• Charles "Chick" Evans, Chicago's favorite son in the early 1900s and one of golf's great amateurs, won his first national U.S. Amateur Championship at Flossmoor in 1916.

• The club has been a strong supporter of the Evans Scholars Program.

• Hearn happens to be one of the only two practicing golf course architects who's an Evans Scholar, receiving a full four-year college scholarship from the program.

• Bobby Jones' then club-record 67 was broken in 1996 by Egge.

• Having hosted some of the great amateur events many years ago, Flossmoor remains committed to the amateur game by welcoming a U.S. Open qualifier last year.

Hearn, who teaches a golf course architecture class overseas each year and has an appreciation of traditional design, holds this project dear to his heart, and for more reasons than his and Flossmoor's connection to Evans.

"There's something magical about Flossmoor," he says. "Just entering the property is surreal. It has such a rich history and tradition, and they're so humble about it. I visit a hundred golf courses every year, and what I normally see are courses that have so many inherent problems that you will look like a hero no matter what you do to them. Then, once in a while, you find a course that's so good you tell members, 'Let's preserve what we've got.'

"Very, very seldom do you run into a place

The restoration project includes a new greenside bunker on the 14th hole. Photo: Flossmoor Country Club

Golf course architect Raymond Hearn and golf course superintendent Robert Lively examine construction plans and a new bunker liner before sand is installed. Photo: Flossmoor Country Club

that's already very, very good, but yet there are opportunities to take it to the next level two to three notches up," he adds. "Flossmoor blew me away. Never in 22 years in the business have I met a membership like this that's so committed to this project – bar none. My hat's off to them for agreeing to such subtle changes. This is off the charts for me."

A CLASSIC LOOK

Flossmoor's members are interested in, for the most part, classic golf course design and obviously because of the overwhelming vote, they wanted to return to that, Hearn says.

This is no typical restoration of a famous old golf course. Hearn has used limited original sketches by architect H.J. Tweedie, a Briton who designed a dozen golf courses in Illinois, Indiana and Wisconsin until his death in 1921.

But Hearn isn't restoring all things Tweedie.

"He was good at routing and shot value, and his greens were very good, but bunkers were not a strong part of his palette," he says. "He was probably influenced by Willie Park Jr., C.B. Macdonald, Harry Colt and C.H. Alison. He was definitely not influenced by A.W. Tillinghast, Donald Ross or Alister Mackenzie."

Hearn's goal is to restore a classical look and flair that has been lost over time because of tree plantings, greens that mowing patterns have made smaller and rounder causing pin placements to vanish, bunkers that have lost their shape and other course changes.

"The greens are the heart and soul of the golf

course," Hearn says. "Lose that relationship, and you lose the relation of the green concept with the adjacent bunkers and the approach contours. Equally as important is restoring lost shot values and playability. We've been able to restore many of the old options that have disappeared over the years and created many more."

Working with golf course builder Jerry Deemer of Traverse City, Mich.-based Country Golf, Hearn is placing bunkers perpendicular to fairway edges and undoing years of well-intended but poorly placed tree plantings by cutting down a number of trees. Because the course isn't landlocked and has plenty of interior acreage, he's also able to expand and create multiple attack angles and shot options on several holes that will test the ingenuity and shot-making of the best golfers, while adding uniqueness and variety for others.

He also has blown up the stereotypical bunker-bunker in front of greens, allowing the bump-and-run game, and added 80- to 100-foot bentgrass areas behind the greens.

Aiding the work is Flossmoor golf course superintendent Bob Lively who, Hearn says, is incredible and an advocate of the old school of firm and true fairways, greens and bunkers. That fits perfectly with Hearn's desire to revive the classic feel and bump-and-run play of the original golf course.

"We wanted an architect who wouldn't turn up a lot of dirt," Lively says. "Ray has a lay-of-the-land approach to his projects and is the perfect architect for us. His bunker styles are like landforms. They're gorgeous and unique.

"He's changing a lot of contours in the fairways, especially where he's doing the bunkering," he adds. "I'm impressed."

PHASE IT IN

Phase I of the project comprises restoring holes 14 through 18. Phase II, including restoring holes one through three and 10 through 13, will begin this fall. Phase III includes restoring holes four through nine and will be carried out in 2008.

Lively won't have to alter any of his maintenance practices, and there won't be a need for special mowers because of banks or bunkers.

Meanwhile, because of the club's age, the turfgrass on the golf course is a mix of bentgrass and *Poa annua*, including all kinds of mutations from

AT A GLANCE
Flossmoor Country Club

Location: Flossmoor, Ill.
Type of project: Restoration (three phases)
Cost: $1.8 million
Phase I: Six holes started and completed in fall 2006
Phase II: Six holes to be started and completed in fall of 2007
Phase III: Six holes to be started and completed in November 2008
Architect: Raymond Hearn
Builder: Country Golf
Golf course superintendent: Bob Lively
Turfgrass: Bentgrass and *Poa annua*
Length: 7,139 yards

Raymond Hearn and Robert Lively examine construction plans and a new sand bunker lip. Photo: Flossmoor Country Club

The restoration project includes new fairway sand bunkers on the 18th hole. Photo: Flossmoor Country Club

tee to green, Lively says. Because the course isn't being closed during the restoration, regrassing the greens is impossible. Besides, members are pleased with the conditions of the greens and don't want them touched, Lively says.

Therefore, the only new greens will be on holes eight and 13, which will be built to USGA specifications and seeded with a mix of Penn-A bentgrasses. The existing 13th hole is a 118-yard downhill par-3 whose 4,800-square-foot green explodes from top right to bottom left with a 6.5-degree slope and contains only 1,000 square

feet of pinnable space.

"It's a terrible green, and when greens got faster in the 1980s and '90s, it became especially unfair," Lively says.

As part of Phase II this year, Hearn is moving the entire 13th hole left into a wooded area where it will become a 145-yard hole with bunkering on the right side, giving it bump-and-run possibilities.

As part of Phase III, the eighth hole, a 305- to 425-yard par 4, will be transformed. Two small ponds built 40 years ago will, by necessity, remain in play on the hole. But Hearn will lengthen the hole 40 yards and give the green a lower profile like the others but with a better relationship with the water and a bump-and-run feeding into the green from the left.

Additionally, Egge, Zagotta and Lively reference the great lawn effect Hearn created in front of the clubhouse, where the large 16th, 17th and 18th fairways converge.

"It is a very nice aesthetic look, and it really opens up the view through the course from the veranda," Lively says.

DOING THE RIGHT THING

Already, club members are excited about Hearn's work.

"People are thrilled with the plan and look forward to finishing it," Zagotta says.

"When all this work is done, it's going to be phenomenal," Egge says. "It will be a lot more fun and challenging. We're adding some native grass areas that will create a memorable golf experience. The prestige associated with the club will be elevated within the Chicago Golf District. It's already a special place, but it will be better."

Zagotta gives credit to the hard work of the previous five club presidents – Tom Gillie, Dennis Gillie, Bob Blum, Taylor Cope and Greg Palumbo – who laid the groundwork to complete the long-range plan.

"Anything at a golf course is like politics," Zagotta says. "You can't turn the Titanic around on a dime. All five men were integral in getting it done. They laid all the groundwork and got the members accustomed to the idea."

Although Bandon Dunes developer Mike Keiser wasn't involved with the Flossmoor resoration, Zagotta knows and respects Keiser, who influenced the Flossmoor project.

"Guys like him are pioneering the effort back to classic golf," Zagotta says. "His decision-making process and success and great vision played a role in us getting back to our traditional roots. If you want a model in 2007, you can't go wrong looking at that model. That's one of the reasons we know we've done the right thing." **GCI**

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BY JOHN R. STREET AND DEBORAH D. HOLDREN

The fertilzer/disease link

How nitrogen source, rate and timing application method effect creeping bentgrass quality and dollar spot

Dollar spot (*Sclerotinia homoeocarpa*) is a major problem on high maintenance turfgrasses such as bentgrass (*Agrostis palustris* Hudollar *spot*), annual bluegrass (*Poa annua*), Kentucky bluegrass (*Poa pratensis* L.) and perennial ryegrass (*Lolium perenne* L.).

Foliar and granular fertilization programs were compared on bentgrass performance and dollar spot incidence at various nitrogen rates and application frequencies. The granular fertilizer source consistently resulted in lower color ratings than the foliar sources. Good to excellent color responses didn't always result in acceptable dollar spot suppression; however, foliar fertilization consistently resulted in less dollar spot than comparable granular treatments. Foliar sources provided dollar spot suppression for at least 70 to 80 days and 154 days without fungicide at 0.25 of a pound of N/M weekly (every seven days) in 2004 and 2005, respectively.

This research suggests foliar feeding with sufficient nitrogen can reduce dollar spot severity and potentially result in less fungicide use.

PREMISES AND OBJECTIVES

Dollar spot continues to be problematic on high maintenance turfgrasses such as bentgrass, annual bluegrass, Kentucky bluegrass and perennial ryegrass. As such, golf course superintendents reportedly spend more money on fungicides to control dollar spot than for any other turfgrass disease (Vargas, 1994).

Superintendents managing bentgrass fairways are reporting more intense dollar spot pressure and increased difficulty in dollar spot control. Many reasons for these problems have been hypothesized, including resistance in field populations of *S. homoeocarpa* to chemicals, lower nitrogen fertility programs, fungicide interactions and plant growth regulator use.

Chlorothalonil has been used as a standard contact fungicide for dollar spot management throughout the years. Recently, chlorothalonil use by golf courses has been restricted to a certain seasonal limit. This restriction has significantly influenced superintendents' fungicide-usage programs and their chemical family alteration strategies for dollar spot management.

The purpose of this research project was to:

1. Reiterate previous Ohio State research about the effects of nitrogen fertilization rate, (light rates vs. traditional heavier rates), frequency (seven-day vs. 14-day application schedule) and application method (foliar feed vs. granular feed) on bentgrass quality and dollar spot severity; and
2. Determine the latter interactions on dollar spot incidence, fungicide efficacy, reduced fungicide rates and extended fungicide application intervals.

Table 1. Fertilizer rates, frequencies and timings

N rate		Frequency	Total N / month	
lb N/M	kg N/ha		lbs N/M	kg N/ha
0.175	8.6	weekly	0.70	34.4
0.25	12.2	weekly	1.0	48.8
0.35	17.1	biweekly	0.70	34.4
0.50	24.4	biweekly	1.0	48.8
Untreated check	– – –	–	–	–

Fertilizer treatments received either no fungicide, half rate or full rate "predisease" applied at 30-day intervals beginning May 11, 2004 and May 26, 2005.

MATERIALS AND METHODOLOGY

This study was conducted in 2004 and 2005 at the Ohio Turfgrass Foundation Research and Education Facility at The Ohio State University in Columbus, Ohio. The study was a randomized complete block design with three replications. The creeping bentgrass cultivar was 'Lopez'.

Four fertilizers (three liquid and one granular), four nitrogen rates and two timing frequencies were used (Table 1). The granular

fertilizer Tee Time 20-4-12 (The Andersons) was applied using a drop spreader. The liquid and water-soluble fertilizers were applied using a CO_2 pressurized sprayer using two flat-fan nozzles calibrated to deliver two gallons per 1,000 square feet.

Tee Time is a granular fertilizer containing 1 percent polymer – coated ammoniacal nitrogen – and 19 percent urea nitrogen with 12 percent of the urea as microprilled sulfur-coated urea. Bulldog 28-8-18 is a dry, water-soluble fertilizer with 2.1 percent ammoniacal nitrogen, 5.4 percent nitrate nitrogen and 20.5 percent urea nitrogen for liquid/foliar feeding.

ACLF 20-2-1 and HPF 19-1-1 (Agro-Culture Liquid Fertilizers) are liquid fertilizers also designed for liquid/foliar feeding composed of urea, nitrate and ammoniacal nitrogen with micronutrients.

The nitrogen rates were 0.175 of a pound of nitrogen per 1,000 square feet and 0.25 of a pound of nitrogen per 1,000 square feet applied every seven days, and 0.35 of a pound of nitrogen per 1,000 square feet and 0.5 of a pound of nitrogen per 1,000 square feet applied every 14 days.

Chlorothalonil (Daconil Ultrex) was split across the fertilizer source/rate/timing treatments as no-fungicide, half rate (1.625 ounces per 1,000 square feet), and full rate "predisease" (3.25 ounces per 1,000 square feet), resulting in 54 total treatments. Applications were made on about a 30-day treatment schedule beginning May 11 and ending Sept. 14, 2004, and again on May 26 and ending Sept. 30, 2005.

Additionally, on April 27, 2005, a preseason preventive rate of chlorothalonil was applied as a blanket application to the entire study. This preseason application was designed to bring all plots to 0 percent prior to 2005 treatments.

Mowing was performed three times a week (Monday, Wednesday and Friday) using a Toro 3100 triplex mower with a bench setting of 0.5 inch, and clippings were removed. The site was irrigated regularly to prevent wilt. Insecticide

Table 2. Dollar spot severity as affected by nitrogen source, rate and application frequency

			% Dollar Spot					
Fertilizer source	N rate (kg ha^{-1}	Timing	Aug. 2, 2004			Sept. 22, 2005		
			No fungicide	Half	Full	No fungicide	Half	Full
Tee Time	8.6	7 day	56.7	33.3	20	25	21.7	11.7
ACLF	8.6		20	16.7	10	21.7	20	8.3
Bulldog	8.6		8.3	10	5	16.7	11.7	8.3
HPF-N	8.6		18.3	15	11.7	16.7	11.7	6.7
Tee Time	12.2	7 day	46.7	31.7	18.3	28.3	28.3	18.3
ACLF	12.2		1.7	1.7	0	11.7	8.3	3.3
Bulldog	12.2		0	0	0	1.7	1.7	0
HPF-N	12.2		1.7	0	0	6.7	1.7	1.7
Tee Time	17.1	14 day	46.7	21.7	23.3	33.3	25	18.3
ACLF	17.1		21.7	20	13.3	28.3	25	16.7
Bulldog	17.1		26.7	13.3	8.3	21.7	13.3	10
HPF-N	17.1		28.3	16.7	18.3	20	18.3	11.7
Tee Time	24.4	14 day	30	20	16.7	26.7	25	16.7
ACLF	24.4		20	10	6.7	25	18.3	10
Bulldog	24.4		18.3	8.3	3.3	1.7	0	0
HPF-N	24.4		21.7	6.7	6.7	10	8.3	3.3
Unfertilized	–	–	46.7	35	26.7	30	25	18.3
			LSD (0.05) 10.52			LSD (0.05) 12.56		

applications were made for cutworms, white grubs and black turfgrass ataenius. Preemergent herbicide was applied each year in April.

Dollar spot ratings were taken during active dollar spot period. Dollar spot was active in May and June and again in late July through September 2004 and August and September 2005. Dollar spot was rated subjectively as an estimate of percent plot infected with no visible disease and total dollar spot cover.

Turfgrass color ratings were taken biweekly using a scale of one to nine with one representing poorest color, six representing just acceptable and nine representing best (dark green).

Clippings were harvested on Sept. 13, 2004, and Sept. 20, 2005, by making a single pass down the center of each nitrogen treatment with a commercial walk-behind greensmower. Clippings were bagged, dried at 149 F for 72 hours and analyzed for total nitrogen content of clippings (percent by weight) using the standard Kjeldahl method.

DOLLAR SPOT

Dollar spot severity is reported for the peak period in August 2004 and September 2005 (Table 2). Only one major outbreak of dollar spot occurred in 2005 (August, September and October).

All granular treatments resulted in consistently more dollar spot when compared to equivalent foliar treatments. Among the granular no-fungicide treatments, 0.5 pound N/M every 14 days resulted in the least amount of dollar spot and was the only granular no-fungicide treatment to exhibit a dollar spot reduction less than the unfertilized no-fungicide check.

All granular treatments with or without fungicide in 2004 and 2005 failed to provide levels of dollar spot control that would be acceptable among most golf course superintendents (Table 2).

Among the no-fungicide foliar treatments, all sources at 0.25 pound N/M every seven days consistently exhibited the least amount of dollar spot (see photo at right) and provided remarkable dollar spot suppression for 80 days and 154 days in 2004 and 2005, respectively. The no-fungicide 0.25-pound N/M treatment with all three foliar sources resulted in dollar spot suppression equivalent to the latter nitrogen rate with half- and full-rate fungicide. This clearly points to the importance of nitrogen rate, source, and application timing in nitrogen fertility and dollar spot interactions.

All the foliar treatments at 0.25 pound N/M every seven days in combination with half-rate fungicide resulted in less than 3 percent dollar spot in 2004, less than 10 percent dollar spot in 2005, and minimized peaks in dollar spot severity as compared with fertilizer treatments alone, and dollar spot control was equivalent to the full-fungicide rate.

At the foliar nitrogen rates of 0.175 of a pound N/M and 0.35 of a pound N/M every seven and 14 days, respectively, Bulldog was the only foliar source that consistently exhibited a trend toward acceptable dollar spot control at the half- and full-fungicide rates in 2004 and 2005.

All the foliar sources at 0.25 pound N/M every seven days consistently provided better dollar spot control than the foliar sources at 0.5 pound N/M every 14 days.

Finally, granular treatments had lower foliage nitrogen levels than the foliar treatments within the same rate/frequency programs with average foliar nitrogen contents of 5 percent in 2004. In 2004, all three foliar sources at the 0.25-pound N/M rate, which consistently resulted in the least dollar spot incidence among treatments, exhibited foliage nitrogen contents of 5.3 percent (Table 3).

In 2005, granular treatments again showed a trend for lower foliage nitrogen levels than the foliar treatments within the same rate/frequency programs. Foliage nitrogen levels in 2005 were on the average 0.5 to 1.0 percent higher than in 2004, which might reflect a buildup of residual nitrogen or conditions more conducive to nitrogen use efficiency (i.e. 2005 summer temperatures relative to 2004). The granular treatments (Table 3) in 2005 resulted in foliage nitrogen levels ranging from 5.56 to 5.9 percent. Dollar spot incidence was still significant at these latter foliage nitrogen levels suggesting factors other than foliage nitrogen content might be connected to higher dollar spot incidence with granular vs. foliar feeding.

TURFGRASS COLOR

Among all nitrogen source/rate and application frequency treatments, turfgrass color wasn't influenced by fungicide rate (i.e. zero, half and full) in either year. For example, the turfgrass color ratings for ACLF at each rate and frequency within any rating date were the same whether at zero, half or full rate of chlorothalonil. This trend was consistent within each fertilizer source/rate and frequency treatment throughout both seasons.

Within the granular treatments, initial green-up responses were significantly slower than any of the foliar treatments in 2004 and 2005. After green-up, seasonal color responses with all granular treatments were acceptable with color ratings ranging from six to seven in 2004 and six to 7.5 in 2005. The granular treatments within any comparative fertilizer rate and frequency consistently resulted in color ratings of one to three units less than foliar treatments. Within the granular treatments, the highest and most consistent turf color resulted with the 0.5-pound N/M rate biweekly.

The foliar treatments consistently provided higher turf color than the granular treatments. All the foliar treatments provided good to excellent green-up responses. All the foliar treatments also provided good to excellent color responses throughout the season. The highest and most consistent turf color among all the foliar sources occurred at the 0.25-pound N/M weekly treatment with average seasonal ratings from 8.5 to nine.

This photo shows the differences among dollar spot severity of the 0.25-pound-nitrogen, seven-day foliar treatment (yellow box on the left) vs. 0.5-pound-nitrogen, 14-day foliar treatment (yellow box in the middle) and 0.5-pound-nitrogen, granular 14-day treatment (yellow box on right) with no fungicide and one-half-rate fungicide applied (red boxes).

IMPACT ON THE BUSINESS

Treating dollar spot preventively saves in more ways than one

BY CINDY CODE

Dollar spot is one of the most recognized and ubiquitous diseases on golf courses, wreaking havoc on cool-season turf but less destructive to warm-season turf such as bermudagrass.

Its economic impact is hard to quantify, but it's considered enough of a threat that most superintendents work proactively to treat dollar spot rather than wait for the disease to make an appearance.

However, that wasn't always the case. In the past, if superintendents were surveyed with the question of when they first spray fungicides to manage dollar spot, many would answer after they first see it. Historically, this was true because there was no sure way of predicting it. Depending on the year, the first outbreaks of dollar spot might appear any time from June to early July, and were treated on an as-needed basis.

Now, superintendents work to treat their courses for dollar spot because they prefer not to see the familiar round, tan spots on their courses.

"Superintendents are spending more money on pesticides because they don't want to see insect or disease infestations," says Stan Zontek, Mid-Atlantic director for the USGA Green Section. "Many courses figure it's easier and cheaper to spend money upfront to prevent a problem than to fix it."

Treating diseases is becoming much more of a preventive than curative proposition because turf blemishes are unacceptable, Zontek says.

"It becomes a real problem if you get into treating a disease because if you have dollar spot on fairways and a golfer or a g.m. asks you, 'Why does that grass look the way it does?' Some try to save money and wait until they see a problem and then try to react as quick as they can," he says. "A huge percent of cases that I see, people just don't want to see dead grass, particularly if it's preventable."

Consequently, superintendents decide to spend the money upfront. In many cases, it's the separation between the better clubs and average courses.

Contact and systemic fungicides are used to treat dollar spot. While systemics must enter a plant, go through a transformation and be metabolized by the plant to manage dollar spot, contacts act more as a topical skin cream but can easily wash off. As a result, many superintendents tank mix contact and systemic fungicides to create twice the chemical to cure the disease and prevent the next outbreak.

Most superintendents are sensitive to criticism. Each club has to make judgment decisions. Some choose to wait while others don't.

Dollar spot has become more prevalent during the past five to eight years, says Terry Bonar, CGCS, at Canterbury Golf Club in Beachwood, Ohio.

"I don't know if it's a different variety from years ago, but it's more of a problem today," he says. "Before, we could outgrow it by putting nitrogen down and growing the grass. Now when it affects the turf, it takes it down to the dirt. It's a disease to be reckoned with and very prevalent in this part of the country. It's a problem for every course."

Bonar preventively sprays light rates of fungicide every week – rather than every other week – to manage dollar spot. Daconil is his primary contact fungicide of choice.

"Once you have dollar spot, you have to increase your fungicide rates to get rid of it," he says. "Certainly not the whole course, but you need to spray where it's infected. Once it appears, the next time disease pressure appears, dollar spot pops up. So, it's certainly easier to keep it out."

Bonar follows research conducted by The Ohio State University that shows treating dollar spot in the early spring knocks the innoculant down. For superintendents who only spray three times a season, Michigan State University recommends that spring is the most important application, he says.

"Superintendents are spending more money on pesticides because they don't want to see insect or disease infestations."

– STAN ZONTEK

Bonar generally applies a systemic fungicide (Bayleton) in early April and then turns to a weekly program beginning in May until the first or second week of September. By the end of the season, dollar spot isn't a problem. Bonar will spot spray in the fall, but it's not just for dollar spot; he's also treating snow mold.

Canterbury spends about $35,000 a year treating turf diseases, which is comparable to other private clubs. Bonar says he's fortunate to have the resources to keep dollar spot at bay. He's been superintendent at Canterbury since 1984 and says dollar spot appears the worst on tee edges and fairways. GCI

Table 3. Effect of nitrogen rate, timing and application method on nitrogen content of creeping bentgrass foliage*

Treatment	Rate (lb N/M)	Timing	% Total N**	
			2004	2005
1. ACLF	0.175	7 day	5 efg	5.95 abcd***
2. HPF-N	0.175	7 day	4.8 fgh	5.94 abcd
3. Tee Time	0.175	7 day	4.7 gh	5.60 d
4. Bulldog	0.175	7 day	5.0 efg	5.92 abcd
5. ACLF	0.25	7 day	5.5 abc	6.38 a
6. HPF-N	0.25	7 day	5.3bcd	6.16 abc
7. Tee Time	0.25	7 day	4.7 gh	5.90 abcd
8. Bulldog	0.25	7 day	5.6 ab	6.13 abc
9. ACLF	0.35	14 day	5.1 def	5.75 cd
10. HPF-N	0.35	14 day	4.9 efgh	5.61d
11. Tee Time	0.35	14 day	4.6 h	5.56 d
12. Bulldog	0.35	14 day	5.2 cde	5.85 bcd
13. ACLF	0.5	14 day	5.6 ab	6.16 abc
14. HPF-N	0.5	14 day	5.8a	6.24 abc
15. Tee Time	0.5	14 day	5 defg	5.72 cd
16. Bulldog	0.5	14 day	5.7 ab	6.29 ab
17. Check	--	--	3.7 i	4.93 e
LSD			0.35	0.53

* Clippings collected on Sept. 13, 2004 and Sept. 20, 2005
** Nitrogen content determined by the Kjeldahl method
*** Numbers followed by the same letter aren't significantly different

CONCLUSIONS

A positive relationship exists between dollar spot control/suppression, nitrogen rate and application frequency with foliar nitrogen sources. Nitrogen rate and application frequency are important.

This research to date suggests dollar spot control/suppression is impacted by higher nitrogen rates (i.e. one pound N/M) than are typically being used by golf course superintendents. Foliar fertilization provides consistently superior dollar spot suppression than equivalent granular fertilization. Foliar fertilization every seven days results in better dollar spot control than foliar fertilization every 14 days (see photo on page 88).

It's also apparent that nitrogen source responses that produce acceptable color responses might not be sufficient monthly or seasonal totals to impact dollar spot suppression significantly. The nitrogen content of foliage among the various treatments suggests dollar spot suppression via nitrogen fertility requires foliage nitrogen levels at the upper end of the sufficiency range of 3 to 6 percent with a target of at least 5 percent or greater.

This research suggests foliar feeding with sufficient nitrogen can reduce dollar spot severity and potentially result in less fungicide use. The impact of foliar feeding on dollar spot severity might be related to a number of factors, including more efficient use of foliar-applied nitrogen, a simple dosage response relative to slow-release granulars, an interaction with the pathogen on the leaf surface, a physiological response because of the production of a chemical that suppresses the pathogen in or on the foliage or simply related to a critical nitrogen rate.

More research needs to be conducted about foliar feeding, foliar feeding efficiency, nitrogen rate and fungicide programming and plant growth regulator/foliar feeding responses. **GCI**

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Literature cited for this article can be found on our Web site, www.golfcourseindustry.com. posted with this article.