Fungicidal control of gray leaf spot

Disease need not destroy perennial ryegrass.

Paul Vincelli, Ph.D.

Gray leaf spot (Pyricularia grisea) has emerged in recent years as one of the most destructive turfgrass diseases (4). Epidemics can seem explosive, causing widespread turf loss within days. Long known to damage St. Augustinegrass (Stenotaphrum secundatum), gray leaf spot epidemics have arisen in perennial ryegrass (Lolium perenne) only within the past few years. Epidemics have also occurred in newly established tall fescue (Festuca arundinacea) in Georgia and the Carolinas.

Disease dynamics

Pyricularia grisea is a leaf-infecting fungus that causes spotting and rapid blighting of infected leaves. During humid weather, the fungus produces vast quantities of spores on blighted tissues. These spores are spread by wind currents and splashing water. Symptoms and spores can appear within a few days of infection.

Leaf wetness, high humidity and suitable temperatures are the three most important environmental factors that govern infection and sporulation by P. grisea. Increasingly longer periods of leaf wetness allow for increasingly greater levels of infection, although sporulation is favored by intermittent drying. Temperatures in the high 70s to about 90 F are ideal for infection of rye-grasses. The disease often first develops in tall-cut swards such as roughs, especially in “heat sinks” such as southern slopes. Areas of cart traffic or otherwise compacted soil are often affected first.

Certain cultural practices can help reduce disease pressure from gray leaf spot. Keep nitrogen fertility low during spring and summer. In Kentucky, we recommend avoiding applications completely during this period, but if necessary, no more than 0.1 to 0.25 pounds of nitrogen per 1,000 square feet from spring greenup through Labor Day, to reduce susceptibility of the grass.

In the Mid-Atlantic States, superintendents are advised to maintain low mowing heights, because research there indicates that this reduces disease pressure (in the Midwest, the effect of mowing height is less certain). Collecting clippings can also reduce disease under low disease pressure, by removing infected leaf blades that serve as a source of spores. Avoiding irrigating near dusk may also help.

Unfortunately, cultural practices alone usually do not provide satisfactory control under high disease pressure on any perennial ryegrass cultivar. Many superintendents who manage perennial ryegrass have no alternative but to spray fungicides preventively.

Timely use of fungicides can help prevent the disease from reaching its “logarithmic phase,” or “log phase,” which is a period of rapid disease increase. Although infections can be found as much as four to six weeks before the start of log phase, this rapid uptick in disease development must be prevented (8,9,14). In Kentucky, this log phase can occur in established perennial ryegrass any time from the first week of August through September. In more-conducive climates, such as eastern and central Maryland, the log phase may occur as early as the third week of July. North of...
The greatest damage from gray leaf spot occurs during the pathogen's "log phase," when its population increases rapidly and destructively.

The Transition Zone, the general experience has been that the log phase often occurs later in August or in September.

**Efficacy**

Recent studies show that the disease is manageable with adequate applications of fungicides. The following guidelines are comprehensive and up-to-date, but they are based on current knowledge, which could change as additional data become available. Although all of the guidelines are consistent with product labels as of press time, the product label in hand at the time of application is the only appropriate guide for legal application of a fungicide.

Heritage 50WG (with the active ingredient azoxystrobin) is labeled for application against gray leaf spot at 0.2 to 0.4 ounce at 14- to 28-day intervals. Although the 0.2-ounce rate has proven very effective in some tests (5,6,7,13,15), biweekly applications of 0.2 ounce sometimes have resulted in noticeable foliar blighting (6,8,9,11,12).

In contrast, Heritage 50WG at 0.4 ounce has provided excellent disease control under high disease pressure (1,2,6,13,14,15,16). In one test, Heritage applied biweekly at 0.4 ounce failed to provide adequate disease control (10), perhaps because of severe drought stress during much of the experiment.

Thiophanate methyl has provided excellent control under high disease pressure. For example, Cleary's 3336 50WP and Fungo 50WSB have worked well when used at a minimum of 6 ounces at 14-day intervals (1,2,8,9,11,13). In one test at the University of Maryland, Cleary's 3336 50WP applied biweekly at 6 ounces provided excellent control for most of the season but slipped slightly at the end of the epidemic (5), suggesting that under the highest disease pressure, the 8-ounce rate may be necessary. Scheduling applications more than two weeks apart has resulted in unacceptable disease losses (2,13). Spectro 90WDG, a pre-mix of thiophanate-methyl and chlorothalonil, has provided excellent control under high disease pressure when applied biweekly at 8 ounces (5,11,13,15).

Trifloxystrobin (Compass 50WG) is labeled for controlling gray leaf spot at 0.15 to 0.20 ounce at 14-day intervals or at 0.25 ounce at 21-day intervals.
The performance of Compass 50WG in field tests thus far has varied from good to excellent against gray leaf spot. In a number of studies, there is no statistical difference between Compass used at 0.2 ounce at two-week intervals and the top-performing treatment in the test (3,5,7,10,13). However, in two tests (11,15), application of Compass 50WG at 0.2 ounce or more at two-week intervals provided slightly lower disease control than the top treatment in the test. Applications less frequent than every two weeks may result in unacceptable disease losses, even at 0.25 ounce (15). Overall, however, Compass at 0.2 ounce at two-week intervals can provide good to excellent control under high disease pressure.

Formulations of propiconazole (Banner Maxx 1.24MEC) and chlorothalonil (Daconil Ultrex 82.5WDG and related products) are labeled for gray leaf spot. Used alone, these products provide acceptable control under low disease pressure (3,7), and in one study, Daconil Ultrex provided excellent control under high pressure (10). However, research indicates that these products usually cannot provide acceptable control under high disease pressure (1,5,6,9,12,13,15). Tank-mixing propiconazole and chlorothalonil can, however, provide good to excellent control under a range of disease pressures (5,7,10,15).

Another soon-to-be-labeled product is MANhandle, a premix of mancozeb and myclobutanil. Mancozeb provides acceptable control of gray leaf spot under moderate pressure (2,3), but provides poor control under high disease pressure (1,8,9,11). Myclobutanil has performed poorly against gray leaf spot.

### Fungicides vs. gray leaf spot

<table>
<thead>
<tr>
<th>Efficacy category</th>
<th>Product</th>
<th>Rate (in ounces)</th>
<th>Interval (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I – Good to excellent with high disease pressure</td>
<td>Banner MAXX plus Daconil Ultrex</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Clear's 3336 50WP</td>
<td>6-8</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Compass 50WG</td>
<td>0.2</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Fungo 50WISB</td>
<td>6-8</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Heritage 50WG</td>
<td>0.4</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Spectro 90 WDG</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Tier II – Good under light to moderate disease pressure</td>
<td>Banner MAXX</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Daconil Ultrex</td>
<td>3.7</td>
<td>7-10</td>
</tr>
<tr>
<td>No significant efficacy</td>
<td>Chipco GT</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prostar 70WP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Gray leaf spot affects the perennial ryegrass surrounds, but not the closer-cut collar or the bentgrass green in this picture.

when used alone (6,9,13). Although performance of the mixture was good under high disease pressure in one test (9), a wise strategy may be to use other products and tank mixes until more data are available for this product.

It is important to point out that iprodione (Chipco 26GT and related products) and flutolanil (Prostar 70WG) have no meaningful activity against gray leaf spot (1,5,11,12). It is unfortunate that these fungicides — commonly used for brown patch control of perennial ryegrass — cannot also provide control of gray leaf spot.

A program for Kentucky

Some of the most effective fungicides against gray leaf spot are also the most costly. Thus, superintendents have an economic incentive to use these products wisely — which means taking steps to delay development of fungicide-resistant strains of the disease.

Pyricularia grisea will be quite capable of developing resistance to all of the systemic fungicides currently labeled against it. As a pathogen of rice, P. grisea is notoriously adaptable to new control strategies. The question is only when this fungus will develop resistance to these turf fungicides, so don't speed the process by using just one fungicide repeatedly.

A scouting-based approach to scheduling sprays against this disease seems to make the most sense and would be consistent with an IPM approach to turf management. However, research suggests that a spray schedule based on calendar date can be as effective as initiating sprays when lesions are first detected (8,9,14).

Several factors complicate the scouting-based approach to scheduling sprays. First, experienced pathologists often agree that it is usually not possible to positively identify gray leaf spot without a microscope. Another complication with a scouting-based approach is the very rapid rate of disease progression under ideal conditions for disease development, and once a substantial amount of blighting has occurred, a curative spray program may provide unsatisfactory results (11). Unfortunately, we do not have a predictive system that can reliably identify periods when fungicide protection is necessary, although research on this topic is continuing, and perhaps one will be
available in the near future.

Thus, a spray program should integrate at least three objectives: acceptable preventive control, reasonable cost and resistance management. For Kentucky courses for the upcoming season, begin by spraying the Banner Maxx/Daconil Ultrex tank mix July 15-20. This provides sufficient protection that superintendents can sleep soundly even if disease activity begins.

Two weeks later, select Heritage, Spectro 90WG or Cleary's 3336 for the second application, for excellent control should disease pressure increase. Because of the high disease potential at that time of year, the third spray would likewise be selected from these or related products, but the systemic component would have a different mode of action than the previous spray.

For example, if one chose to spray Spectro 90WG or Cleary's 3336 (both of which contain thiophanate methyl) for the second application, then choose a strobilurin like Heritage for the third application. These sprays should carry a superintendent through until about Labor Day.

After Labor Day in Kentucky, fungicide protection is still often needed, but not always. In an epidemic year such as 1998, aggressive disease progress can occur in Kentucky even in the latter half of September in mature turf. In such years, fungicidal protection is necessary in established swards throughout the month (13). However, even then, it may be possible toward the latter half of the month to use the less-expensive products or tank mixes.

In Kentucky, it is clearly possible to withhold fungicides after Labor Day under low to moderate disease pressure after weather turns cool and dry (12,16). This may be risky until we have a better handle on how to predict epidemics of gray leaf spot, but it is possible. Our research indicates that, in Kentucky, if one has kept the disease

### Delay fungicide resistance

By using fungicides with different modes of action, superintendents can slow the development of resistance in the pathogen population. *Pyricularia grisea* is likely to quickly become resistant to fungicides that are used repeatedly.

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Mobility within plant</th>
<th>Fungicide group</th>
<th>Examples of product names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azoxyostrobin</td>
<td>systemic</td>
<td>Strobilurin</td>
<td>Heritage 50WG</td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>protectant</td>
<td>Multisite inhibitor</td>
<td>Daconil Ultrex</td>
</tr>
<tr>
<td>Propiconazole</td>
<td>systemic</td>
<td>DMI*</td>
<td>Banner MAXX</td>
</tr>
<tr>
<td>Thiophanate methyl</td>
<td>systemic</td>
<td>Benzimidazole</td>
<td>Cleary's 3336, Fungo 50WSB</td>
</tr>
<tr>
<td>Trifloxystrobin</td>
<td>mesostemetic†</td>
<td>Strobilurin</td>
<td>Compass 50WG</td>
</tr>
</tbody>
</table>

*Demethylation-inhibitor, a sterol-inhibitor fungicide.
† Enters plant tissue but does not translocate in vascular tissues.
under control through Labor Day in a season with low-to-moderate disease pressure, it should be possible to exercise more flexibility in selecting products and spray intervals after Labor Day, especially if weather conditions have become unfavorable for the disease.

Seedlings are highly susceptible to infection by *P. grisea*. Delaying overseeding until mid-to late-September can reduce the chance that seedlings will encounter a disease outbreak. In Kentucky swards that have been overseeded late may need preventive fungidal protection through at least the first week of October and possibly later. Research on protecting overseeded plants will be initiated at the University of Kentucky this year, but for now, there are no guidelines, although seedlings are not at risk of significant phytotoxicity from most products in this article. Nevertheless, check with manufacturer’s representatives to confirm the safety of products on emerging seedlings.

These guidelines for fungicide timing apply to Kentucky conditions. The timing would need to be adjusted to fit the dynamics of the disease in your own area. Extension turfgrass scientists, USGA agronomists, and other knowledgeable professionals can help you make appropriate adjustments.

**Reducing risk of resistance**

The foundation of a resistance-management program is to minimize disease pressure through cultural practices as much as possible. Reducing the size of the pathogen population will reduce the chances of a resistant mutant occurring on your course.

Another important tactic is to minimize consecutive applications of fungicides that have a similar mode of action, especially during periods of greatest disease pressure. In the example above, three applications would provide protection from mid-July through Labor Day. Each application uses a different

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**Fungicide costs for gray leaf spot**

Estimated prices for Lexington, Ky., reveal a dangerous temptation: Superintendents should not use only the cheapest alternatives, because gray leaf spot is likely to quickly become resistant to fungicides it is overexposed to.

<table>
<thead>
<tr>
<th>Product</th>
<th>Rate (in ounces) per 1,000 sq. ft.</th>
<th>Spray interval (days)</th>
<th>Cost per application*</th>
<th>Cost per treatment-day†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daconil Ultrex 82.5WDG</td>
<td>3.7</td>
<td>10</td>
<td>$2,692</td>
<td>$274</td>
</tr>
<tr>
<td>Compass 50WDG</td>
<td>0.2</td>
<td>14</td>
<td>4,417</td>
<td>314</td>
</tr>
<tr>
<td>Banner MAXX 1.24MEC</td>
<td>2 fl</td>
<td>14</td>
<td>4,992</td>
<td>353</td>
</tr>
<tr>
<td>Banner MAXX 1.24MEC</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Daconil Ultrex 82.5WDG</td>
<td>3.7</td>
<td>14</td>
<td>5,188</td>
<td>366</td>
</tr>
<tr>
<td>Heritage 50WG</td>
<td>0.4</td>
<td>21</td>
<td>11,265</td>
<td>536</td>
</tr>
<tr>
<td>Cleary’s 3336 50WP</td>
<td>6</td>
<td>14</td>
<td>9,723</td>
<td>693</td>
</tr>
<tr>
<td>Spectro 90WDG</td>
<td>8</td>
<td>14</td>
<td>11,435</td>
<td>823</td>
</tr>
</tbody>
</table>

*Based on expected prices in Lexington in April 2000. Assumes treatment of 30 acres of fairway.  
†Cost per application divided by spray interval.
systemic fungicide, each with a distinct biochemical mode of action.

Unfortunately, the substantially higher cost of Cleary’s 3336 and related products compared with strobilurin fungicides provides a large incentive to rely heavily or exclusively on the strobilurins under high disease pressure. This could accelerate the selection of strobilurin-resistant strains of *P. grisea*. Ask your greens committee to provide a suitable budget to allow a rigorous fungicide rotation strategy. Don’t let your course be the first in the nation to select for fungicide-resistant *P. grisea*.

Another tactic is to tank-mix products having different modes of action during periods of high disease pressure. Chorothalonil, a multisite inhibitor, is an especially good mixing partner from the standpoint of resistance management. There is essentially no significant risk of resistance to a multisite inhibitor fungicide.

Switching away from the strobilurins and thiophanate methyl is an important resistance-management strategy as the risk of log phase diminishes, because it reduces the exposure of *P. grisea* to these at-risk fungicides.

If a substantial amount of blighting has occurred before a fungicide has been applied, use a tank-mix or pre-mix of a highly effective systemic with a contact like chlorothalonil. Subsequent applications should be made with a product having a different mode of action than first. Such an approach should help to minimize the risk of quickly selecting for a fungicide-resistant strain.

At the University of Kentucky we are initiating a program for monitoring the baseline sensitivity of early collections of *P. grisea* to a range of fungicides. This database will be invaluable as possible fungicide-resistant strains of *P. grisea* emerge in the future.

**Acknowledgment**

Thanks to Wakar Uddin, Ph.D., and Robert Soika, Ph.D., for background information on one of the tests mentioned in this article.

**Literature cited**