Research *You Can Use*

Controlling Spring Dead Spot of Bermudagrass

Scientists at Mississippi State University conduct research to unravel this mysterious turfgrass disease.

BY MARIA TOMASO-PETERSON

OBJECTIVES

- Determine the effectiveness of spring and fall fungicide applications for reduction of spring dead spot incidence and severity.
- Determine the effect of organic fertilizer for the reduction of spring dead spot incidence and severity and overall improvement of turf quality.

Start Date: 2007
Project Duration: Three Years
Total Funding: $30,000 Per Year

Spring dead spot is a serious root-rot disease of bermudagrass and is the most important disease of hybrid bermudagrasses managed as putting green and fairway turf. Aesthetically undesirable necrotic patches ranging from a few inches to several feet in diameter are evident in the spring and early summer in bermudagrass swards that experience a dormant period.

Three fungal species in the genus *Ophiosphaerella* (*O. korrae*, *O. herpotricha*, and *O. narmari*) are identified as the causal organisms throughout the United States and Australia. In Mississippi, *O. korrae* has been identified as the causal organism of spring dead spot and has been consistently isolated from Tifway bermudagrass roots managed as a fairway on a monthly basis for two years.

Based on fungal isolation results, it has been determined that the frequency of occurrence of *O. korrae* was greatest

Fungicide applications are watered into the rootzone of Tifway bermudagrass at Old Waverly Golf Club, West Point, Mississippi.

Table 1
Fungicide treatments, application rates, and timing for controlling spring dead spot in a Tifway bermudagrass fairway.

Fungicide Treatment	Application Rate (oz. product/1,000 sq. ft.)	Application Timing
Fenarimol (Rubigan)	4.0	March, April, Sept., Oct.
Fenarimol	4.0	Sept., Oct.
Fenarimol	4.0	March, April, May
Fenarimol	4.0	April, Sept., Oct.
Fenarimol + thiophanate-methyl	6.0 + 6.0	Sept.
Propaconazole (Banner)	4.0	Oct.
Myclobutanil	1.2	Nov.
Azoxystrobin	2.0	Oct.
Control (water)	—	—

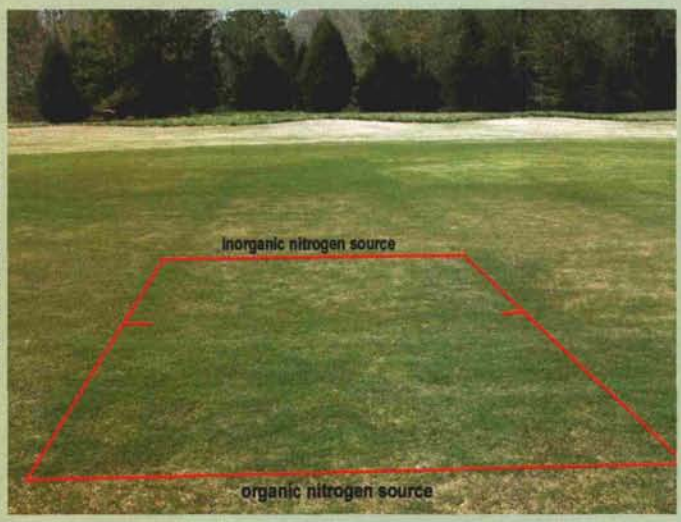
Spring dead spot is a serious root-rot disease of bermudagrass and is the most important disease of hybrid bermudagrasses managed as putting green and fairway turf.

during spring transition (9.4%) compared to summer (4.6%) and fall (3.1%) transition growth periods. As a result of the observed fungal activity in bermudagrass roots during spring transition, fenarimol (Rubigan) and other standard fungicides labeled for spring dead spot control are being applied to the symptomatic bermudagrass fairway in the spring and fall (Table 1). An organic or inorganic nitrogen source is being applied concurrently with fungicides to identify a fungicide/nitrogen source combination that may result in reduced spring dead spot incidence and severity while promoting high turf quality.

The study was initiated in the spring of 2007 in the Tifway bermudagrass fairway located at Old Waverly Golf Club, West Point, Miss. Spring dead spot symptoms were observed throughout the study area in the spring of 2007. The treatment plots (15 × 10 ft.) are arranged in a randomized complete block design with a split-plot arrangement of treatments and replicated four times.

Fungicide treatments are the whole-plot factor, and nitrogen source is the sub-plot factor (7.5 × 10 ft. sub-plots). Fungicide treatments are applied during the spring and fall transitions. The nitrogen sources include Roots® 12-2-12 organic fertilizer and a 12-2-12 blend of inorganic fertilizer including ammonium sulfate (21-0-0), triple super phosphate (0-46-0), and muriate of potash (0-0-60) applied at 1.0 lb. of N per 1,000 sq. ft. per month (May-October).

Turfgrass quality is recorded monthly throughout the growing season. Spring dead spot incidence and severity are evaluated in the spring of each year by determining the number of patches and quantifying the area of symptomatic bermudagrass per plot using digital image analysis. Recovery of symptomatic patches also will be monitored throughout spring transition. The soil pH was 6.1, with phosphorus, potassium, magnesium, zinc, and calcium at high to very high levels, according to soil analyses conducted at the Mississippi State University Soil Testing Lab. Soil pH is being analyzed



Control plot in March 2008. Half the plot was treated with an organic nitrogen source (foreground) and the other with an inorganic nitrogen source (background) throughout the 2007 growing season.

Healthy turf (above) quantified as no disease. Spring dead spot symptomatic turf (below) determined to be 7% diseased. These results are based on digital imaging analysis.

in the spring and fall of each year to monitor the effects of the nitrogen sources.

The results of this three-year study will identify a fungicide/fertility disease management program that is effective for controlling spring dead spot of bermudagrass managed as fairway turf. These results also will allow us to determine whether there is an added benefit of using an organic nitrogen source that includes bio-stimulants and microbes compared to an inorganic, acidifying fertilizer in reducing spring dead spot incidence and severity.

SUMMARY POINTS

- The occurrence of *O. korrae* was greatest in Tifway bermudagrass roots in spring transition (9.4%) compared to summer (4.6%) and fall (3.1%) transition growth periods in 2005 and 2006.
- Fenarimol and other standard fungicides labeled for spring dead spot control are applied to a symptomatic Tifway bermudagrass fairway in the spring and fall.
- An organic or inorganic nitrogen source is applied concurrently with fungicides to identify a fungicide/nitrogen source combination that results in reduced spring dead spot incidence and severity.

RELATED INFORMATION

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http://turf.lib.msu.edu/ressum/2007/20.pdf

http://a-c-s.confex.com/crops/2007am/techprogram/P36305.HTM

http://www.apsnet.org/meetings/2007/abstracts/a07ma561.htm

http://www.apsnet.org/meetings/2006/abstracts/a06ma587.htm

http://a-c-s.confex.com/crops/2006am/techprogram/P23425.HTM

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CONNECTING THE DOTS

An interview with Dr. Maria Tomaso-Peterson *regarding Mississippi State University's efforts to manage this important disease of bermudagrass.*

Q: *Developing effective management strategies for spring dead spot (SDS) of bermudagrass would certainly be welcome news for superintendents of southern golf courses. Your data indicate that the frequency of occurrence of* O. korrae *was greatest in spring compared to summer and fall. Depending on the eventual outcome of this study, could this mean that fungicide programs to control SDS may be focused on applying fungicides in the spring to prevent necrotic symptoms that would otherwise appear a year later?*

A: Bermudagrass root production occurs on an annual basis, with the sloughing of old roots in early spring, while simultaneously initiating new roots. The greatest root production occurs in the summer growing season and declines in the fall. Spring fungicide applications may protect the new roots from *O. korrae* infection.
In this study, we may find that spring and fall applications are necessary to reduce *O. korrae* activity, allowing a window for establishing and sustaining a healthy, vigorous root system that can support stored carbohydrates that are necessary for spring green-up. Keep in mind that fungicides alone will not control this disease as past reports have stated. Cultivation practices such as core aeration and vertical mowing must be implemented during the growing season to promote vigorous bermudagrass root production.

Q: *What is the purpose of the nitrogen treatments? Are they largely to quantify regrowth rate from necrotic patches, or do you think nitrogen inhibits the infection and spread of SDS pathogens similar to the way nitrogen inhibits dollar spot?*

A: This project was designed to have nitrogen available to the bermudagrass fairway throughout the growing season and more specifically into the fall. It has been reported in the literature that late-season nitrogen (N) applications on bermudagrass improved fall and spring color and did not reduce total nonstructural carbohydrates in the rhizomes. Winter survival was not compromised and late-season N fertilization did not influence cold tolerance parameters such as lipid unsaturation or proline concentration. Reports also suggest no differences in freeze tolerances between N-treated and untreated samples, indicating late-season N applications do not predispose bermudagrass to winterkill, and therefore should not influence enhanced SDS severity of bermudagrass. Nitrogen most likely will not have a direct effect on *O. korrae*. The whole premise is to grow the healthiest bermudagrass plant such that if and when *O. korrae* infection occurs in the root system, the plant can out-compete the disease pressure.

Q: *What leads you to believe that an organic source of nitrogen would have any different effects on spring dead spot incidence than the inorganic ammonium sulfate source?*

A: It is not only the organic source of nitrogen that is slowly released and made available to the plant, but how the organic fertilizer also enhances the beneficial microbial populations in the rhizosphere. The organic fertilizer also has a biostimulant and a potentially beneficial microbial package that reduces stress and facilitates the release of nutrients for uptake. In our first spring observations for this study, a large number of plots showed improved spring green-up following a season of organic fertilizer applications as compared to ammonium sulfate plots.

Q: *Some previous research focused on the effects of temperature on the infection and spread of the SDS pathogen. From a previous conversation, you indicated that this spring's lack of severe SDS symptoms followed last year's exceptionally dry growing season. How might moisture affect SDS development in bermudagrass?*

A: Soil moisture is essential not only for healthy root and shoot production, but for fungal growth as well. With a rainfall deficit of more than 25 inches in 2007 where this study is located in Mississippi, we still recovered *O. korrae* isolates every month from bermudagrass roots. But the fungus may have been in a dormant state, not parasitizing and colonizing as actively as if soil moisture was adequate, and less root damage would occur, which could translate into reduced spring dead spot incidence and severity.

Q: *Previous growth chamber studies at Kansas State University have shown that once infected by the SDS pathogen, the host bermudagrass experiences a significant loss in the ability to acclimate to cold. Is this consistent with your observations of field-grown bermudagrass in your area?*

A: In previous spring dead spot studies in Mississippi, we determined there was no direct association between the occurrence of *O. korrae* and soil temperature. Over the three-year study, winter soil temperatures averaged 46°F, with spring and fall transitions averaging 61°F and 63°F, respectively. Spring dead spot incidence and severity were inconsistent from year to year and could not be correlated with soil temperatures. This is just one factor that leads to the bewilderment of this pathosystem!

Q: *What are your current recommendations on how to manage spring dead spot, and how are the results of your study likely to reaffirm or change those recommendations?*

A: When a golf course superintendent discusses spring dead spot management with me, we discuss the conventional fungicides that are currently labeled for spring dead spot, with the most successful being fenarimol (Rubigan). Split or single applications in the fall should be made when soil temperatures are between 60°F and 80°F.

Manage healthy turf throughout the growing season. The fundamentals of proper plant nutrition should be followed for greens, tees, and fairways. Maintain soil pH in the 5.5 range. Schedule cultivation practices that include core aeration and deep vertical mowing. The management of the turf will dictate the frequency. All debris generated from cultivation practices should be removed from the site. In most fairways and some greens, the cores are backfilled into the aeration holes. The spring dead spot fungus colonizes roots, rhizomes, stolons, and crowns. If the infected plant parts are moved to non-infested or healthy turf, new infection courts can become established through the introduction of this infested material. This is the most common way the spring dead spot fungus is disseminated. Water management is critical for healthy plants. Deep, infrequent irrigation cycles are the best approach.

No spring dead spot management recommendations can be made until definitive conclusions are drawn based on the results of this three-year study.

Q: *Explain the process of digital image analysis as you are using it to quantify disease symptoms. Is it a superior technique compared to simply rating the plots for disease patches?*

A: Digital image analysis is fast becoming an accepted means for evaluating plant diseases, and turf is no exception. Several software programs are available to interpret the data and provide quantitative results instead of relying solely on subjective rating schemes. With regard to spring dead spot, an overhead view of the plot is captured with a digital camera and downloaded into the digital image analysis software. Parameters are established for the image and the percent area green is calculated. To confirm the accuracy of the software, I took pictures of healthy bermudagrass turf and compared them to turf symptomatic for spring dead spot. The software calculates the area of disease based on the amount of green color present in the image. Digital image analysis is another tool for quantitatively interpreting data that can be used in addition to qualitative disease ratings.

Q: *It is fairly early in the project, but are there indications of how both fungicide timing and nitrogen treatments affect SDS development?*

A: The first spring into this project did not result in high disease pressure as compared to spring 2007. This is one of the challenges when investigating spring dead spot — unexplained inconsistencies from year to year. I did, however, observe differences in spring green-up when comparing organic and inorganic nitrogen sources as previously discussed. I might interpret this as healthier plants going into winter dormancy, perhaps due to increased carbohydrate storage, but that would be another project altogether. I did observe that the control plots had poorer turfgrass quality and did have spring dead spot symptoms. At this point it is really too early to make any preliminary conclusions on fungicide timing, nitrogen treatments, and their effect on SDS development. We do know that spring applications of the demethylation inhibitor (DMI) fungicide fenarimol, applied at 4 oz. per 1,000 sq. ft., does not cause delayed green-up or phytotoxic effects on the bermudagrass fairway.

Jeff Nus, Ph.D., *manager, USGA Green Section Research.*