A PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

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TURFGRASS PATHOLOGY

Anthracnose:
A Problem in Tall and Short Cut Turf

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Anthracnose damage in turf, caused by the pathogen *Colletotrichum graminicola*, is a recognized major disease of closely mown, highly managed golf course and sports turf, but it is also an increasing problem with taller-cut, well maintained home lawns and commercial sites. A recognized problem on bentgrass and annual bluegrass stands for golf and sports turf managers, anthracnose often goes undiagnosed and unrecognized on many well managed fine fescue, bluegrass, ryegrass and tall fescue ornamental turfgrass sites.

As home lawn and commercial site turf managers become more sophisticated in their overall management practices and as the turf stands that they manage increase in leaf density, the microclimate turf canopy diseases like anthracnose, brown patch, and *Bipolaris* leaf spot are doing more damage. Unfortunately, because these diseases have not historically been well known in the ornamental turf industry, the negative impact that they have is rising. With that increase in damage has come an increased level of frustration by managers and the clients or bosses that they serve.

The frustration for any turfgrass manager of not knowing what is causing damage on a managed site is only surpassed by the embarrassment of admitting to the boss or client that you don't understand what has happened and you don't have a plan to stop it from happening in the future.

As with the concept in physics that "for every action there is an equal and opposite reaction," turfgrass managers need to understand that increasing the quality of the turf by increasing management inputs is not accomplished in a biological vacuum. As the leaf and plant density increases, the microclimate of the turf canopy changes. It becomes cooler and the humidity level rises. This, in turn, changes the types and populations of pathogens. A low- or moderate-maintenance site that has only supported low populations of the previously mentioned foliar diseases, can often sustain much higher pathogen populations that begin to produce damage symptoms — particularly when the host plants are stressed by low soil moisture, compaction, traffic or any condition or pest that adversely affects the efficiency or mass of the root system.

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Check the Symptoms

Anthracnose symptoms vary depending on the canopy's environmental conditions. The temperature range for active growth by *Colletotrichum graminicola* is from 52° F to 95° F with the optimum growth occurring between 77° F and 92° F. When temperatures are in the active growth range, the fungus spores will start to germinate following leaf wetness periods of as little as 24 hours. After 72 hours of leaf wetness germination of viable spores hits 100%, with the maximum tissue infection levels occurring in a range of 77° F to 90° F. (See "Leaf Wetness and Anthracnose Spore Germination.")

Under humid conditions at the warmer end of the temperature range and after prolonged leaf wetness periods, the pathogenís germinating spores attack plant leaves causing brown and yellow oblong lesions that, as they age, spread to span the leaf width.

As the infection progresses, the leaf tissue above the initial infection site turns yellow, then tan to light brown as it dies. As ideal or near ideal canopy conditions continue through successive pathogen generations, the plants' overall health become compromised and plants can begin to dieback in small irregular shaped patches.

If the site has an infection history and the plants are subject to a period of moisture stress following a period of leaf wetness, these small irregular patches can coalesce into large areas of blighted turf. Frequently, these blighted areas are misdiagnosed as moisture stress damage, but, unlike the effects of short-term moisture stress, plants subject to prolonged infection from anthracnose do not recover after the weather returns to more favorable conditions.

Under cooler, wet conditions at the lower end of the temperature range, the anthracnose spores can germinate further down the leaf structure at the plant's crown causing what is called a basal stem rot. The plants with infected crowns follow a dieback sequence similar to the foliar damage. Unlike the foliar symptom, however, the plant can be detached easily from its base with the tissue at the bottom of the plant exhibiting a black rotten color.

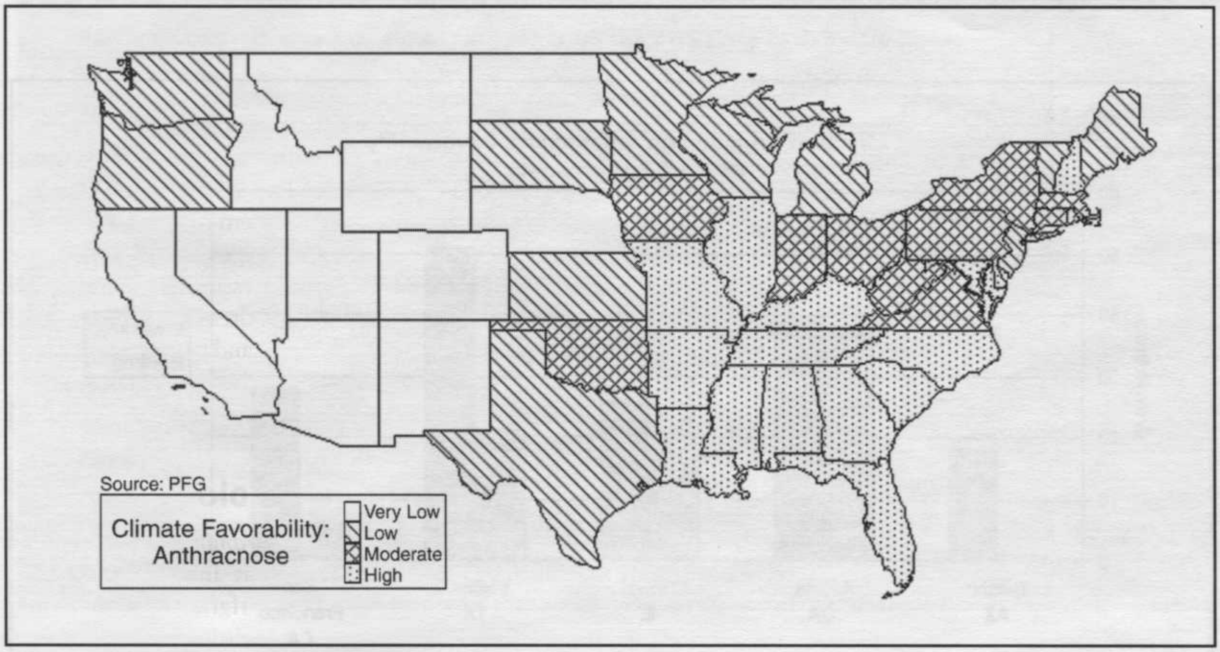
Unlike the foliar symptoms of warm, humid weather, death comes rapidly to plants affected by the basal stem rot phase of this disease. Recent research has indicated that the basal stem rot phase of this disease on golf course greens can be increased by frequent top dressing with sand or high sand content topdressing mixtures. The sharp edges of the sand particles damage the crown's tissue and these wounds act as multiple infection sites.

Pathogen biology

Colletotrichum graminicola is a very widespread fungus that infects many cereal grains as well as turfgrass. It survives long-term adverse conditions as saprophytic mycelium on dead leaf litter at the soil surface. During short-term adverse conditions, the pathogen survives as a black fruiting body or mass called acervuli. These fruiting bodies are small dark colored oval-shaped masses that can be seen on dead or dying infected plant tissue.

When more favorable conditions prevail, acervuli develop multiple black spines called setae that protrude from the mass. When active, the acervuli disperse the pathogen's crescent shaped one-celled spores, called conidia, that are spread to other leaves by traffic, wind, rain and irrigation. Once a spore has been subject to a minimum of 24 hours of wetness on a leaf surface, it germinates and the process starts over again.

Depending on the pathogen's phenotypes or genetic diversity and the climate at the site, anthracnose can affect stands of mixed turfgrass species differently. Despite the fact that fine fescues are the most vulnerable of the cool season grasses to anthracnose infection, it is not uncommon for the annual bluegrass in a mixed fine fescue/annual bluegrass stand to be hardest hit. In a bluegrass/ryegrass stand, the ryegrass may show damage while the bluegrass does not. In a bentgrass/annual bluegrass stand both species may show damage, while the same mixture at a second site may have only one species effected. This apparent



Climate favorability map for anthracnose.

resistance of one species over another may be a result of actual resistance or it may be that the damaged species was more stressed than the other and suffered the damage.

In taller-cut, unirrigated turf sites, anthracnose infections may require several years of favorable weather conditions to produce enough innoculum or pathogen population to develop identifiable symptoms under stress conditions. At frequently irrigated golf and sports turf sites, a damaging level of innoculum may develop rapidly, especially when plants become moisture stressed following prolonged rainfall.

Symptom expression is a function of site characteristics, the species being managed, the pathogen's site history, the range of phenotypes found at the site, the site's cultural practices, recent weather conditions and the density of available, viable anthracnose spores. Recent research concluded that not only are leaf wetness periods and temperatures important to symptom expression, so is the spore or pathogen concentration. When temperature (> 77° F for temperature) and leaf wetness (>24 hours for leaf wetness) are consistently in the favorable range, the higher the spore density and the greater the symptoms.

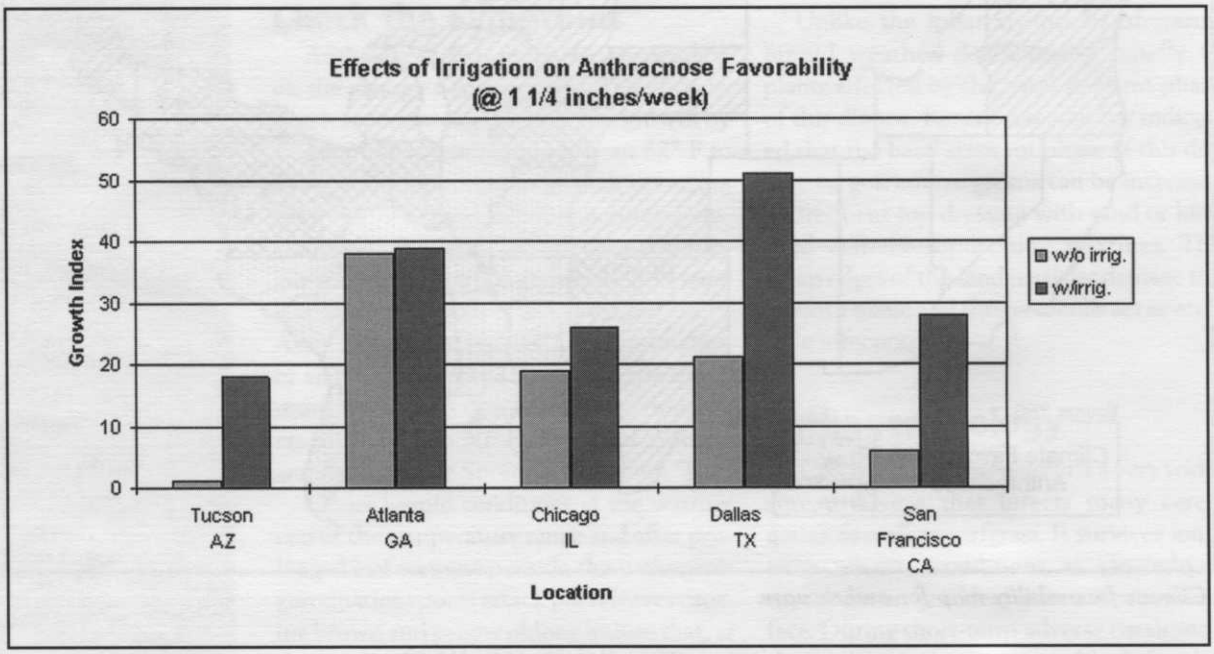
Where the disease ranges and favorable conditions

Because of the wide temperature range for active growth and the concurrent need of prolonged periods of leaf wetness, anthracnose is primarily a problem in areas east of the Midwest grain belt. It is a particular problem in the Southeast and along the Gulf Coast (see Climate Favorability Map above).

The Climate Favorability Map represents the annual climatic favorability for the growth of anthracnose. The value for a state is an average of the values for each region of each state, so managers should be aware that the favorability at a given location may vary from the average.

States that have consistently high rainfall and consistent temperatures in the growth range have high favorabilities. States where rainfall is consistent, but temperatures are not consistently in the growth range, will have moderate favorability. And states whose rainfall and temperatures are variable have low or very low favorability.

Within a region of a state, how a site is maintained can play a significant role in how much of a potential problem anthrac-



Graph1. Effects of Irrigation on Anthracnose Favorability.

nose poses. Graph 1 illustrates this point for locations where irrigation is used at managed sites.

The bar graph shows how 1.25 inches of irrigation per week during the summer changes the annual climatic favorability for anthracnose at five cities in the United States. Of the five cities shown, only the climatic favorability at Atlanta and Chicago was not substantially increased by increasing moisture.

In areas with sufficient moisture (like Atlanta and Chicago), adding additional water through irrigation does not increase the favorability significantly (+ 2% and + 30%). In drier climates like Tucson, Dallas and San Francisco, however, increasing moisture increased favorability by 1,000%, 250% and 400% respectively.

Site and soil can play role in symptom expression

Shaded or transitionally shaded sites with the accompanying longer leaf wetness periods can consistently support damaging populations. Drainage areas, downspout exhaust areas, areas with transient water flow, low areas and sites at the base of slopes are all vulnerable to infection, particularly after periods of consistent rainfall.

Areas with compacted or layered soil and areas with poor subsoil drainage are also areas vulnerable to anthracnose. Additionally, turf that has a shortened or compromised root system due to insect activity, soil-borne pathogen activity, poor fertility practices or frequent coring activity are all subject to intermittent anthracnose.

Finally, cultural practices that stress plants can lead to infection by anthracnose. Activities like low mowing, intermittent watering practices and reduced soil nutrient availability from failure to monitor and correct soil chemistry can all contribute by predisposing turfgrass to opportunistic infections.

Host susceptibility

At ornamental turfgrass sites, anthracnose is a problem on most managed species or varieties. Fine fescues are the most susceptible to infection with ryegrasses and tall

TABLE 1. ANTHRACNOSE RATINGS OF BENTGRASS CULTIVARS

Bentgrass cultivars grown on a green in 1997 @ OK site #1. Rating 1 - 9; 9 = No Disease

Name	*Rate*		
Lopes	8.7	Imperial	7.3
Penn A-1	8.3	Pennlinks	7.3
Penn A-4	8.3	SR 1020	7.3
Penn G-6	8.3	Lofts L-93	7.0
Regent	8.3	Msueb	6.7
Trueline	8.3	Penncross	6.7
Backspin	8.0	Mariner	6.3
Crenshaw	8.0	Penn G-2	6.3
Cato	7.7	Seaside	6.3
Century	7.7	18th Green	5.7
Pro/Cup	7.7	LSD Value = 2.3*	
Providence	7.7		
Southshore	7.7		

* — Plants whose value falls within a range of + or - the LSD value from a given cultivar are statistically equal to that cultivar.

fescues a distant second. Bluegrasses are the least vulnerable, but under suitable conditions, almost all of the grasses maintained at a higher cut can suffer significant damage.

On lower cut bentgrasses, cultivar resistance can be used to limit damage at sites with consistent problems or at sites where the occasional infections are difficult to deal with. Table 1 Shows the results of recent N.T.E.P. testing for anthracnose resistance among bentgrass cultivars.

How to diagnose anthracnose

Unlike many other turfgrass diseases diagnosing anthracnose is relatively easy. Finding acervuli with setae in several random grab samples is a strong probable indicator of current or near-term pathogen activity. This is particularly true if the acervuli with setae are found on green or yellow green leaves.

Acervuli without setae indicates a potential for disease activity, if the climatic conditions change to favor activity. Acervuli on leaf litter act as storage areas for spores that can be splashed or blown up on leaves or crowns for future germination.

Recommendations

Recent work at Michigan State and Ohio State universities indicates that symptom expression has a relationship not only to climate but also pathogen density (see "Leaf Wetness and Anthracnose Spore Germination). This can be used to estimate the relative likelihood that anthracnose will strike.

Although it is difficult to assign a threshold number of acervuli per grab sample, the relative number per leaf and the density of leaves with acervuli per sample is a good relative predictor of potential or current activity. A few leaves from a grab sample with a few acervuli without setae need occasional future scouting. Several acervuli with setae on several asymptomatic leaves following a rainfall require consistent monitoring and a change in any cultural practices that may be contributing to anthracnose favorability.

Multiple acervuli with setae with infected leaves in the sample need at least one fungicide treatment. And small to large areas of anthracnose damaged turf need multiple fungicide treatments and a change in cultural practices or site modification to avoid continued damage.

Changing cultural practices that cause plant stress can help reduce pathogen activity. Keeping a consistent mowing height, watering only when needed (not on a schedule), increasing soil nutrient availability, and monitoring and correcting soil chemistry can all work to reduce the impact of light to moderate infections.

Site modifications, such as improving subsoil drainage, reducing the amount and frequency of topdressing with sharp-edged sand, coring and verticutting only during periods of low potential pathogen growth, improving air and water flow and introducing more resistant cultivars can reduce the tendency of a site to harbor damaging pathogen populations.

Finally, at sites where anthracnose is a perennial and severe problem, change your expectations or change the site's usage parameters. Despite the fact that anthracnose is relatively easy to diagnose, stopping its negative consequences can be difficult. Early recognition of anthracnose at a site and developing a thorough understanding of the site conditions and cultural practices that contribute to the problem, are essential to controlling this disease.

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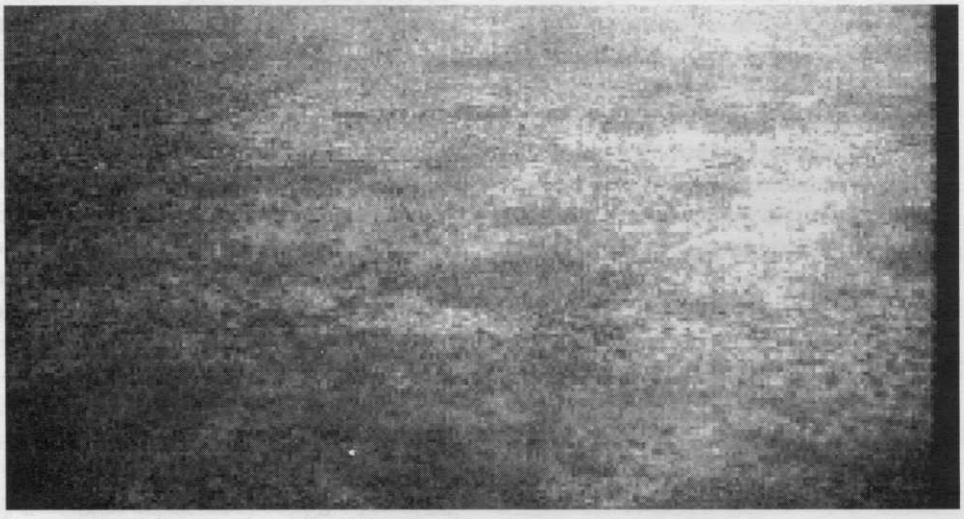
Setae growing from an acervuli.



Light colored bentgrass is infected with anthracnose.