Infection, Disease, and Symptoms

The perils of turfgrass disease identification and management.

BY STEVEN J. KAMMERER

Turfgrass pathology and disease management can be a real challenge! The causal agents of diseases can be very small, their life cycle very short or very long, and the expression of visible symptoms deceptive. When symptoms are apparent, disease may be the result, not the cause. Turfgrass diseases can be caused by a number of microorganisms, including viruses, bacteria, fungi, and nematodes. The majority of turfgrass diseases are caused by fungi. To our benefit, the majority of fungi are either beneficial or else incapable of causing disease.

Turfgrass diseases are either foliar or soil-borne. Foliar diseases are easier to identify, as the turf foliage is easily recognized as being spotted or blighted. Sometimes, fungal structures also can be seen with the naked eye or with a 10× hand lens. I prefer using an 8 × 30 monocular 25/45× macroscope (RF Inter-Science Co., N.Y.), which is portable and very easy to operate. It is amazing what you can see and the money it can save you when scouting your greens for potential problems. When fungal spores and mycelium are seen, it is important to discern whether the fungal growth is on living turf tissue (green to slightly chlorotic leaves), versus fungal growth on the lower leaves that are the first to senesce. The presence of fungal growth on living turfgrass tissue is an early indicator of possible problems. Most fungal structures are either small or transient, so they might not be as apparent as, say, an army worm or a clump of crabgrass. The best time to look at above-ground, suspect diseased areas is early in the morning when dew is present. As the free moisture evaporates, fungal mycelia are less visible.

Cottony *Pythium* mycelium can often be seen in the early morning hours before the turf is mowed.

Professional diagnosticians will first spend some time in properly preparing the sample. All thatch, litter, soil, and dead tissue must be removed. The remaining turfgrass tissue is then cleaned and surface sterilized to exclude saprophytic fungi that often come in after the pathogen. Spores are like the fingerprint of a fungus, as they are usually very unique. With a microscope, a diagnostician looks for spores, utilizing a disease key to identify a specific fungus. Definitive diagnosis utilizing spores is dependent on finding the spores inside the living tissues of the turfgrass plant.

Foliar diseases such as dollar spot, when identified early, are easier to cure with fungicides, since the root system and crown (meristematic region) are usually still functioning to outgrow the disease symptoms. Soil-borne diseases are much more difficult to identify, since the causal agent may or may not be present when the turfgrass roots are dug up. It is difficult to separate the true causal agent, the pathogen, from all of the other soil microorganisms.

When diagnosing a questionable area of turfgrass, we may see mycelium and spores and conclude, "Aha, disease!" This decision may be premature. Most fungi are not capable of causing disease, and many are saprophytic, meaning they feed on dead organic matter and are non-pathogenic.

When turfgrass dies or is dying, many saprophytic fungi often come in to take advantage of this easily available food source. At the stage that the sample is taken, the pathogen may be absent or in an inactive state but overwhelmed by saprophytic fungi.

Most turfgrass diseases start with spores, which are the reproductive seeds of the fungus, and are usually the start and the end of the disease cycle. Not all turfgrass pathogens produce spores,

Some so-called diseases are non-pathogenic and occur as a result of aggressive cultural practices and/or harsh weather conditions.

however. Disease begins with germination of the fungal spore or reactivation of dormant mycelium (connective body/tissue of fungi). This germination or reactivation usually occurs at specific temperatures and moisture/humidity durations. Germination of oospores of *Pythium aphanidermatum* (*Pythium* blight) and movement of the resulting zoospores (motile spores) is triggered by natural exudates from plant roots coupled with very wet conditions. Infection occurs when the fungal germ tube (similar to a root) contacts susceptible turfgrass tissue and penetrates that tissue. Fungal pathogens can be aggressive and especially adept at getting past the turf's natural defenses. Both fungi and nematodes are unique in that they can directly penetrate living, healthy leaves, crown, and roots.

Following penetration of the living turfgrass tissue, the pathogen breaks down the turfgrass tissue with enzymes and begins to feed. While feeding, the fungus grows and begins to reproduce by producing spores. The infected tissue then begins to die and exhibits symptoms. This is one of the perils of a curative disease management program: By the time symptoms first become apparent, reproduction already may have occurred.

While there can be many life cycles a year (epidemics) of *Pythium* blight, dollar spot, and brown patch, *Gaeumannomyces graminis* strains (bermudagrass decline and take-all patch) and the fungus that causes spring dead spot (*Ophiosphaerella* spp.) are very slow growing and have one life cycle a year. For this reason, it is much more difficult to accurately identify the slower-growing fungi as a disease, because by the time the symptoms are apparent, the fungus is most likely in a dormant or inactive state. If the tissue is dead or dying, the sample will be contaminated with fungal and bacterial saprophytes. Some of the more predominant fungal saprophytes are *Curvularia*, *Rhizopus*, *Leptosphaerulina*, *Penicillium*, and others.

Spraying fungicides to knock out these fungi may delay the senescence or ultimate death of the turfgrass tissue, but the conditions that the turfgrass is growing under must be rectified for the turfgrass to fully recover. This is analogous to a cattle rancher who has wolves killing cows every day, and instead of fortifying his fences or defenses to exclude the wolves, the rancher focuses his efforts on shooting the saprophytes coming in to feed on the dead/dying cows.

After disease symptoms appear, if the turfgrass area is sprayed once, twice, or three times with various fungicides, the pathogen is almost certainly gone or in a very weakened state. Spraying a fungicide after spores develop can help in the prevention of additional infection, but it won't always result in recovery of the infected tissue. If the turfgrass plant is infected and dying, it will be more difficult to get systemic fungicides into the plant when the roots and leaves are not functioning normally. For this reason, it is much more difficult to cure existing infections or disease by a curative chemical approach alone. This is also why most fungicides are recommended and more efficacious when applied preventively. Modification of the environment and utilization of cultural practices to alleviate stresses is as important, if not more, than the spraying of fungicides.

When considering all costs, prevention is usually cheaper. Consider a scenario where some unknown disease causes 30-40% turfgrass loss on your greens. What is the cost of all the panic spraying of fungicides after the turfgrass began to die? Was it a disease or was it a cultural problem that set off a general turfgrass decline? What is the cost of the loss of rounds and revenue, the cost of additional labor spent addressing the problem, and, worst case scenario, what is the cost of re-sodding the damaged areas?

There are also fungi that will feed on other fungi. Some of the pathogenic fungi, such as *Rhizoctonia* spp., are more adept at existing saprophytically. Usually these fungi are the ones that only cause disease when the turfgrass is very stressed, but they are always present in the thatch or soil. Turfgrass stresses are many and well documented. The best advice for disease management is to prevent turfgrass stress first.

There are tremendous information resources and guidance available from universities, the USGA, and manufacturers in the turfgrass market. Historical disease data are available from the stand-

point of internet Web sites that give forewarning of when your turfgrass is most susceptible to infection. The USGA, various other associations, universities, and companies have articles and data indicating proper cultural practices for the various turfgrass species and when these practices should be performed. This is all part of a comprehensive preventive approach to disease control. Disease control is disease prevention. Damage control follows after disease occurs.

Some things to consider when addressing turfgrass problems that are suspected to be caused by disease:

- Identify symptoms early, and send samples to diagnostic labs *before* spraying with a fungicide.
- Send turfgrass samples to your local university or to a diagnostician familiar with your area who knows the environment, knows turfgrasses, and is experienced with the local geography. This takes advantage of experience. Local diagnosticians are usually networked with other experts in the area who can visit your course and look at the problem. As an example, if the green is low, surrounded by trees, and has poor air movement, this cultural problem may never be known by the diagnostician without visiting the site.

Speed does not guarantee accuracy. Diseases such as bermudagrass decline and take-all patch can take months to occur; it is not realistic to expect an accurate diagnosis in less than 24 hours. However, fungi in this same genera are commonly found in soils but aren't necessarily pathogenic. These diseases may necessitate growing the fungus out in petrie dishes from the infected, not the dead, turfgrass tissue.

- Analyze your records — what happened prior to the onset of symptoms? Provide this information along with spray records and photographs when sending a sample out for diagnosis.
- Assess your environment. What turfgrass varieties are you maintaining? Under what conditions are you maintaining those varieties? Is the turfgrass more likely suffering from adverse cultural and environmental conditions?

Sometimes, when the problem is concluded not to be a weed or insect, then disease is the conclusion. Disease is often an indicator of cultural problems. It is easier to address something before you get to the endpoint, whether that endpoint is caused by a disease or a culmination of a lot of other adverse factors.

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Plant-parasitic nematodes can severely injure turfgrass roots and cause above-ground turf quality problems. The injured roots also can be colonized by secondary pathogens.