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**GROW GREEN**

BY JIM KERNS, PH.D., PAUL KOCH AND DAMON SMITH, PH.D.

## DOLLARS AND CENTS

Early-season treatments may delay the onset of dollar spot symptoms and save turf managers an application or two.

Diseases are arguably the most important pest problem golf course superintendents' face. Among those diseases, dollar spot is the most economically important disease of high amenity turfgrass. It's interesting to speak with golf course superintendents who started their careers in the 1970s because they always say, "It looks like dollar spot but it doesn't act like the dollar spot I remember." There are a number of reasons that statement is true.

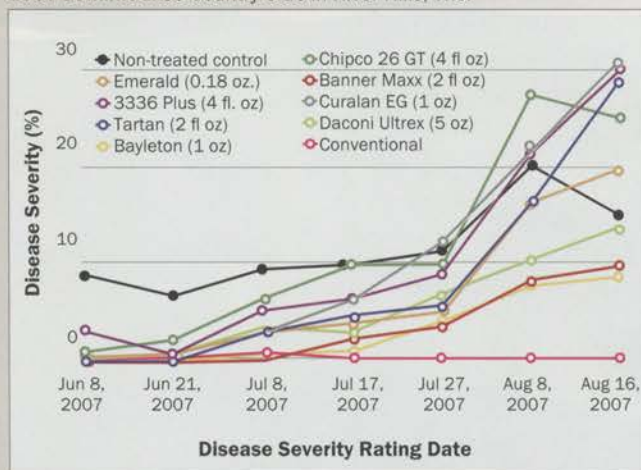
Fertilization practices on golf courses in the 1970s were quite different than they are today. There was an arsenal of nasty fungicides that killed everything under the sun, not to mention we had no documentation of fungicide resistance. Now we have a completely different story. Golf course superintendents feel forced to limit fertilizer to maximize green speed. Heavy metal-based fungicides that were highly effective and highly toxic are no longer in use. The fungicides still available are very effective, but diseases have developed resistance to many common fungicides at an alarming rate. Fungicides, such as chlorothalonil, that are effective weapons against a fungicide-resistant dollar spot population are under intense scrutiny from governmental regulatory agencies. As icing on the cake, we're experiencing the worst economic downturn since the Great Depression. With all of this, golf course superintendents are looking for alternatives to control dollar spot effectively and economically.

There are options for controlling dollar spot besides a calendar-based spray program. A superintendent could do intensive scouting to determine when very small infection centers of dollar spot begin to develop before initiating his first fungicide application. Some golf courses have invested in a sprayer with more capacity to limit fuel costs, while still maintaining their old dollar spot fungicide programs. There are probably other very creative ideas out there, but there is a fundamental problem with dollar spot management. We still do not have a good handle on the biology and epidemiology of dollar spot.

For example, turfgrass pathologists tackled a very tough disease in the late 1980s called take-all patch. Research focused on the biology and epidemiology of take-all patch, which I'm sure was criticized because the work did not immediately address control. However, from this work we now know that fungicide applications should be applied when soil temperatures are between 55 and 65 F. Work conducted by Dr. Kerns and Lane Tredway at North Carolina State University demonstrated that understanding the biology and epidemiology of pythium root dysfunction also led to successful control of the disease. This is a common element in the discipline of plant pathology – the more we know about the details of the disease, the more effective and precise control recommendations are.

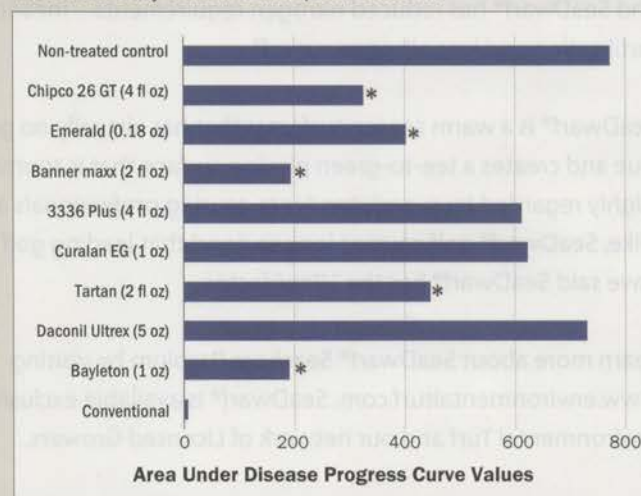
Although dollar spot was described in the early 1900s, turfgrass pathologists focused their attentions on diseases that were more

**Figure 1** Progression of dollar spot symptoms during the summer of 2007 at Milwaukee Country Club in River Hills, Wis.



All treatments except for the conventional program were applied on May 3, 2007, and no other fungicides were applied during the summer. All rates listed are per 1,000 square feet. The conventional program consisted of applications of a tank mixture of Banner Maxx (0.5 ounces) and Daconil Ultrex (1.8 ounces) applied every 21 days starting on June 1, 2007. Disease severity ratings (0 to 100 percent) were visually estimated weekly by the golf course superintendent.

**Figure 2** Area under the disease progress curve (AUDPC) values for the various early-season dollar spot treatments.



All rates were applied per 1,000 square feet. The lower the AUDPC values the longer the treatment suppressed dollar spot symptoms. Bars with an asterisk were significantly different from the non-treated control according to Dunnett's t-test.



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# Research

prevalent and more difficult to control. Thus, the basic research focusing on dollar spot never happened. However, current turfgrass pathologists from around the country have formed a cooperative to pick apart all the nitty-gritty details surrounding dollar spot. This group is focusing on giving the causal agent (*Sclerotinia homoeocarpa*) the correct name, the mechanisms that allow the

fungus to attack turfgrasses, management and mechanisms of fungicide resistance and of course dollar spot epidemiology and management.

At the University of Wisconsin-Madison, in collaboration with Damon Smith, Ph.D., at Oklahoma State University, we have initiated projects to investigate novel control methods and the epidemiology of dollar spot. With

respect to novel control methods, we have examined how a single early-season fungicide application can significantly delay the onset of dollar spot symptoms. The majority of the article will focus on that research. However, we also have started a major effort to understand dollar spot epidemiology and this article will touch briefly on our efforts in dollar spot epidemiology.

In Wisconsin, dollar spot fungicide programs traditionally start around June 1 and continue every 14 to 21 days until October 1. Typically, seven to 10 fungicide applications are made each year to control dollar spot, which includes greens, tees and fairways. With the recent economic downturn, many golf course superintendents have been searching for more economical means of controlling dollar spot on their fairways, which usually make up the largest acreage of highly maintained turf on the course. A possibility is using an early-season dollar spot program.

What is an early-season dollar spot program? Essentially a fungicide is applied well before the onset of dollar spot symptoms, in Wisconsin that would usually be in early May. The theory behind the program is the initial inoculum level of the dollar spot fungus is reduced before the disease can really start to infect, therefore development of the symptoms are delayed.

## EARLY-SEASON EXPERIMENT

The study was conducted at Milwaukee Country Club in River Hills, Wis., on a mature Penncross creeping bentgrass practice fairway. Plots measured 3 feet by 5 feet and were arranged in a randomized complete block design with four replications. All treatments were applied with a backpack CO<sub>2</sub>-pressurized boom sprayer at 40 psi. The boom was equipped with two XR Teejet 8004 VS nozzles. All fungicides were agitated by shaking and were applied in the equivalent of 2 gallons of water per 1,000 square feet.

Early-season treatments included Chipco 26GT, Bayleton, Tartan (Bayer Crop Science), Emerald, Curalan EG (BASF), Banner Maxx, Daconil Ultrex (Syngenta Crop Protection) and 3336 Plus (Cleary Chemical Corp.). These treatments were applied on May 3, 2006, and May 2, 2007, which corresponds to 140 growing degree-days or when soil temperatures reach 55 to 60 F. For specific rates, consult Figure 2 (on page 32).

A non-treated control was included to determine when dollar spot symptoms initially develop and a conventional dollar spot

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fungicide program was included in 2007 as a positive control. The conventional program consisted of an application of a tank mixture of Banner Maxx (0.5 ounces per 1,000 square feet) and Daconil Ultrex (1.8 ounces per 1,000 square feet) applied every 21 days starting on June 1 of each year. The experimental area did not receive fertility or other pesticide inputs except for one application of PCNB combined with chlorothalonil in late November in 2006 and 2007 for preventive control of snow molds.

Disease severity (0 to 100 percent) was visually estimated for each treatment by the golf course superintendent at weekly intervals until early August when all early-season treatments no longer provided adequate control (greater than 10 percent diseased turfgrass). Data from 2006 and 2007 were similar, therefore only data from 2007 is presented in this article.

#### RESULTS

All of the early-season treatments delayed the onset of dollar spot symptoms compared to the untreated control. Dollar spot symptoms initially appeared in the non-treated controls on June 8 (Figure 1). In contrast, dollar spot symptoms did not begin to develop in many of the early-season treatments until July 6 (Figure 1). These results indicate that early-season applications do limit the amount of initial inoculum or adversely affect inoculum efficiency enough to delay the onset of disease symptoms.

A caveat of the experiment is a single early-season application did not provide season-long control. However, a golf course superintendent could save at least one application a season by enacting an early-season dollar spot program.

Some of the early-season treatments were more effective than others. Banner Maxx and Bayleton slowed dollar spot progression more than all of the other early-season applications (Figure 2). Emerald, Chipco 26GT and Tartan did significantly slow dollar spot progress when compared to the non-treated control, but did have disease develop earlier than in plots treated with Banner Maxx and Bayleton (Figure 1).

#### CONCLUSIONS

Early-season fungicide treatments can delay the onset of dollar spot in the summer months by up to 30 days. Utilizing an early-season application can save at least one application if the manager is on a 21-day interval or possibly

two applications if the grower is on a 14-day interval. No single early-season fungicide application provided acceptable levels of control throughout the growing season. Banner Maxx and Bayleton provided the longest suppression of dollar spot symptoms. These results are especially promising, since the timing for early-season applications are similar to

timings for preventive fairy ring and take-all patch applications. Many questions still remain regarding early-season applications. For example, are applications more effective when applied during the fall and/or spring, can intervals be extended after an early-season application and how does watering in early-season application affect efficacy?

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# Research

## FUTURE DIRECTIONS WITH DOLLAR SPOT

Although our early-season applications did not totally prevent dollar spot symptoms during the summer, we are not giving up on this application timing. Currently, we're focusing on expanded early-season dollar spot programs. Basically, we make a single early-season application just like in the aforementioned study, but now we're making follow-up applications

to see if we can use less active ingredient or extend application intervals and achieve dollar spot control that's comparable to the conventional program. We also have added an economic component to this project. Four golf courses, consisting of a municipal course, high-end public, mid-level private and an exclusive private course, have given access to their entire budgets. From this data we will

calculate the cost savings that occurs when an early-season dollar spot program is used.

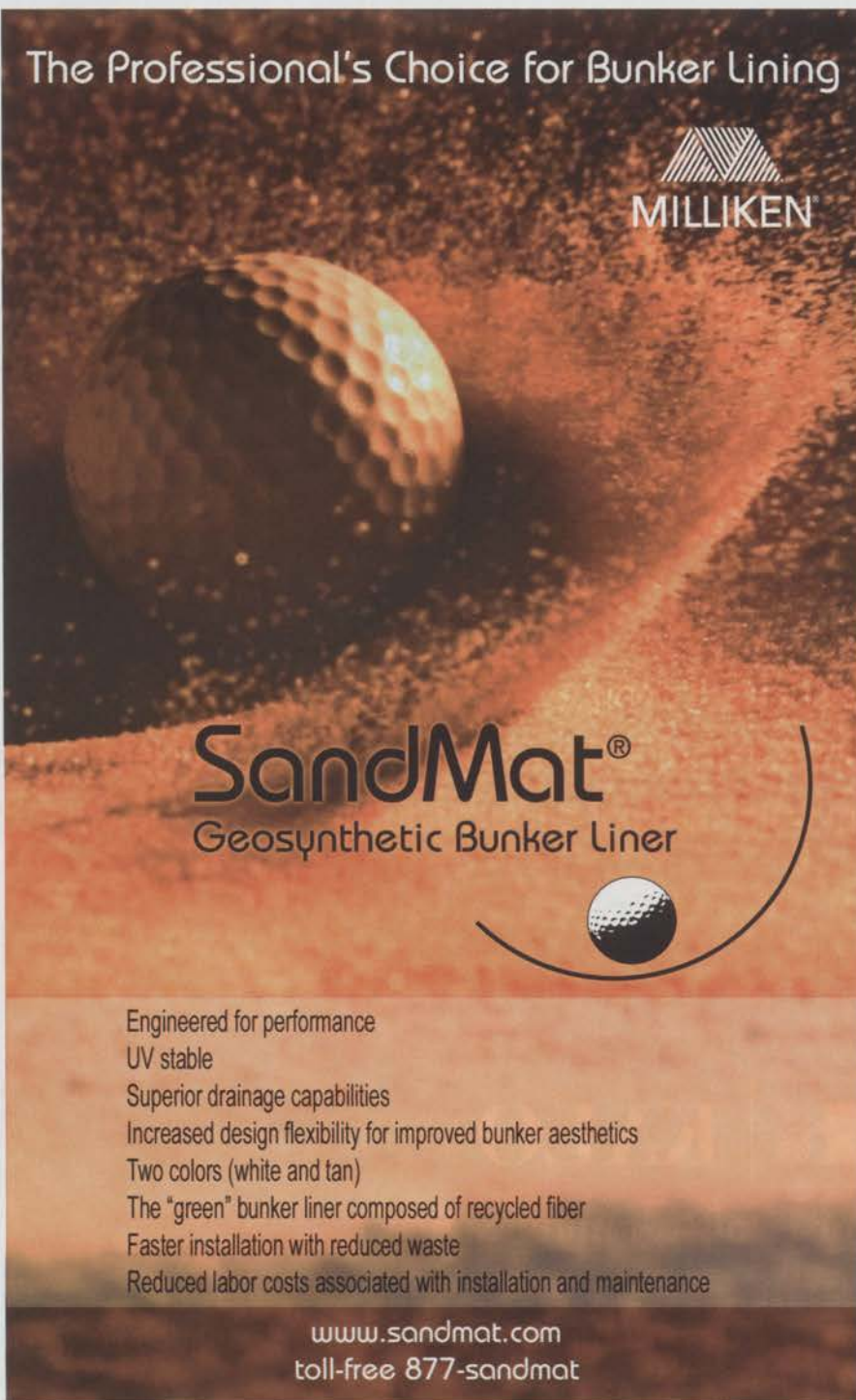
As mentioned previously, we're collaborating with Oklahoma State University to examine the environmental parameters that are responsible for dollar spot development in the field and in controlled growth chamber conditions. Although our results are preliminary, they are very promising. We have determined that the minimum temperature for dollar spot development is 57 F. This threshold was determined through growth chamber assays where we grew the dollar spot fungus on soil or sand with grass debris on the soil surface. We imposed a variety of temperature treatments and found that the dollar spot fungus does not grow well when temperatures are above 95 F and below 57 F. This work is ongoing and expanding to examine the effects of temperature on pathogenicity of the dollar spot fungus.

In field experiments, we have determined that dollar spot symptoms develop exponentially when five-day average air temperatures are above 57 F and when five-day average relative humidity values are above 70 percent. We established plots in Oklahoma and Wisconsin with weather stations immediately next to the plots. The weather stations were calibrated to collect soil temperature, air temperature, relative humidity, wind speed, solar radiation and soil moisture every hour. Once dollar spot infection centers started to develop they were counted daily and painted to ensure that we did not count the same infection centers. Using regression analysis, we constructed a model that could potentially predict dollar spot development.

Dr. Smith initiated this work last year in Oklahoma and has had excellent success with the model predicting dollar spot epidemics. We are using his model to time fungicide applications on one of our plots in Wisconsin and so far it has been successful. Again, these results are preliminary and will require two field seasons before we can make definitive conclusions about the success of the model. Stay tuned. **GCI**

*Jim Kerns, Ph.D., and Paul Koch are with the University of Wisconsin-Madison's Department of Plant Pathology and Damon Smith, Ph.D., is with the Oklahoma State University Department of Entomology and Plant Pathology.*

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## IMPACT ON THE BUSINESS

### Living on the edge

An increase in dollar spot pressure created some challenges at Statesville (N.C.) Country Club. **BY MARISA PALMIERI**

Statesville (N.C.) Country Club's superintendent Fenn Clarke has been dealing with dollar spot on bentgrass greens for the last year. Above average rainfall and cooler temperatures are partly to blame. The area received 40 inches of rain from January to May – an amount equivalent to the typical annual rainfall.

Clarke, who's been at the 18-hole, private club for 17 years, has never had much trouble controlling dollar spot in the past, but over the last year it's been tough and he worries about resistance.

Starting last year, he was spraying in two- to three-week intervals, but only saw 10 days of control before dollar spot would reappear.

"Most fungicide labels say the control lasts 14 to 28 days depending on the rate," he says.

The 18th green was in horrible condition, Clarke says. That resulted in the need for frequent monitoring, increased fungicide use and some concern by the membership.

After winter came and the bentgrass never grew vigorously enough to fill in the dollar spot damage, Clarke planned to begin applying fungicides preventively early in the spring.

Beginning in March, Clarke sprayed propiconazole.

"It's a powerful fungicide – superintendents are sometimes hesitant to spray it in the middle of the summer," he says. "But I was told it's what I need to control dollar spot. We sprayed the max rate on the label, and in less than 10 days I had active dollar spot again.

"Then I started getting worried about resistance," he says.

After researching various chemicals and trying a few more fungicides, Clarke discovered Tourney (metconazole) and received a free sample of about \$900 worth of product, or about an application and a half.

"We applied it and immediately stopped the dollar spot," he says. "At 10 days I still had good control. To be honest, I didn't truly test the Tourney because I never even gave the dollar spot a chance to come back."

After the Tourney, Clarke began a rotation including chlorothalonil and Curalan (vinclozolin).

Despite having to monitor the dollar spot on greens 16 and 11 every 10 days, Clarke is happy with the program.

"The No. 18 green has completely filled in and is one of the most beautiful greens on the golf course," he says, noting he was recently recognized after the member-member tournament for "saving the day."

"The dollar spot has been on 16 and 11 and it still kind of lives on the edge and waits for the

opportunity to grow again," he says. "But this summer, I've just bombarded it with fungicides every 10 to 14 days. We're already seeing improvement, so I'm hoping after this summer I can get back on a schedule of every three to four weeks."

The downside to the intense dollar spot control program has been the increased spending, says Clarke who maintains the golf course with a \$500,000 budget.

"I'm spending more because I've had to go on a 10- to 14-day schedule when I planned to go on a 14- to 21-day schedule," he says. "I budgeted \$30,000, but I'm probably going to spend close to \$40,000."

The biggest relief of all for Clarke was discovering that resistance isn't his problem.

"I found out that my dollar spot isn't resistant, it's just that once I got it, it was hard to eradicate so I had to increase my program." **GCI**

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**Terry Buchen**, CGCS, MG, is president of Golf Agronomy International. He's a 41-year, life member of the GCSAA. He can be reached at 757-561-7777 or [terrybuchen@earthlink.net](mailto:terrybuchen@earthlink.net).



## Travels With Terry

Globetrotting consulting agronomist Terry Buchen visits many golf courses annually with his digital camera in hand. He shares helpful ideas relating to maintenance equipment from the golf course superintendents he visits – as well as a few ideas of his own – with timely photos and captions that explore the changing world of golf course management.

## SPONGE BOB WEED KILLER

**F**rank Dobie, superintendent/general manager, conceived this idea at The Sharon Golf Club in Sharon Center, Ohio. Gary Bogdanski, equipment manager, modified kitchen tongs to selectively apply herbicides to kill unwanted weeds and weedgrasses in ground cover landscape beds without touching the desirable plants. Bogdanski recommends using 18-inch long kitchen tongs (or as long as possible). First, flatten each end. Then glue a 3-inch by 3-inch by 1-inch square sponge to a 3-inch by 3-inch by 1/8-inch hard rubber square and attach it to the flattened tong ends by drilling holes on each tong end and using 1/4-inch diameter stainless steel bolts and wing nuts. Spray the sponge with glyphosate herbicide or broadleaf herbicide until the sponge fully expands. Squeeze off any excess liquid so the sponges do not drip. Close the tongs on the weedgrass or weed and pull upwards. The materials cost less than \$25 and the labor time is approximately 30 minutes.



## TOP UP

**T**he Saadiyat Beach Golf Club is being built in Abu Dhabi, United Arab Emirates (UAE), by MultiGolf Middle East, a Portugal-based full-service contractor where Benjamin Silva, president, designed the protective cover for the John Deere 1200A Bunker Rake. The framework is made of 1/2-inch diameter smooth steel rods that are bent and shaped after being heated with an acetylene torch. Quarter-inch diameter smooth steel rods are welded to the main frame for added support and to help keep the fabrics taut. The framework is attached to the front and rear with 1/4-inch thick flat steel brackets that are welded to both ends of the rods, which are then bolted to the bunker rake with 3/8-inch diameter bolts, lockwashers and nuts. The translucent green fabric is manufactured by Tildenet and then a non-translucent geotextile liner is placed underneath the canopy to keep the direct sunlight and desert heat off of the operator. Black zip strips hold the fabrics, both of which are removable, in place. The fabrics and zip strips cost about \$50; the framework and metal brackets cost about \$25 and it took about two and half hours labor to build. **GC**

