or on soil organic matter. The consistent external growth of the fungus leads to the development of rings. Changing soil types, the fungus involved, condition of the turf, abundance and type of organic matter and obstructions all affect this radial growth. Fairy rings encountering each other in their development will typically produce a scalloped effect of stimulated or dead grass. This condition is believed to result from chemicals (metabolites) produced by the fungus inhibiting the growth of other fungi. This inhibition is called 'fungistasis'. The same condition is thought to occur on slopes, where the lower part of the ring breaks possibly due to the downward movement of these self-inhibiting metabolites. These substances are thought to prevent the growth of the fairy ring fungus in the turf at the lower part of the ring. Under certain conditions, and with certain fairy ring fungi, a ring of dead grass develops. Some of the responsible fungi have been shown to penetrate and kill root cells resulting in dead rings of grass. In addition, the mycelium of some fairy ring fungi is reported to be hydrophobic, creating a water-impervious layer resulting in drought-stress problems for the grass. Once the soil under this mycelial layer becomes dry it is very difficult to wet and the roots of the grass plant die. Some fairy ring fungi stimulate the grass but do not cause its death. The development of other fungi results in no stimulation or damage of any sort. Instead, a ring of mushrooms is the only indication of the presence of the fairy ring fungus. Depending on environmental conditions, a couple of years may pass without the production of mushrooms. The presence of dark green or dead rings may themselves be lacking. Turf subjected to extreme drought stress is more prone to problems from fairy ring.



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# FUSARIUM PATCH



Fusarium patch (*Microdochium nivale*) is a serious disease of cool season golf and sports turf grasses (bentgrass, perennial ryegrass, annual bluegrass etc.) Fusarium patch is found mostly in regions with cool humid weather conditions because of the way the disease spreads and survives. The pathogen usually infests the thatch layer where the spores can easily develop and survive. The mycelium is pink to rose in color; it normally damages the shoots of the plant. It will survive in both live and dead plant tissue; the optimum pathogenicity temperature range is 32-44 degrees F (0-6 degrees C).

Research reveals that the pathogen does not infect the crown or root of the plant, but only causes leaf blade damage. Therefore, if conditions are ideal for growth, the grass will recover. In North America, Fusarium patch is often referred to as "pink snow mold". The pathogen, *Microdochium nivale*, is the causal agent of both Fusarium patch and pink snow mold. The term pink snow mold however is used when the disease occurs under snow or tarp or leaf cover, while the term Fusarium patch is used when snow cover etc. is absent.

## Identifying Features

Fusarium patch first appears as 1-2 inch (25-50mm) diameter water soaked circular patches. They can enlarge up to as much 12 inches (300mm) in diameter. The patches will start off

with a yellow to orange-brown color. As the diseased patch grows larger, the center of the patch turns brown or tan in color. The patches can merge to form large circular or irregular shapes. When conditions are moist and the mycelium is active, there will oftentimes be a ring of pink to white mycelium around the outside of the patch.

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# GRAY LEAF SPOT



Gray leaf spot is a foliar disease that affects perennial ryegrass and tall fescue. It is brought on by a fungal pathogen (*Pyricularia grisea*) that readily infects and kills leaf blades. Leaf infections can progress into the crown area, resulting in death of individual plants. Moderate outbreaks of gray leaf spot breeds clusters of thin, off-colored turf. Severe outbreaks, however, will result in the death and decay of extensive areas and ruin the entire turf stand. Outbreaks are more likely to occur in the red area. Gray leaf spot has not been reported in the blue area.

inspection reveals blighted leaves, some with distinct lesions. Because of the rapid rate that the epidemic progresses, the leaf spot symptom may be short-lived. When leaf spots are noticeable, they may be confused with symptoms caused by the other leaf spot diseases. Therefore, accurate identification is imperative. The importance of obtaining an accurate identification as soon as possible cannot be over emphasized. The disease spreads so fast and control is so expensive that a delay in identification can come at a high cost.

## Disease Characteristics

From a distance, initial gray leaf spot outbreaks resemble drought stress. Affected turf often assumes a blue-gray cast and is noticeably thinned by dead and decaying leaf blades. Close

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# GRAY SNOWMOLD



Damage from snow mold fungi usually becomes noticeable as the snow melts and reveals the grass in late winter. Snow mold symptoms consist of roughly circular patches (at least 3 to 12 inches) of dead and matted grass blades. In extreme cases, these patches coalesce and may not be discernible as individual circles. Just after the snow melts and while the grass remains moist, one may be able to tell the difference between the two common types of snow mold found in New England by their color. The web-like mycelium of pink snow mold (*Microdochium nivale*) may initially look white and mature to a faint pink to salmon color. Gray snow mold (*Typhula* spp.) is white to gray in color. The mycelium of both types of fungi will disappear quickly as the grass dries. A useful identifying characteristic of gray snow mold is the presence of tiny brown to black mycelial masses (sclerotia) on the blades and in the leaf sheaths of infected plants.

Accurately identifying whether the disease is pink or gray snow mold is helpful because gray snow mold rarely damages more than the blades of the grass. Lawns with gray snow mold can be expected to recover fairly quickly even when the damage seems extensive. Pink snow mold, in contrast, may invade the crowns and roots causing more severe injury. It is not unusual for both types of snow mold to be found in the same area. All common lawn grasses may be infected, but Kentucky bluegrass-fescue lawns are the least prone to severe damage.



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# LARGE PATCH



Large patch is a new name for an old disease of warm-season turfgrasses. This disease was formerly called brown patch. This disease affects cool-season grasses during hot weather. Other than the fact that they affect different grasses, there are a couple of vital differences between brown patch and large patch that necessitated a name change: they occur at different times of the year, produce distinct symptoms, are produced by different strains of the fungus *Rhizoctonia solani*, and require very contrasting control strategies. Large patch appears in roughly circular patches that are yellow, tan, or straw-brown. The patches start off at 2 to 3 feet in diameter, but can expand in size rapidly up to 10 feet or more in diameter, hence the name "large patch". Multiple patches

may coalesce to surround even larger areas of turf. When the disease is actively growing, the outer edge of the patches is often red, orange, or bronze in color. Close examination of individual plants reveals the presence of reddish-brown or gray lesions on the leaf sheaths. It may be necessary to peel away the older, dead leaves in order to reveal the lesions on the younger leaf sheaths underneath.

Establishment of a disease-resistant turfgrass species is the most effective means for management of large patch. Bermudagrass rarely sustains significant damage from large patch, and grows out the symptoms quickly when the

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disease does occur. In contrast, centipede grass, seashore paspalum, St. Augustine grass, and zoysia grass often sustain serious damage and healing can take several weeks or months. Fescues and bluegrasses are immune to large patch and are also an option in areas where cool-season turfgrasses can be maintained.

Do not apply nitrogen to warm-season grasses in the fall and spring. These grasses are growing slowly during this time and do not need a significant amount of this nutrient. In general, nitrogen should not be used on warm-season grasses within 6 weeks before dormancy in the fall or within 3 weeks after green-up begins in the spring. Warm-season grasses vary in their fertility requirements, so refer to local University recommendations for more specific recommendations for timing and rates. Avoid establishing warm-season grasses in low lying areas that remain saturated for long periods of time from surface runoff. If this is unavoidable, install subsurface drainage to remove excess water from the soil. Irrigate only as needed to avert severe drought stress in the fall and spring. Control traffic patterns to avoid severe compaction, and aerify as needed to maintain soil drainage and aeration. Mow at recommended heights, and power rake or vertical mow as needed to control thatch accumulations.



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# MELTING OUT



Leaf spot is one of the most widespread fungus in cool season turfgrass in our area. It starts off as little brown spots on the sheaths, leaves and stalks. As it begins to grow the dark brown spots grow in size and the center becomes a lighter brown which indicates that the tissue in that area is now dead. Excess thatch, heavy nitrogen fertilization, excess shade, mowing too close, and broadleaf herbicides promote these diseases.

The spots may extend the width of the leaf and are somewhat longer than wide. Leaf spots may result in the death of leaf tips. Leaf sheaths are also infected, and may die, resulting in thin strands of grass. Melting out starts off as spots on the leaf blades and rapidly moves down the leaf sheath and into crowns and roots. In advanced stages, when many plants die in a large irregular patch, it is known as "melting out". These patches may

range in size from several inches up to many feet and may produce an irregular patchwork across an entire lawn.

Once "Melting Out" has begun it is challenging to control. Proper watering and mowing techniques are important in warding it off and avoiding it in the first place. If it has taken hold and areas of the lawn have undergone the "Melting Out" process, then reseeding is absolutely needed. Reseeding with resistant varieties is recommended as older varieties of bluegrass and other cool season grasses are more prone to disease. It is particularly important to not use excess nitrogen fertilizer and DO NOT water in the evening. Evening watering is never recommended as this only boosts more disease. Morning watering is the only time you should water your turfgrass. Fungicides can be used to stop leafspot but are

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usually not warranted. Most residential turfgrass will not be adversely affected by leafspot. Only under extreme conditions will this fungus bloom and cause the melting out.



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# POWDERY MILDEW



Powdery mildews are common on a wide variety of plants. Although they may look the same, each kind of plant is infected by a different species of powdery mildew fungus. Powdery mildew fungi on grasses will not infect lilacs, phlox, roses or other garden plants.

#### Symptoms:

Powdery mildew may appear quite suddenly, usually in shaded areas, and most commonly on Kentucky bluegrass. The grass blades look as if they were dusted with flour or lime. The white to gray powder is a combination of the mycelium and spores of the powdery mildew fungus. The mycelium grows over the surface of the leaf, absorbing nutrients from the plant. Later, the leaf

may turn yellowish and begin to dry up and die, but the leaves often support the presence of the powdery mildew fungus for some time without significant injury. Powdery mildew commonly shows up in turf from July to September, and occasionally in the spring. It is most common during overcast periods of cool, moist weather.

#### Life Cycle:

Powdery mildew fungi overwinter on infected grass plants and in survival structures on dead grass. Spores can infect leaves in less than two hours, and plenty of new spores pop up in about a week. Air currents carry the spores to new grass plants. Disease development can be so rapid that powdery mildew may seem to appear very suddenly.

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#### Cultural Management:

Powdery mildew is usually a disease of shaded turfgrass. Similar grasses growing nearby in full sun usually will remain free of powdery mildew. To reduce shade and increase air circulation, prune shrubs and tree branches. If grass is thin or weakened in shady areas, re-seed with shade-tolerant grass species and select cultivars resistant to powdery mildew. If grass is growing very poorly because of shade, consider its replacement with shade-loving ground covers such as hosta, pachysandra or lily-of-the-valley. In moist, shaded areas of lawns, powdery mildew may be prevented or reduced by careful lawn care. Avoid excess nitrogen fertilizer, raise the mowing height and water deeply but not often. Avoid frequent, light sprinkling.

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# PYTHIUM BLIGHT



Pythium blight begins in mature turf as small slimy or greasy looking spots. The spots may take on a reddish color if weather conditions become cooler and drier. When the turfgrass is wet or where air circulation is poor, the cottony, white, web-like mycelium of the fungus may appear. This disease can develop very quickly and extensively in poorly drained areas and is especially prone to following surface drainage channels. Other common names for this disease are "greasy spot" or "cottony blight," and it occurs most commonly in perennial ryegrass lawns. Pythium fungi are "water molds" which produce microscopic swimming spores. These spores are attracted to living plants. Plants that are succulent from recent nitrogen fertilization are more susceptible to infection. The fungi grow

well in soil and thatch in wet weather and survive as thick-walled resting spores during adverse conditions. Pythium species are present in every soil and will grow rapidly under conducive conditions. Pythium fungi commonly cause seed rots and seedling death, resulting in the poor establishment of newly seeded turf. Infected seeds are not able to germinate. Infected seedlings are discolored, and many topple over at the soil line and die.



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# PYTHIUM ROOT ROT



Pythium root rot is a continuous problem in areas that are poorly drained or over-irrigated. The disease can also come out in well-drained areas following long periods of rainfall. Pythium root rot can occur at any time of the year as long as the soil stays saturated for several days or weeks. From a distance, symptoms are orange or yellow and usually appear in irregular patterns, but occasionally develop in spots or distinct patches. Symptoms of Pythium root rot may spread in drainage patterns during periods of heavy rainfall. On individual plants, the crowns, roots, rhizomes, and/or stolons look dark and greasy. The depth and density of roots will be drastically reduced in affected areas.

There are many species of Pythium that have the

ability to cause root rot of turfgrasses. As a result, Pythium root rot can develop at any time during the growing season if the soil remains saturated for prolonged periods. Poor surface or subsurface drainage, over-irrigation, heavy rainfalls, and excessive thatch and organic matter accumulation are the most common factors that lead to a Pythium root rot outbreak.

## CULTURAL CONTROL

Avoid establishing turfgrasses in poorly drained areas that remain saturated for long periods of time. Golf course putting greens must be aerified and top-dressed regularly to control thatch and reduce organic matter accumulation. In general, 15% to 20% of the putting green surface area should be impacted by hollow-tine aerification

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annually, and 5000 lbs. of topdressing should be applied per 1000 ft<sup>2</sup> each year. Pruning or removal of trees surrounding putting greens to increase sunlight penetration and air movement will decrease the activity of Pythium root rot. Installation of high-powered fans will also help to alleviate the problem where air movement is restricted. For golf course putting greens with poor internal drainage, reconstruction is the only practical long-term solution for Pythium root rot.



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# RED THREAD



Red thread is a foliar disease that usually occurs on taller mown turfgrasses during spring and fall. Red thread symptoms are not aesthetically-pleasing, but crowns and roots are not infected, so plants are not killed, and turf eventually will recover. Red thread takes its name from the antler-like structures (sclerotia) produced by a fungus (*Laetisaria fuciformis*) on the tips of the infected leaf blades. The red or pink sclerotia are visible without magnification and allows one to easily identify the disease in the field. From a distance, red thread symptoms appear as circular patches of tan or pink turf about 4-8 inches in diameter. The pink color is brought on by the sclerotia and/or flocks of pink mycelium on leaf blades. Other diseases, such as dollar spot, pink snow mold, and especially pink patch, have field

patterns and symptoms that resemble red thread and are active during similar environmental conditions. However, after close inspection, red thread is easily distinguished from other diseases by the presence of the sclerotia. Red thread most commonly affects Kentucky bluegrass, perennial ryegrass, and tall fescue. Outbreaks usually happen in low maintenance turf stands such as residential lawns, golf course roughs, and some low budget athletic fields. Red thread development is most common where turfgrass nutrition is poor and there are other factors that promote slow growing turf. Disease development occurs over a relatively wide range of cool conditions (40-70° F), typically in the spring and fall, especially during long evening dew periods. Although the disease is often associated with



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malnourished, low-quality, slow-growing turf, a rapid build-up of inoculum can result in outbreaks on well managed turf, including golf course fairways and tee boxes.

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# SPRING DEAD SPOT



Spring dead spot symptoms show up in circular patches from 6 inches to several feet in diameter that remain dormant as the turf greens up in the spring. These patches eventually die and collapse to the soil surface. The roots, stolons, and rhizomes are dark and rotten in affected areas. Spring dead spot patches recur in the same spot each year and grow in size by up to several inches each season. As the patches expand, the centers are sometimes re-established with bermudagrass or weedy species, causing a ring-like appearance. Recovery of the patches occurs by spread of the bermudagrass from the outside. This process takes a lot of time, taking the entire growing season in severe situations. The spring dead spot patches greatly detract from the uniformity of the playing surface and are frequently invaded by weeds. Spring dead spot may also affect

specific types of zoysia grass, such as "Meyer" and "El Toro". Spring dead spot is most evident on intensely-managed bermudagrass, such as athletic fields and golf courses. The disease typically takes 3 to 5 years to become established in a new bermudagrass stand. Unlike take-all patch, spring dead spot does not decline in severity as the turf matures. It becomes more severe if left unmanaged.

The spring dead spot fungus attacks the roots, rhizomes, and stolons of bermudagrass during the fall and winter. This activity does not directly kill the plant, but instead makes the bermudagrass more prone to freezing injury. As a result, spring dead spot is most severe in the northern range of bermudagrass adaptation and is usually worse after extremely cold winters.

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Any factor that restricts bermudagrass root growth or increases its susceptibility to winter injury will also enhance the disease. Excessive nitrogen, potassium deficiencies, poor soil drainage, over-irrigation, excessive thatch accumulation, and soil compaction have been shown to promote disease development. The impact of soil pH on spring dead spot development in bermudagrass is not well understood.



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# SUMMER PATCH



Summer patch is one of the most damaging problems of turfgrasses and sometimes one of the most challenging to control. The main host plants are Kentucky bluegrass and fine-leaved fescues, which are often found in "shade-adapted" grass seed mixes. Summer patch is caused by a fungus which lives in the soil and attacks the roots. It produces dark-colored hyphae (fungal strands) that can destroy and kill roots. The symptoms of summer patch are striking: circles or semicircles of grass, 6 to 12 inches in diameter, that are light tan in color and matted in appearance. Tan circles with green grass in the center are often referred to as "frog-eye" symptoms because of the dark center and light border. Symptoms can proliferate in a lawn to the point where some areas have more damage than healthy lawn. A similar disease, called necrotic ring spot, produces identical symptoms in fall and spring, but summer patch typically appears in July and August.

Experience shows that summer patch is by far the more common problem.

Management of summer patch starts with good cultural practices. This means raising the mowing height to at least 3 inches in summer. If thatch is a problem, it will be helpful to vertical-mulch or power-rake the lawn in spring and fall (you can either rent the equipment or contract to have it done twice a year). Core-aerating helps relieve compaction and aids roots in obtaining oxygen in heavy soils (again, you can rent equipment or hire a specialist). A complementary approach is the application of fungicides. Systemic fungicides labeled for summer patch control can be applied every 3-4 weeks beginning when the grass starts to grow (early May) and continuing through the end of June. When summer patch is severe, overseeding is probably the only option. It's

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important to overseed with blends and mixtures of grasses with tolerance or resistance to summer patch. Check with lawncare services or garden centers for appropriate blends that work. A blend of Kentucky bluegrasses with turf-type tall fescue varieties will lessen the risk of severe summer patch and also minimizes the risk of other diseases. This is a long-term strategy that can help the lawn avoid serious summer patch die-off in the future.

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# TAKE ALL PATCH



Take-all patch, caused by the fungus *Gaeumannomyces graminis* var. *graminis*, is a serious disease of St. Augustine grass. It may also cause problems in bermudagrass. The causal organism appears to be most 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 and a darkening of roots. The area of discolored and dying leaves may be circular to irregular in shape and up to 20 feet in diameter. A thinning of the turfgrass within the affected area happens as roots, nodes and stolons become infected and the plants decline. Unlike brownpatch, the leaves of take-all infected plants do not easily separate from the plant when pulled and the stolons will often have discolored areas with brown to black roots. The roots are sometimes so rotted that damaged stolons are easily pulled from the ground. Roots and stolons of brownpatch infected plants usually look healthy. Regrowth of the grass into the affected area is

often slow and fails 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 perennial parts of living grass plants. In good and favorable conditions with 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.



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# YELLOW PATCH



Yellow patch is a cool-season disease caused by *Rhizoctonia cerealis*. Yellow patch occurs on bentgrass and annual bluegrass putting greens and at times on higher-cut Kentucky bluegrass. Symptoms are often gone with warmer temperatures, but in some regions yellow patch on putting surfaces can be a serious and chronic problem.

## Symptoms:

Symptoms usually show up from October through late April. Yellow to rusty-red rings or arc-like patterns ranging in size from a few inches to several feet develop in affected turf. In many cases, only a 1- to 3-inch-wide band of discolored turf is visible and the turfgrass inside the ring may show no adverse effects. In other cases, turf inside the ring is discolored a light yellow, lending a more patch-like quality to the symptoms on the putting surface. Early stages of yellow patch are most noticeable early in the morning, then difficult

to spot by midday. Infected plants exhibit a light, water-soaked lesion at the base of the leaf sheaf or in the crown tissue. Lesions on the leaf blade are rare. A cobwebby growth of mycelium may be seen early in the day when dew is present, but it is sparser than that seen with brown patch. It is usually necessary to use a stereo microscope to detect the mycelium. The hyphae exhibit right-angled branching characteristic of other *Rhizoctonia* species. *Rhizoctonia cerealis* is somewhat similar to, but distinct from, *Rhizoctonia* species that cause leaf and sheath spot, large patch of zoysia grass and brown patch of cool-season turfgrasses. *R. cerealis* is binucleate (two nuclei per cell), in contrast to *R. zeae* and *R. solani*, which are multinucleate. The fungus survives in the soil as bulbils (resting structures). Bulbils are initially light colored, then dark brown when mature. There can be plenty of pinhead-sized bulbils in the thatch surrounding damaged turfgrass. The rings are most conspicuous in the

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early spring, because they contrast sharply with newly emerging leaves. In most cases the symptoms remain superficial, with rings that are difficult to spot. Infected plants recover quickly when temperatures increase. During prolonged cool, wet periods in late winter to early spring, patches can become necrotic and sunken. These damaged areas do not recover quickly.

Conditions:

Yellow patch development is favored by longer periods of wet, cloudy weather. It is a cool-temperature disease (50 to 65 degrees F). Disease development is greatly suppressed at temperatures lower than 45 degrees F and greater than 75 degrees. Yellow patch tends to be more severe on putting greens with poor subsurface drainage.