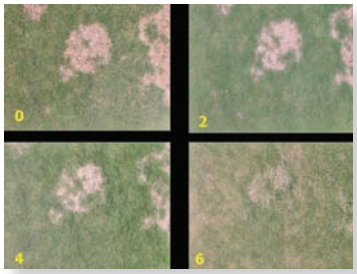
Spring dead spot management in bermudagrass

Testing in North Carolina has found that some products successfully control spring dead spot and others show some potential.



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Superintendents who manage bermudagrass (*Cynodon* species) in the transition zone are faced with the daunting task of managing a warm-season grass that goes into a dormant state during the winter. In addition to the potential for injury during the winter from cold, freezing or desiccation, dormant or slowly growing bermudagrass becomes susceptible to damage from fungal diseases, including spring dead spot.

What is it?

Spring dead spot is the most important disease of bermudagrass grown in the transition zone. As the name implies, spring dead spot symptoms appear in the spring as bermudagrass comes out of winter dormancy. Circular patches of turf ranging from 6 inches (15.2 centimeters) to several feet in diameter remain dormant as the surrounding turf turns green. The patches of dormant turf eventually disintegrate, leaving depressions in the playing surface that are often invaded by weeds. Recovery from spring dead spot is slow and occurs when bermudagrass spreads into the patch from the outside. In severe cases, recovery can take the entire growing season.

Managing spring dead spot

In many regions, spring dead spot is the only disease of bermudagrass that warrants preventive fungicide applications. Unfortunately, fungicide treatments for spring dead spot that are both cost-effective and reliable are lacking. In fact, some university extension services specifically do not recommend fungicide applications for spring dead spot because results are unreliable, and most others provide no specific recommendations (6,9,10). Furthermore, application instructions on fungicide labels are vague and do not provide specific guidelines for the timing or method of applications.

Spring dead spot can be partially controlled with a combination of variety selection and cultural practices. Bermudagrass varieties selected for cold-tolerance, such as Midiron, Vamont and TifSport, tend to be more resistant to spring dead spot (1). Culturally, spring dead spot is encouraged by high nitrogen levels in the fall, potassium deficiency, high soil pH, soil compaction, excessive thatch and poor soil drainage (4,7). Correcting these cultural problems is a critical first step for spring dead spot management. However, cultural practices alone do not provide adequate control in many cases, and fungicide applications are needed to prevent unacceptable damage.

Currently, five fungicides are labeled for spring dead spot: Cleary's 3336 (Cleary Chemical Corp.) and others (thiophanate-methyl); Banner Maxx (Syngenta) and others (propiconazole); Eagle (myclobutanil, Dow AgroSciences); Heritage (azoxystrobin, Syngenta); and Rubigan (fenarimol, Gowan Co.). Of these, Rubigan and Eagle are the products most widely used for spring dead spot control. Some superintendents report excellent results with Rubigan or Eagle, whereas others have seen little benefit from these products. Our

research efforts at North Carolina State University have focused on developing fungicide programs for spring dead spot that are specific, effective and reliable. Although fungicide treatment may not be economical in all situations, our goal is to provide superintendents with more options to manage this destructive disease in high-value areas.

Factors influencing spring dead spot control

Although the aboveground symptoms of spring dead spot are most striking, the disease actually develops belowground in the roots, rhizomes and stolons. Three fungal species have been shown to cause spring dead spot: *Ophiosphaerella herpotricha, O. korrae* and *O. narmari* (8). These fungi belong to a group of pathogens called the ectotrophic root-infecting fungi. Other pathogens in this group include *Magnaporthe poae*, which causes summer patch, and *Gaeumannomyces graminis* var. *avenae*, which causes take-all patch.

For effective control of summer patch and take-all patch, the timing and method of fungicide application is critical. Applications must be initiated early, when the pathogens are just beginning to grow and infect roots. Infection of bermudagrass roots by *Ophiosphaerella* species is thought to occur in the fall, but the precise soil temperature that triggers disease development is unknown and must be determined so that applications can be timed accurately.

Application methods that move a fungicide into the root and crown area are most effective for control of take-all patch and summer patch. Increased water volumes (5 gallons of water/1,000 square feet [0.2 liter/square meter]), post-application irrigation (0.25 inch [0.64 centimeter] water) or fungicide injection (1 to 2 inches [2.5-5.1 centimeters] deep) significantly improve control compared to foliar applications in 2 gallons of water or less/1,000 square feet (≤0.08 liter/square meter). Application method may also affect spring dead spot control, but this has not been studied in detail.

Differences in pathogen distribution may also be responsible for erratic control of spring dead spot. Research has not been conducted to verify if the *Ophiosphaerellas* vary in their response to fungicides, but they do differ in their aggressiveness, with *O. herpotricha* being more aggressive than *O. korrae* (5). Most attempts to control *O. herpotricha* with fungicides have failed, whereas control of *O. korrae* has been moderately successful. In the Midwestern United States, *O. herpotricha* is the predominant cause of spring dead spot, with *O. korrae* and *O. narmari* present at low levels (5). *O. korrae* is the predominant species in the east-

Early spring symptoms of spring dead spot in bermudagrass. **Photos by L. Tredway**

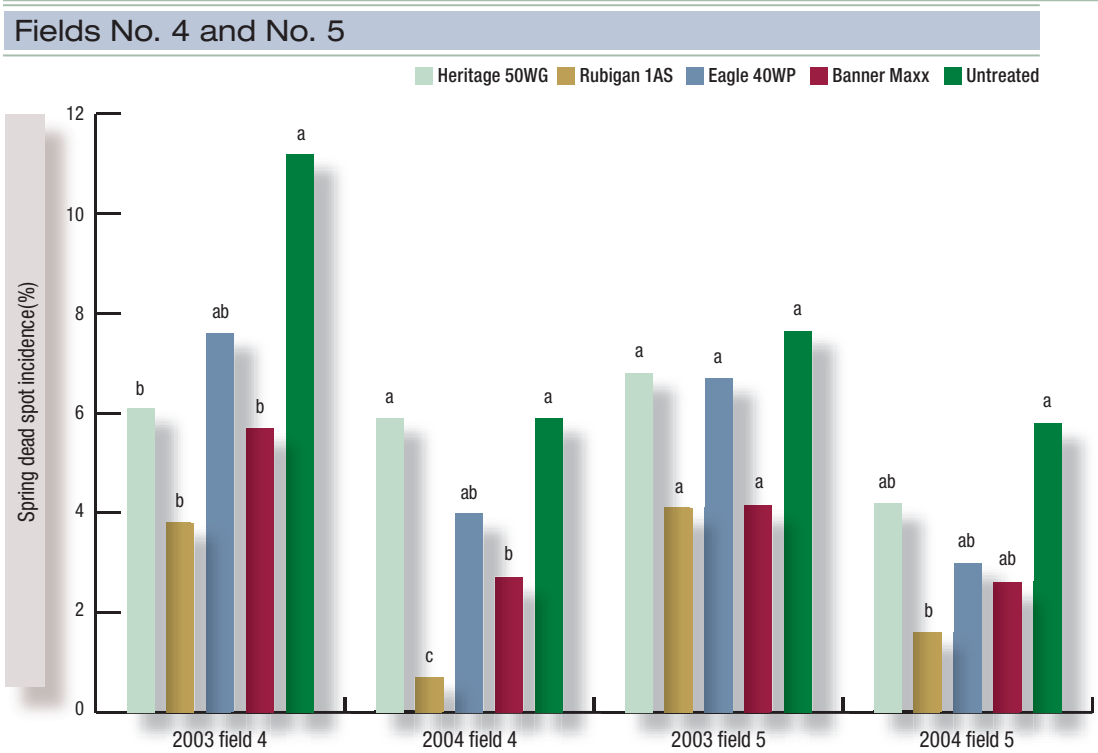
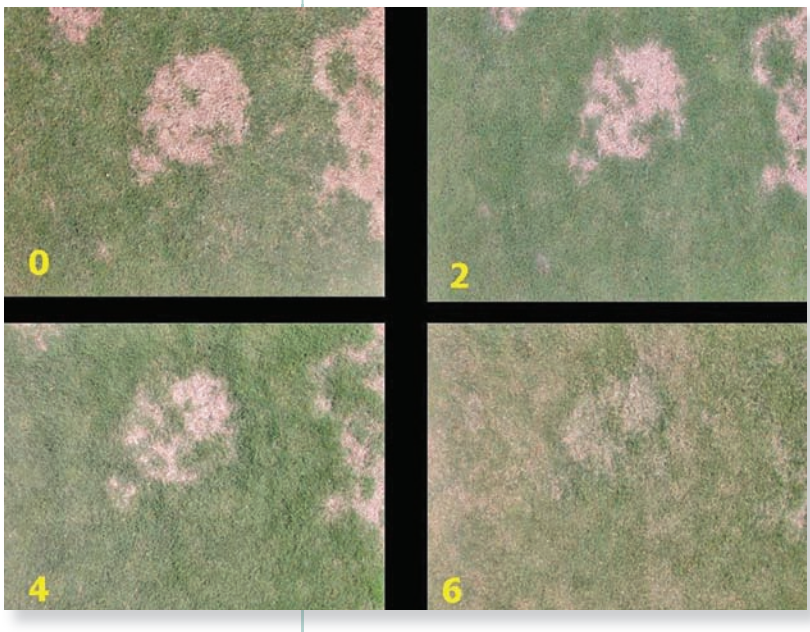


Figure 1. Spring dead spot incidence in response to fungicide applications on fields No. 4 and No. 5 at Walnut Creek Softball Complex in Raleigh, N.C. Data are averaged across all application methods. Bars containing the same letter are not significantly different.



Images taken of an untreated plot demonstrate the slow recovery of bermudagrass from spring dead spot injury; 0 = day one, 2 = 2 weeks later, 4 = 4 weeks later, and 6 = 6 weeks later.

ern U.S., but *O. herpotricha* may also be present in certain locations (2,3).

Comparison of fungicides and application methods

At North Carolina State University, we have conducted several research projects to identify the most effective and cost-efficient methods for spring dead spot control in bermudagrass. Field experiments were initiated in fall 2002 on Tifway bermudagrass maintained under athletic field conditions at the Walnut Creek Softball Complex in Raleigh, N.C. This location has a history of severe spring dead spot infestation, and the disease is well distributed across several fields in the complex. Before our experiments, the fields had never been treated with fungicides for spring dead spot control. The same plots were treated in both years of the study.

This experiment was designed to compare fungicides as well as application methods. Four fungicides were used in this experiment:

- Banner Maxx at 4 fluid ounces/1,000 square feet (1.3 milliliters/square meter)
- Eagle 40WP at 1.2 ounces/1,000 square feet (0.37 gram/square meter)
- Heritage 50WG at 0.4 ounce/1,000 square feet (0.12 gram/square meter)
- Rubigan at 6 fluid ounces/1,000 square feet (1.9 milliliters/square meter)

Each fungicide was applied on Sept. 24 and Oct. 31, 2002, and on Oct. 2 and Oct. 28, 2003, using one of five different application methods:

- surface application in 2.5, 5 or 10 gallons water/1,000 square feet (0.1, 0.2 or 0.4 liter/square meter)
- surface application in 2.5 gallons/1,000 square feet (0.1 liter/square meter) watered-in with 0.25 inch (0.64 centimeter) of water immediately after application
- subsurface injection to a depth of 1.5-2.0 inches (3.8-5.1 centimeters) using the Textron Envirojet

In 2003, Banner Maxx, Heritage and Rubigan significantly reduced spring dead spot incidence on field No. 4, but only Banner Maxx and Rubigan controlled the disease on field No. 5 (Figure 1). Overall, Rubigan provided the best control, reducing spring dead spot from 11% to 4% on field No. 4 and from 8% to 4% on field No. 5. Banner Maxx also performed well, reducing the disease from 11% to 6% on field No. 4 and from 8% to 4% on field No. 5.

In 2004, Banner Maxx and Rubigan significantly reduced spring dead spot incidence on field No. 4, but only Rubigan significantly reduced disease on field No. 5 (Figure 1). Once again, Rubigan provided the best control by reducing spring dead spot from 6% to 1% on field No. 4 and from 6% to 1.5% on field No. 5. Banner Maxx performed well again, reducing the disease from 6% to 3% on both fields.

In both years, application methods did not significantly affect the performance of fungicides; however, applications that were watered-in with 0.25 inch (0.64 centimeter) of irrigation or made in high volumes of water (5 or 10 gallons/1,000 square feet [0.20 or 0.40 liter/square meter])

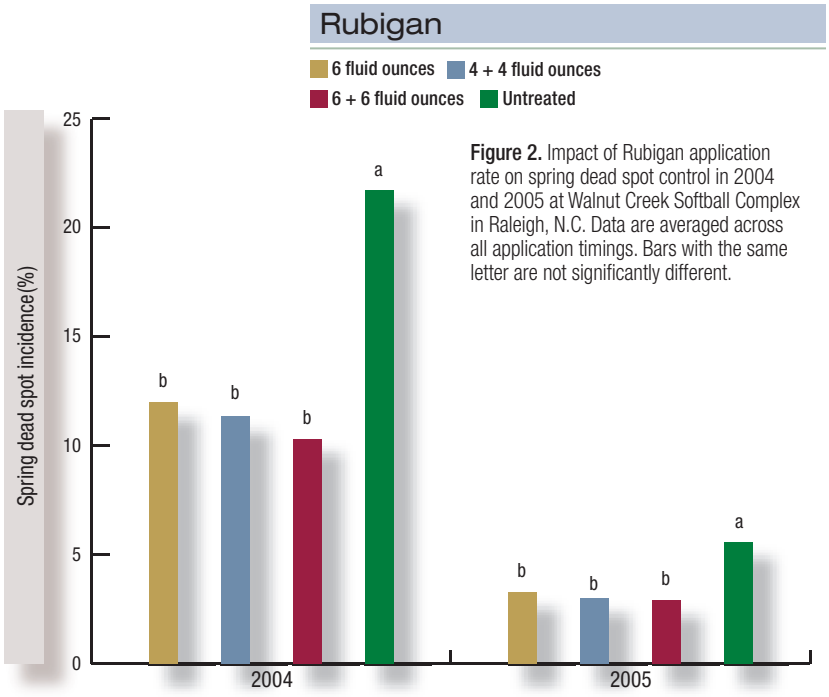


Figure 2. Impact of Rubigan application rate on spring dead spot control in 2004 and 2005 at Walnut Creek Softball Complex in Raleigh, N.C. Data are averaged across all application timings. Bars with the same letter are not significantly different.

tended to provide better control (data not shown). Fungicide injection using the Textron Envirojet did not improve the level of control, likely because of the large injection spacing (4 inches × 2 inches [10.2 centimeters × 5.1 centimeters]) employed by the unit used in this research.

Optimal rate and timing of Rubigan applications

Based on the results described above, we initiated an experiment to determine the optimal rate and timing of Rubigan applications for control of spring dead spot. This research was also conducted at the Walnut Creek Softball Complex in Raleigh, N.C.

In 2003, treatments were applied on Aug. 1, Aug. 15, Sept. 1, Sept. 15 and Oct. 1. Applications were scheduled for the same dates in 2004, but because of inclement weather were applied on Aug. 23, Oct. 4, Oct. 20 and Nov. 5. On each date, the following fungicide programs were initiated:

- no fungicide
- Rubigan 1AS at 6 fluid ounces/1,000 square feet (1.9 milliliters/square meter)
- Rubigan 1AS at 4 fluid ounces + 4 fluid ounces/1,000 square feet (1.3 milliliters + 1.3 milliliters/square meter)
- Rubigan 1AS at 6 fluid ounces + 6 fluid ounces/1,000 square feet (1.9 milliliters + 1.9 milliliters/square meter)

For treatments receiving split applications, the second application was made 14 days after the first. All treatments were applied at 40 psi (275.8 kilopascals) with TeeJet 8008 flat-fan nozzles to deliver 5 gallons of water/1,000 square feet (0.20 liter/square meter). The same plots were treated in both years of the experiment.

In both years, no differences in efficacy were detected among the application timings. Rubigan programs initiated between Aug. 1 and Oct. 1 were equally effective (data not shown). There were also no differences in efficacy among the application rates in both years. A single application of 6 fluid ounces (1.9 milliliters/square meter) was as effective as two applications of 4 or 6 fluid ounces (1.3 or 1.9 milliliters/square meter) (Figure 2). Rubigan provided between 45% and 52% control in 2004 and 41% to 48% control in 2005.

Fungicide performance and application timing in fairways

We initiated this experiment in 2005 on Tifway bermudagrass fairways at Brier Creek Country Club in Raleigh, N.C. Four fungicides were evaluated at this location:

- Rubigan 1AS applied once at 6 fluid ounces/1,000 square feet (1.9 milliliters/square meter) or twice at 4 fluid ounces/1,000 square feet (1.3 milliliters/square meter)
- Banner Maxx 1.3ME applied at 4 fluid ounces/1,000 square feet (1.3 milliliters/square meter)
- Lynx 2SC (tebuconazole, Bayer), applied at 2.2 fluid ounces/1,000 square feet (0.70 milliliter/square meter) (at press time, this product had not been registered for use on turf)
- Eagle 1.67EW applied at 2.4 fluid ounces/1,000 square feet (0.76 milliliter/square meter)

Each product was applied on seven different dates from Aug. 21 through Nov. 14, and each was applied either once or twice on a 28-day interval. All fungicides were applied at 40 pounds/square inch (275.8 kilopascals) with TeeJet 8008 flat-fan nozzles in 5 gallons of water/1,000 square feet (0.20 liter/square meter).

As in our previous research at Walnut Creek, application timing did not significantly influence fungicide performance; applications initiated between Aug. 21 and Nov. 14 were equally effective (data not shown). When averaged across all application timings, one or two applications of Rubigan significantly reduced spring dead spot incidence, providing a 46% and 55% reduction, respectively (Figure 3). Two applications of Lynx were required to provide significant control and reduced spring dead spot incidence by 50%. Banner Maxx and Eagle did not provide significant control whether they were applied once or twice.

Ophiosphaerella korrae infections cause necrosis in bermudagrass stolons and roots.

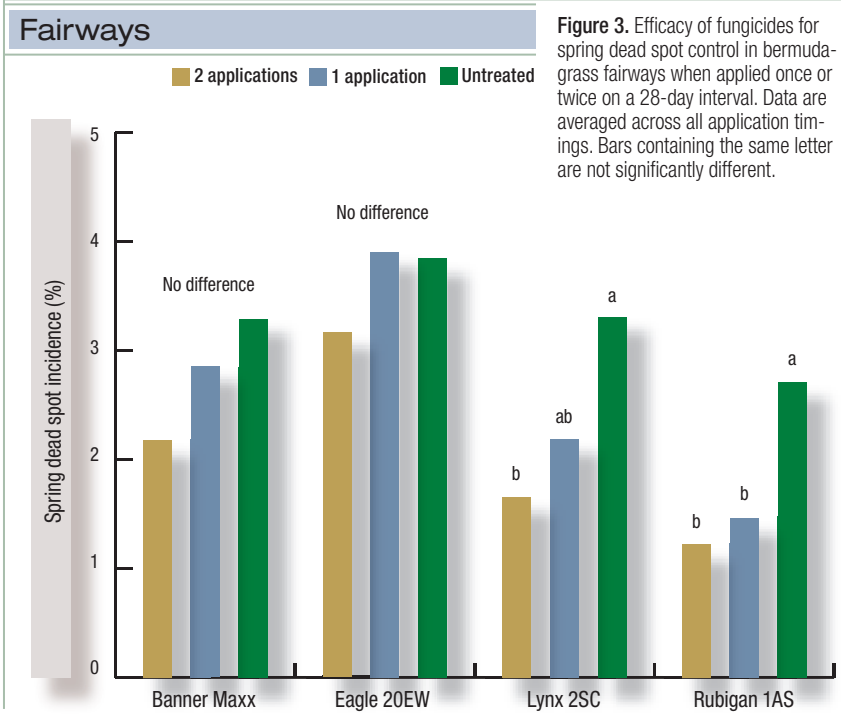


Figure 3. Efficacy of fungicides for spring dead spot control in bermudagrass fairways when applied once or twice on a 28-day interval. Data are averaged across all application timings. Bars containing the same letter are not significantly different.

Summary and conclusions

For decades, turfgrass researchers have attempted to develop effective methods for spring dead spot control. Therefore, it is no surprise that we did not identify the "magic bullet" after a few years of research. We did, however, observe several important trends.

- Rubigan has provided the most effective and consistent control of spring dead spot across all of our experiments. Banner Maxx and Lynx have also shown promise for prevention of spring dead spot, but continued research on these products is needed. (At press time, Lynx had not yet been registered for use on turf.)
- Fungicides applied in high volumes of water (5 or 10 gallons/1,000 square feet [0.20 or 0.41 liter/square meter]) or watered-in after application tended to be more effective than foliar applications in 2.5 gallons/1,000 square feet (0.10 liter/square meter).
- A single application of Rubigan at 6 fluid ounces/1,000 square feet [1.9 milliliters/square meter] has been as effective as two applications at 4 or 6 fluid ounces (1.3 or 1.9 milliliters/square meter) over three years of research in athletic fields and fairways.
- The precise timing of fungicide applications for spring dead spot does not appear to be critical. Applications between Aug. 1 and Nov. 14 have been equally effective in our trials; during this time period, soil temperatures are generally between 60 F (15.5 C) and 80 F (26.6 C) in Raleigh, N.C. Preventive fungicide applications should be made in the fall when soil temperatures are in this range.

Based on our results and observations, preventive control of spring dead spot with fungicides is possible. However, complete disease control apparently cannot be obtained within two years following initiation of a fungicide program. Long-term research is needed to determine whether the level of spring dead spot control will improve after several successive years of preventive treatments. It should be emphasized that this study was conducted on sites that were infested with *O. korrae* and that these strategies may not apply to managing spring dead spot caused by other *Ophiosphaerella* species. Current research at N.C. State is focusing on long-term management of spring dead spot and the differential response of *Ophiosphaerella* species to fungicide applications.

The research says

- Rubigan and Eagle are the fungicides most often used to combat spring dead spot. This study tested Banner Maxx, Eagle 40WP, Eagle 20 EW, Heritage 50WG, Rubigan and Lynx (not yet registered for turf).
- Rubigan provided the most effective and consistent control of spring dead spot control. Banner Maxx and Lynx have shown some promise but require more testing.
- Fungicides that are watered-in or applied in high volumes of water (5 or 10 gallons/1,000 square feet) were more effective than foliar applications in 2.5 gallons/1,000 square feet.
- A single application of Rubigan at 6 fluid ounces/1,000 square feet has been as effective as two applications at 4 or 6 fluid ounces over three years of research in athletic fields and fairways.
- Preventive fungicide applications should be made in the fall when soil temperatures range from 60 F to 80 F.

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