GRAY LEAF SPOT, AN EMERGING DISEASE OF PERENNIAL RYEGRASS

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In recent years, epidemics of gray leaf spot on perennial ryegrass have occurred throughout the transition zone from New Jersey to Virginia and as far west as Kansas. Significant outbreaks north of the transition zone have been observed in Connecticut, Rhode Island, eastern Massachusetts, southern Pennsylvania, southern Ohio, Iowa, middle Illinois, and eastern Nebraska. The cause of this emerging disease is the fungus *Pyricularia grisea,* a pathogen of over 20 genera of grasses. Among turfgrasses, *P. grisea* is also known to attack St. Augustinegrass and tall fescue.

P. grisea infects the foliage, causing leaf spots and blighting. Under humid conditions, this fungus produces microscopic spores on both upper and lower surfaces of infected leaves; these spores are dispersed by air movement. Leaf wetness, high humidity, and temperatures in the high 70's to low 80's °F are the three most important environmental factors that govern infection and sporulation of *P. grisea.* One of our great knowledge gaps is an understanding of how periods of high temperatures may increase the susceptibility of perennial ryegrass to infection.

Although tall fescue also is a host, it is generally regarded as less susceptible than perennial ryegrass. Epidemics of gray leaf spot on tall fescue have been reported in the southeastern-most portion of the range of this cool-season grass, namely in Georgia and in the Carolinas. Some varieties of tall fescue show substantial resistance to gray leaf spot, and may even be a source of resistance genes for perennial ryegrass.

Recent studies of the molecular genetics of *P. grisea* have shown that the strains of *P. grisea* that attack perennial ryegrass and tall fescue are very nearly identical to one another and completely different from the strains which infect all other grasses. This indicates that, even though *P. grisea* infects many grass species, grasses other than tall fescue are not sources of inoculum for outbreaks of gray leaf spot on perennial rye.

Symptoms

On established perennial ryegrass, the disease first appears as patches an inch or two in size, and the leaf blades turn a reddish-brown color. These initial infections can enlarge to patches a foot or two in size within days. As the disease progresses, large, diffuse areas of turf can quickly become blighted. Affected turf often appears wilted despite adequate irrigation. In extremely severe outbreaks, most or all of the turf is killed.

Several types of symptoms can be found when individual leaves are inspected. Sometimes one can find brown, oval lesions which develop tan centers as they expand; these lesions can look very similar to "Helminthosporium" leaf spots. *P. grisea* may also produce leaf spots which are gray in color and which sometimes develop a yellow halo; these are often most common along the margin of leaf blades, a unique feature of this disease. In yet other instances, infected leaves, especially the youngest leaves, may simply develop an olive-green, watersoaked appearance with no indication of a discrete lesion. When the youngest leaves of perennial ryegrass are infected and killed by *P. grisea*, they sometimes appear twisted and curled, a symptom referred to as a "fishhook" symptom. Seedlings of perennial ryegrass are very susceptible to gray leaf spot. Plants less than 8-12 weeks old may blight rapidly. New seedings often fail when the disease is active during emergence and establishment.

P. grisea produces sporulation on diseased tissues under humid conditions. The fungus has a remarkable ability to produce very dense sporulation overnight on both upper and lower leaf surfaces. Dense sporulation looks like a grayish felt with a hand lense or even with the naked eye. No foliar mycelium is visible on diseased tissues. All of the fungal mycelium is within infected leaf blades and sheaths.

Influences of Cultural Practices on Disease Development

It is important to understand how cultural practices might influence disease development, since

some turf management practices may contribute to reducing disease pressure, while others may enhance disease pressure. Recognize, however, that cultural practices which reduce the activity of gray leaf spot have their greatest impact when disease pressure is light to moderate. Cultural practices alone will not arrest this disease under high disease pressure, and many golf course superintendents will find it necessary to use fungicides preventively.

Nitrogen Fertilization

Studies indicate that perennial ryegrass is more susceptible to disease development with increasing levels of nitrogen fertilization. Keep nitrogen levels low during the summer to reduce susceptibility. If fertilizing during the period of June through August, foliar-feed with a total of no more than 0.1 to 0.25 lb soluble nitrogen/1000 ft^2 during that period. To date, no research results are available to address the question as to how the source of nitrogen might influence gray leaf spot development.

Mowing

Many observers have noticed that gray leaf spot often develops earliest and most severely in tall-cut perennial ryegrass. Studies to date have generally shown that disease severity on perennial ryegrass increases as mowing height increases, although this question is still being researched. Some turf managers have observed that the gray leaf spot is sometimes associated with mower passes, much like Pythium cottony blight. Based on these observations, some turfgrass pathologists recommend mowing when the foliage is dry.

Other Practices

Foliar diseases caused by fungi are commonly enhanced when turf is irrigated at dusk as compared to early morning. Schedule irrigation near sunrise whenever possible, as this will often speed drying of the turfgrass foliage, because the impact of irrigation water knocks a great quantity of dew and guttation droplets from the leaves.

There is some speculation, based on field observations, that applications of plant growth regulators and postemergence herbicides may enhance susceptibility of perennial ryegrass to this disease. Tests of the effects of such products have been limited, but in one year of testing, no disease enhancement was observed from either Acclaim Extra or Dimension on perennial ryegrass (University of Kentucky). Likewise, no change in disease development was caused by Primo on tall fescue (University of Georgia).

There is rather strong evidence that all commercial perennial ryegrass varieties can suffer extensive turf loss under severe disease pressure. Thus, golf course superintendents must consider management practices other than variety selection until varieties with substantial resistance become available.

Fungicidal Management

In areas with a substantial risk of this disease, preventive use of fungicides is the only way to protect perennial ryegrass during periods of moderate to high disease pressure. When the *logarithmic phase* (the period of rapid disease increase) kicks in, this disease is explosive and extremely destructive. Fungicidal protection is needed before this occurs. This is not to suggest that all perennial ryegrass should be treated aggressively for this disease. The disease has not been reported in all areas where perennial rye is grown. However, gray leaf spot is a dynamic and emerging problem. Some areas developed the disease for the first time in the last year or two. Furthermore, some growing seasons are not conducive for epidemics of gray leaf spot. We understand very little about the conditions that lead to the logarithmic phase in natural turfgrass swards. Given our current state of knowledge, no-one can positively identify those locations nor forecast those seasons when golf course superintendents can safely withhold all preventive sprays. Learn as much as you can about disease development in your area, and be informed about what turfgrass scientists know about the disease for your region.

Timing and Efficacy

The comments provided below are consistent with the labels of products mentioned and are based on a careful study of all available research, much of which is available in recent and forthcoming volumes of the journal *Fungicide and Nematicide Tests*, published by APS Press. *However, fungicide labels do change, and the only valid guides regarding legal rates and timing of fungicides are the product labels*

themselves.

On established perennial ryegrass, preventive fungicide protection is needed prior to the logarithmic phase of the disease. It is possible to find the first lesions of gray leaf spot six weeks or more in advance of this phase, but the logarithmic phase is the time when protection is critical. In many areas, this phase commonly occurs sometime during the first three weeks of August. Although the logarithmic phase can occur as early as mid-July in Maryland, this phase may not develop in locations at the more northern range of occurrence until around, or after, Labor Day. Seedlings are more susceptible to gray leaf spot than is established turf. Seedings made in mid- to late-summer may need preventive fungicide protection from emergence until near the first frost.

Three fungicides–Heritage 50WG, Cleary's 3336, and Compass 50WG—are effective against gray leaf spot under moderate to high disease pressure. Heritage 50WG (active ingredient azoxystrobin) at 0.4 oz can be expected to provide good to excellent control for a minimum of three weeks under high disease pressure. Heritage 50WG at 0.2 oz at 2-3 week intervals also has worked very well in several tests, although some loss in disease control has been observed in some studies. Cleary's 3336 F (thiophanate methyl) at 6 fl oz at a two-week spray interval has provided excellent control in almost all studies, although control slipped slightly at the end of the two-week interval in one study at the University of Maryland. The 8 fl oz rate of Cleary's 3336 F at no more than two-week intervals may be necessary for assuring excellent disease control in all circumstances. Stretching the spray interval for Cleary's 3336 F beyond two weeks not only exceeds the instructions on the label, but also is unwise in the event that disease pressure becomes intense. In UK tests for gray leaf spot control conducted thus far, Compass 50WG (trifloxystrobin) applied by itself has provided good control when used at high rates and frequent intervals (such as 0.2 oz at 14-day intervals), but the use of low labeled rates or long spray intervals may result in unacceptable levels of disease.

Several labeled fungicides would fall into the "second tier" for gray leaf spot control. These are products that, in my opinion, can be expected to provide adequate disease control under low to moderate pressure, but inadequate disease control under high disease pressure. Products which fall into this category include: those containing chlorothalonil (Daconil and related products), propiconazole (Banner) and cyproconazole (Sentinel).

It is noteworthy that iprodione (Chipco 26GT) and flutolanil (Prostar)–fungicides commonly used for brown patch control on perennial ryegrass—are ineffective against gray leaf spot.

Fungicide Resistance Issues

Azoxystrobin, thiophanate-methyl, and trifloxystrobin are clearly key players for gray leaf spot control. However, superintendents are advised not to rely on these products exclusively for gray leaf spot control. All three are considered to have a significant risk of resistance development. Azoxystrobin and trifloxystrobin are considered to be in the same fungicide family (the strobilurin family) and share a common mode of action. *P. grisea* does not distinguish between these two products once it has been exposed to them, and resistance to one would confer resistance to the other. Thiophanate methyl is toxic to fungi by a completely different biochemical mode of action than the strobilurins, and thus, strains of *P. grisea* resistant to it would not be expected to be resistant to the strobilurins, at least at first.

The fungus *P. grisea* is remarkably adaptable to new control strategies, so I have great concern that repeated, widespread use of these fungicides could lead to a buildup of strains of *P. grisea* resistant to all three fungicides in a short time. Thus, golf course superintendents across the nation would be well-advised to practice appropriate resistance management strategies. Such strategies would include using all reasonable cultural practices to reduce disease pressure, and avoiding exclusive use of fungicides with a similar mode of action.

Based on my assessment to date, it seems that the most sensible use of azoxystrobin, thiophanate-methyl, and trifloxystrobin is to apply them during the period of greatest risk–the period when logarithmic disease increase is likely–and to use Tier II products when the risk of disease is low to moderate. This balances the need for excellent disease control with concerns over fungicide resistance as well as cost of the Tier I products.