Turfgrass Disease Management

Plant Diseases – An Introduction

A plant disease can be defined as an abnormal alteration in the structure and/or physiological function of a plant. This alteration often leads to the development of symptoms, which is the visible expression of a disease. Some diseases produce specific symptoms that are used in diagnosing the disease. The causes of plant diseases may be broadly divided into two basic groups: abiotic (nonliving agent) or biotic (living agent). Abiotic diseases are caused by an unfavorable growing environment. Examples of environmental stress include water stress, temperature extremes, nutrient imbalances and plant injury (chemical or mechanical). Biotic plant diseases are most commonly caused by living microscopic organisms called pathogens. These diseases are often referred to as parasitic diseases. A parasitic disease is the end result of three very important factors that make up the **"disease triangle"** (**Figure 4.1**). This triangle consists of a **susceptible host plant**, a **favorable environment** and a **pathogen** (causal agent) capable of infecting the host plant. There is a very close relationship between these three factors. If one of these factors is incompatible with the other two at a specific time, there will be no disease development. The most common plant disease pathogens consist of fungi, bacteria, viruses and nematodes. Biotic diseases usually develop over an extended period of time, whereas abiotic diseases usually develop over a short time period.

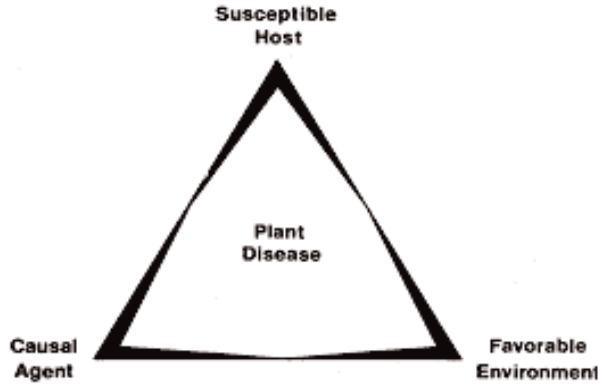

FIGURE 4.1. Disease triangle.

Fungi cause the majority of severe diseases on plants. The thread-like body (hyphae) of a fungus usually reproduces by forming microscopic seed-like structures called spores that are commonly spread from one plant to another by wind, splashing water, equipment, animals and infected plant parts. The fungi may enter the plant by natural openings (stomata, lenticels and nectarines), wounds and direct penetration. Fungi cannot manufacture their own food. They rely on a host plant for nourishment. They live on dead or living plant or animal matter. Spores land on a leaf surface, germinate and penetrate the leaf tissue. This is called the infection process, after which disease symptoms appear. Use of protectant fungicides interrupts this process and prevents disease from developing. Understanding the preventive nature of this process helps an applicator understand the importance of proper spray intervals and adequate coverage of foliage. Not all fungi are detrimental to plants. Some fungi are beneficial because they break down organic matter and are extremely important in the food-making process and the production of some antibiotics. Significant plant diseases caused by fungi include late blight of potato, downy mildew on grapes, powdery mildew on many field-grown ornamentals, cereal rusts and smuts, Chestnut blight, daylily rust, Dutch elm disease, brown patch of turf, brown spot of rice and soybean rust.

Bacteria are single-celled microorganisms that reproduce by dividing themselves. Most plant pathogenic bacteria are rod-shaped microorganisms that divide rapidly. Under optimum conditions, bacteria may divide every 20 to 50 minutes, one bacterial cell becoming two, two becoming four, four becoming eight and so on. Bacteria enter plants through wounds created on the plant or through natural openings, such as the stomata on the leaf, nectarines of the flower and lenticels on the stems. Bacteria are spread by splashing water, wind, equipment, animals and soil. Some insects are important vectors of bacterial diseases. Most bacterial diseases are related to moist environments where plants are grown. The bacteria commonly infect plants by being splashed onto wet plant foliage from the soil.

Viruses are much smaller than bacteria and can exist and multiply only inside living cells. Viruses enter the plant only by wounds made

mechanically or by vectors or occasionally by infected pollen grains. These agents do not divide and do not produce any kind of reproductive structure like spores of a fungus. They multiply by inducing the cells of the living host plant to form more virus particles. They are spread mainly by contact between plants, sucking insects (leafhoppers, whiteflies and aphids), propagation of infected plants and contaminated equipment. Mosaic (a mixture of dark and light green areas), flecking and ringspotting are foliar symptoms typical of viruses. Viruses can also cause stunting and other growth disorders. The disease symptoms of some virus infections often resemble other plant problems, such as herbicide injury and nutritional imbalances. Viruses may remain from season to season in perennial weeds, insects, nematodes and seeds. Once a plant is infected with a virus, no practical treatment for complete removal of the pathogen exists. Plant removal is often recommended to prevent spread of the virus to healthy plants. Infected plants may serve as a reservoir for additional infections when there is an insect or other vector present that can transmit viruses. Chemical control for virus diseases is not effective. Diseases caused by viruses include rose mosaic, tobacco mosaic, tomato spotted wilt, impatiens necrotic spot, barley yellow dwarf of wheat and plum pox of stone fruits.

Mycoplasmas are ultramicroscopic organisms that lack a true cell wall but are bounded by a "unit" membrane. They grow to various shapes and sizes. These organisms reproduce by budding and binary fission. They do not produce spores like the fungi. Spiroplasmas and Phytoplasmas are related organisms and cause diseases including corn stunt, aster yellows and elm yellows. These organisms may be found in the food conducting tissues of the plant.

Nematodes constitute a serious problem with many plants. Nematodes are microscopic, round worms approximately 1/50-inch long. If they have a satisfactory food source, they reproduce rapidly. A single female nematode may lay up to 500 eggs at a time. Once the eggs hatch, the immature nematode will undergo several morphological changes as it matures into an adult. Nematodes can be found in all types of soil but tend to be most numerous in sandy or light-textured soils. Nematodes are usually spread by soil movement or irrigation water. Many types of plant parasitic nematodes exist, but the most common one is the root-knot nematode. This nematode may attack many species of economically important plants. Most of the damage inflicted by nematodes is a result of direct feeding on the roots. The nematode inserts a sophisticated feeding tube (stylet) into the cells of the root. Although the majority of plant parasitic nematodes feed on the roots of plants, some feed on the leaves. Plants with knotted or galled root systems cannot absorb enough water and nutrients to adequately supply the plant. The tops of plants may appear wilted or inadequately fertilized. Once the soil becomes infested with nematodes, it is difficult to eradicate them completely by conventional means. Damage to the plant may not become apparent until the nematode population increases beyond an economic threshold for the host plant. Chemical treatment is often used to reduce the population so that a reasonable crop can be grown. Important nematode problems include root-knot on many ornamentals and vegetables, lesion nematode, cyst nematode on soybean, reniform nematode on cotton, foliar nematode on ornamental foliage plants and pinewood nematode.

Parasitic higher plants such as dodder, mistletoe and witchweed obtain all or part of their nutrition from a host plant. The dodder produces a yellow, small diameter vine that attacks plants intertwining around the host plant. With the aid of a specialized absorbing organ (haustoria), it drains nutrients and water from its host. The mistletoes can be found on a number of woody plants. These parasitic plants have chlorophyll and produce sticky seed dispersed by birds that eat them. Control is difficult to achieve. Witchweed, another parasite, is not common in North America. It is a parasite on corn, rice, sugarcane and a few small grain crops. Heavily infected plants die as a result of the roots being parasitized by witchweed.

Abiotic plant disorders constitute a vast majority of problems with ornamentals in the landscape. Among the most common problems are moisture and temperature stress, improper planting and maintenance, improper site, improper fertilization and pesticide application and string trimmer injury. When plants are stressed, they are more vulnerable to the effects of attack by disease-causing pathogens and insects. Although some pathogens will attack vigorously growing and healthy plants, many attack and infect only plants that are stressed. A weakened tree or shrub is much more susceptible to cankers, wood decay, root rot and certain wilt diseases than a vigorously growing ornamental.

Accurate disease identification is the first important step in planning an effective and efficient disease control program. An understanding of the pathogens' life cycle and mode of action is crucial in developing control strategies. Literally thousands of specific diseases exist. As growers, we may encounter only a few during a particular season, but we must be able to distinguish significant and potentially serious diseases from those of lesser significance.

Turfgrass Disease Descriptions

Lawns constitute a significant place in home landscapes. For a landscape to be healthy and attractive, the lawn must be healthy. Turfgrass diseases can seriously damage the appearance of a home lawn, athletic field or golf course. With few exceptions, fungi are more damaging to turfgrass plants during wet weather or when moisture from rain, irrigation or dew remains on the leaves for a long time than during dry weather. In Arkansas, the fungi are responsible for most of the infectious (biotic) diseases of turf. The bacteria and virus diseases are considered minor problems in turfgrasses. The fungi that cause turfgrass diseases have specific temperature ranges and are active during different times of the year. Some diseases are more prevalent than others, depending on the season.

Brown patch (*Rhizoctonia* spp.) is caused by a fungus that affects grasses when night temperatures are cool in the fall and spring. Rhizoctonia affects both warm and cool season turfgrasses in Arkansas. Disease symptoms depend on whether it is a cool or warm season grass, cultural practices and environmental conditions. Brown patch develops most rapidly during periods of warm temperatures (75 to 85 degrees F) and moist or wet conditions. On warm season grasses, the disease can be a problem during the fall, winter and spring when grasses are entering or emerging from dormancy. Infected turfgrass usually exhibits irregular or circular patches of blighted grass ranging from several inches to many feet in diameter (**Figure 4.2**). The bases of infected leaves become rotted and can easily be pulled from the bottom of the grass plant. The fungus primarily attacks the shoots rather than the roots. Roots of affected grass generally will not be discolored, and green grass will occasionally be present in the middle of diseased patches, giving a "smoke ring" appearance.

FIGURE 4.2. Brown patch symptoms on zoysia.

To reduce the severity of brown patch, irrigate only when needed and do so early in the morning. Although several fungicides are labeled for control of brown patch, effectiveness is much greater when applied before the disease becomes well established. Brown patch severity is directly related to the fertility status of the turfgrass. High nitrogen tends to increase disease severity.

SAD (St. Augustine Decline) is the most significant virus disease of turfgrass in Arkansas. SAD is caused by panicum mosaic virus. This disease occurs only on St. Augustine and centipedegrass. Leaves appear mottled. Do not confuse this with iron chlorosis, which causes a striped appearance. In iron chlorosis, the veins remain green and the chlorotic areas occur between the veins. If the virus is present, however, a mottled or speckled condition occurs in the leaf tissue. Another distinguishing factor is that iron chlorosis appears first in the new or young leaves, whereas SAD causes yellowing in both old and young leaves (**Figure 4.3**). SAD is spread by lawn mowers and cannot be controlled with chemicals. The best control of this disease is to plant one of the commercially available, resistant St. Augustinegrass varieties.

FIGURE 4.3. SAD on St. Augustinegrass.

Fairy ring is a condition caused by fungal development in the soil. Several fungi can cause fairy ring. Most are growing in association with organic material buried in the soil such as decomposing stumps, branches or building materials. All turfgrasses can be affected by fairy ring. The fungi can be located at varying depths in the soil, making it virtually impossible to remove by digging infested soil out of the area. Fungi that typically produce mushrooms invade organic matter in the soil (**Figure 4.4**). It then produces mushrooms on the edge of this organic matter, and a ring effect is often noted. The disease becomes noticeable during spring and summer months when a ring of dark green grass or brown circular bands appear. The dark green grass is a result of nitrogen released after fungi decompose organic matter in the soil. The brown ring of dead or dying grass appears as a result of a hydrophobic (water repelling) effect from the spreading fungi. Mushrooms can be removed by mowing, and proper irrigation and fertilization will suppress or mask the green or brown rings associated with this disease.

Managing fairy ring involves forcing water into the hydrophobic or dry areas and using fungicides specifically labeled for this disease. Wetting agents added to the water may help penetration. This disease is considered more of a cosmetic problem in the home lawn, whereas it may be significant in a golf course situation. Fungicides are available that suppress disease development; however, multiple applications will be necessary to maintain suppression of this disease.

FIGURE 4.4. Mushrooms of fairy ring.

Take-all patch (*Gaeumannomyces graminis* var. *graminis*) is a serious fungal problem in St. Augustinegrass and bermudagrass. This disease is most active during fall, winter and spring when soil is moist and temperatures are moderate. Take-all patch can destroy large areas of grass if not controlled. The first symptom of take-all patch is yellowing of leaves, usually in large circular or irregular shaped patches (**Figure 4.5**). The grass gradually thins within the patch. The roots of infected plants are frequently rotted, but the leaves cannot be easily pulled from the plant, as is the case with brown patch. Because the fungus that causes take-all patch survives on plant debris, use practices that prevent thatch buildup. Take-all patch tends to be more severe on soils with a high pH. Although there are fungicides labeled for control of this disease; these chemicals should be applied on a preventive basis, generally in the fall. On an already established take-all patch, fungicides may be ineffective.

FIGURE 4.5. Take-all patch.

Gray leaf spot (*Pyricularia grisea*) is a disease of St. Augustinegrass in Arkansas. This disease can be a problem in the spring and early summer, especially in shaded areas. Symptoms include tan lesions with purple or brown borders on the leaf blades (**Figure 4.6**). Eliminating the use of soluble nitrogen fertilizers during summer months on shaded lawns can reduce the severity of the disease. Water early in the morning and remove grass clippings from infected lawns to slow the spread of gray leaf spot. Several fungicides are labeled for control of this disease.

FIGURE 4.6. Gray leaf spot on St. Augustinegrass.

Dollar spot (*Sclerotinia homeocarpa)* is a fungal disease that attacks most turfgrasses grown in the South. Hybrid bermudagrass, zoysiagrass and bentgrass are particularly sensitive to this disease. Generally occurring in the spring through the fall, it prefers low soil moisture. The disease receives its name from the development of small, circular, brown to straw-colored spots, roughly the size of a silver dollar, sometimes larger on coarse-textured grasses. Not to be confused with brown patch, grass blades affected by dollar spot exhibit light tan lesions with reddish-brown bands (**Figure 4.7**). Dollar spot is often associated with poor turf maintenance. Dry soils, thatch buildup and inadequate amounts of nitrogen and potassium favor this fungus. Control dollar spot by removing thatch, fertilizing properly and avoiding shallow, frequent watering. Several fungicides are recommended to prevent dollar spot.

FIGURE 4.7. Dollar spot on bermudagrass.

Spring dead spot (SDS) is a very destructive disease in bermudagrass lawns. Two fungi (*Leptosphaeria korrae* and *Ophiosphaerella herpotricha*) are associated with the disease in North America. Bermudagrass is the most significant host to this disease. The causal organisms grow most actively during the fall and spring when temperatures are cool and soils are moist. Bermudagrass varieties that have poor cold hardiness tend to have more severe SDS. SDS-infected lawns exhibit small, circular, dead areas from less than one to several feet across in the spring (**Figure 4.8**). This disease becomes noticeable during greenup in the spring. Other symptoms include dark and rotted roots and a slow recovery of bermudagrass into the affected areas, usually about midsummer. SDS does not affect newly planted lawns but becomes a problem on lawns three to four years old. It may be connected to an accumulation of thatch. In some locations, SDS has been controlled with repeated applications of systemic fungicides in the early fall.

FIGURE 4.8. Spring dead spot.

Rust (*Puccinia* sp.) can be found on a number of turfgrass species, but is most frequently a problem on zoysiagrass, fescue and bermudagrass. Grass that is under stress during warm, humid conditions is most susceptible to the disease. Rust is identified by orange to reddish-brown flecks on grass blades that develop into pustules and eventually turn brown to black (**Figure 4.9**). Ryegrass can be very susceptible to rust in the spring, especially when nitrogen levels are low.

FIGURE 4.9. Zoysia leaf rust.

Severely infected turf looks reddish brown, yellowish or orange. The turfgrass often thins and becomes chlorotic. Cool to moderately warm, moist weather favors rust development. Condensed moisture, even dew, for 10 to 12 hours is sufficient for rust spores to infect plants. Cultural practices such as proper fertilization, avoiding moisture stress and

selecting resistant varieties can help prevent rust. Removal of grass clippings from affected areas is helpful. Spores on the mowed leaves die out rapidly. The rust over-seasons in infected grasses. The over-wintering rust produces short, black streaks on the leaves. If cultural practices are inadequate, there are a number of fungicides recommended for rust control.

Pythium blight (*Pythium* sp.) is caused by several species of *Pythium* fungi. The infection process, symptom development, spread of the pathogen and destruction of turf is often very rapid. This disease is most prevalent on highly maintained turf such as golf course greens. This disease is often associated with waterlogged soils and a moist thatch layer, along with high relative humidity and daytime temperatures in the 80s and 90s with warm nights (above 70 degrees F). These conditions are ideal for warm weather pythium blight. There are cool weather pythiums also. The disease often appears as elongated streaks, following water drainage or mowing patterns. Large areas of turf can be destroyed within 24 to 48 hours after disease onset. Excessive nitrogen favors this disease. Wet turfgrass and poor soil drainage are the two most important criteria for disease development. For control, both surface and subsurface drainage needs to be improved. Avoid overwatering, thick thatch, excessive nitrogen fertilization and compacted soil profiles. Systemic fungicides when applied as part of a preventative program before the onset of hot, humid conditions is recommended for high value turfgrass.

Nematodes are probably the most abundant form of animal life in the soil. Most species that occur in soil feed on fungi, bacteria or small invertebrate animals; but many are parasites of higher plants, including turfgrass. Nematodes have distinctive life cycles very similar to those of insects. Females lay eggs, which hatch into larvae. The larvae mature through a series of four molts to become adults. Nematodes typically survive adverse conditions in the egg or larval stages and feed most actively when the turfgrass is also actively growing. Nematodes are mobile within the soil, but long distance spread usually requires their movement in surface water runoff, in soil on equipment or in sod.

All turfgrasses are susceptible to nematode damage. In Arkansas, nematodes can cause significant damage and need to be controlled on bentgrass golf greens and sod farms. Plant parasitic nematodes feed on turfgrass roots and on other organs by puncturing the plant cells with a hollow, needle-like structure called a stylet (**Figure 4.10**). Nematodes cause direct impairment of root functions, and nematode-weakened plants are susceptible to infection by various pathogenic fungi and bacteria. The aboveground symptoms of a nematode infestation include chlorosis (yellowing) of the leaves, slow growth, gradual thinning, poor response to adequate fertilization and irrigation, rapid wilting during dry weather and weed invasion.

FIGURE 4.10. Schematic drawing of a plant parasitic nematode.

Nematodes are most damaging in light, sandy soils which are low in nutrients and water-holding capacity. Increased fertilization and irrigation practices can often overcome the effects of some types of nematodes. Highly compacted and heavy-textured soils are less favorable to nematodes because they restrict nematode movement and prevent good turfgrass growth. Nematodes are usually most active and most numerous on warm-season grasses during the summer and autumn, on cool season grasses in mid to late spring, and again in autumn. These times correspond with and follow

active growth of turfgrass roots. However, the result of nematode feeding generally becomes most apparent when conditions become unfavorable for the turfgrass. For high maintenance turfgrass, such as golf greens and sod farms, chemical control of nematodes may be necessary. Because of their distribution in the soil profile and their position on or in the roots, complete chemical control is impossible, but reductions of large populations to manageable levels can be achieved with chemical nematicides. The only way to determine if nematodes are involved is to have soil samples assayed for nematodes. They seldom, if ever, are controlled in home or recreational turfgrass.

Slime molds are harmless but unsightly fungi that seem to suddenly appear over the grass surface during warm weather, following heavy rains or watering. These fungi may be black, bluish-gray, cream to yellow or white in color and grow in round to irregular patches (**Figure 4.11**). These organisms are not parasitic on turf but feed on decaying organic matter, other fungi and bacteria in the thatch layer and soil. Slime molds usually disappear when dry conditions are present. Raking, brushing or hosing down the area with water is helpful in speeding their disappearance.

FIGURE 4.11. Slime mold on zoysiagrass leaves.

Turfgrass Disease Summary

Diseases, whether abiotic or biotic, can be destructive to all plants. It is very helpful to become familiar with the way healthy plants look in the landscape. Proper placement and maintenance are of the utmost importance in overall plant health. We have discussed the interactions of the “disease triangle” and its role in disease development. Infectious disease development is an ever-changing and dynamic process in which a series of events occurs in succession that leads to the development and perpetuation of the disease and a pathogen.

In order to diagnose a plant disease, it is important to determine if the disease is caused by a pathogen (fungus, bacteria, virus, etc.) or if the problem is a result of an unfavorable growing environment. Accurate identification is the most important step in designing an effective disease control program. Details of the symptom expression on individual plants are very important in the diagnosis of plant diseases. Each causal agent, biotic or abiotic, will produce some specific symptoms. These symptoms may vary, depending on the plant, growth stage, exposure time, etc. The ability to anticipate and react appropriately to common problems and implement preventive solutions can be quite valuable in maintaining a healthy lawn grass and landscape planting.

The aim of this information is to help with the diagnosis and understanding of disease mechanisms of ornamentals and turfgrasses. It describes many common diseases that have distinctive symptoms. This information offers comments on controlling these various diseases.

For further information and assistance with plant disease identification and control, consult your local Extension office.