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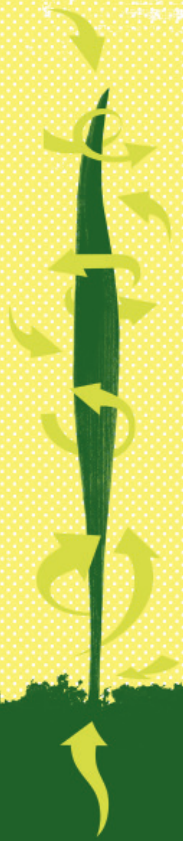

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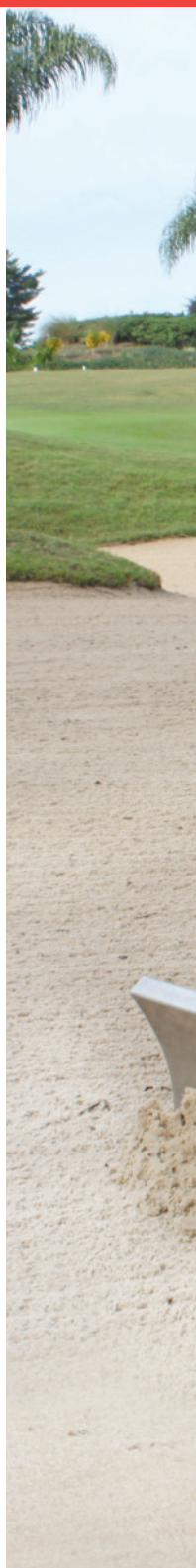

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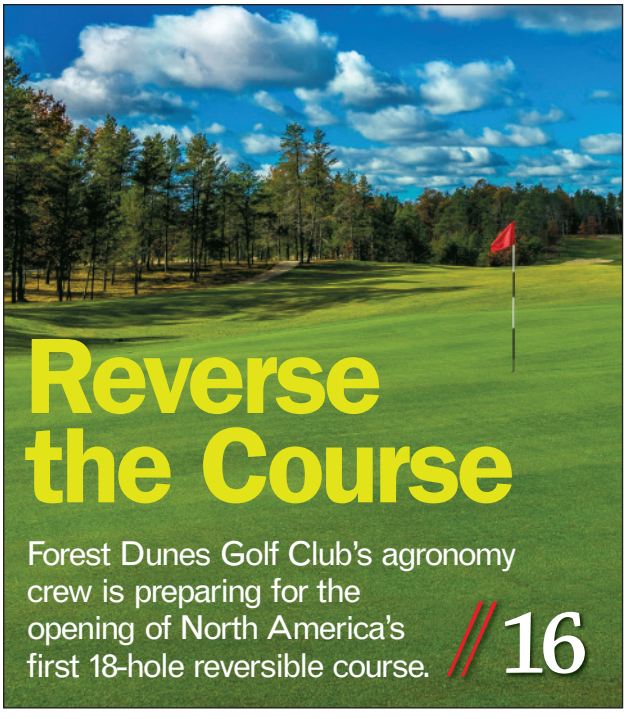

Reverse the Course

Forest Dunes Golf Club's agronomy crew is preparing for the opening of North America's first 18-hole reversible course. //16

PROPANE (provides savings) POWER

Propane has a new home at the Vinoy Resort & Golf Club in Florida thanks to results seen at the course during an elective program. //22

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DEPARTMENTS

SUPER SCIENCE

COVER PHOTO: BRIAN WALTERS

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"On Sunday morning, another thunderstorm rolled through. Areas of the course looked like the Brazos River. It was their fourth delay of the tournament."

SETH JONES, *Editor-in-Chief*

Introducing the Professor and the Admiral

I am writing this from the beach in South Padre Island, on a family vacation. A lot has gone on since the last issue, so we're going with the bullet column…

● In this issue of *Golfdom* we welcome two new columnists: Jared Nemitz of the Peninsula Club, Cornelius, N.C., and Sean Tully of Meadow Club, Fairfax, Calif.

Regular readers of *Golfdom* will recognize Nemitz from the March cover story. He's our Herb Graffis Businessperson of the Year. I hope you read that story and know his background as a talented grass-grower. I'm excited to see what insights he will bring to the pages of the magazine.

Meanwhile, Sean Tully might be a new face to you. I first met him in person at a Golf Industry Show a few years ago, but before that our paths crossed when he won an old issue of *Golfdom* autographed by Arnold Palmer and Jack Nicklaus. I called him back then to see what he thought of the magazine. Turns out that one-of-a-kind piece of golf memorabilia found the right home. Tully, whose nickname among his friends is "The Professor," is a golf historian.

I think both superintendents will make fine additions to the *Golfdom* team. Their columns are on pages 13 and 14. And don't worry, none of the other columnists are going anywhere… we just wanted to grow the team and add some variety.

● Speaking of teams, thanks to the team at Colonial CC in Fort Worth, Texas, for allowing me to crash their party during the Dean & DeLuca Invitational. Texas has been getting hammered with rain all month, and I think I brought some with me from Kansas.

Scott Ebers, CGCS, and his staff do things differently than many of the other big golf events I go to. There's no tent for volunteers, no shuttle bus from a nearby hotel… it's really just his crew, and a few hand-selected local guys. Despite the small crew, the course still looks great every year.

On Sunday morning, another thunderstorm rolled through. Areas of the course looked like the Brazos River. It was their fourth delay of the tournament.

And yet they got the tournament finished on Sunday afternoon, a great looking tournament, a great champion and an exciting finish.

The guys were all burned out when I joined back up with them Sunday evening. But I saw a lot of looks of satisfaction (mixed with exhaustion) and felt fortunate to be there to see it in person. You'll see some of the photos I took in this month's *Golfdom* Gallery.

● May brought the 80th birthday of the National Golf Foundation. *Golfdom* Publisher Pat Roberts and I were invited to attend the celebration at the National Golf Foundation annual Golf Business Symposium. We were honored to take part.

The NGF asks me to put away my reporter's notebook when I attend this event. But I can at least tell you they have lots of interesting information they shared, and the NGF will be sharing that information later this year. We'll help spread the word, but if you're not already a member of NGF, now is a good time to join.

● May also means the annual Turf and Ornamental Communicators Association awards. Though I had to miss the meeting itself, I was thrilled with the results — *Golfdom* won more awards than any of our competitors.

We finally lost the "best blog" award after a five-year streak (to our sister publication, *Landscape Management*) but we maintained the "best columnist" award, won this year by our own Matt Neff (see more on this on page 9.)

The TOCA awards aren't as big a deal as the FedEx Cup (they definitely pay less), but they are important to me. I'm proud of my team, proud to be surrounded by such talented people.

Email Jones at:
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NEWS, NOTES AND QUOTES

//MONEY, IT'S A HIT

President Barack Obama, surrounded by supporters, signs a presidential memorandum directing Labor Secretary Tom Perez to modernize overtime protections, Thursday, March 13, 2014, in the East Room of the White House in Washington.

MILLIONS OF AMERICANS TO SEE INCREASED OVERTIME PAY

The United States Department of Labor (DOL) recently finalized a rule to update the regulations on overtime pay. According to the department, more than 4 million workers will receive overtime protection or see a raise in their salary once the rule takes effect on Dec. 1, 2016.

Currently, salaried employees making less than $23,660 annually are entitled to receive time-and-a-half pay for hours worked beyond 40 hours a week. With the new rule, that threshold will be raised to $47,476 per year.

"Our whole mission here is about strengthening and growing the middle class," Secretary of Labor Tom Perez told National Public Radio. "In order to do that, we need to ensure that middle class jobs pay middle class wages."

The DOL has the authority to update this rule because of the New Deal-era Fair Labor Standards Act. Congress will still challenge the rule, according to Speaker of the House Paul Ryan.

"There are a couple of options we are weighing. We are going to be responding legislatively for sure," Ryan told the *Waukesha (Wis.) Freeman*. "This is, for all intents and purposes, a law. It changes our overtime laws and rules; however, it never went through Congress. Not a single member of Congress had a vote on this."

The salary threshold will be revisited every three years, and projections show it is expected to rise to $51,000 on Jan. 1, 2020.

//HANGING IT UP

USGA GREEN SECTION VETERAN MOORE RETIRES

After a 32-year career with the United States Golf Association (USGA), Jim Moore, director of Green Section's Education Program, retired from the organization effective June 1.

Jim Moore

Moore held multiple titles while with the USGA. In his first 12 years Moore was director of the Green Section's former Mid-Continent Region. He then went on to serve as director of the USGA Construction Education program the next 16 years.

Before joining the USGA, Moore was a superintendent for seven years and finished his superintendent career at Ridgewood Country Club in Waco, Texas.

Adam Moeller was named Moore's successor and named director of the USGA's Green Section Education and Outreach.

//ARCHITECT-IN-CHIEF

AMERICAN SOCIETY OF GOLF COURSE ARCHITECTS ELECTS MARTIN PRESIDENT

Greg Martin, ASGCA, was elected president of the American Society of Golf Course Architects (ASGCA) at the organization's recent 70th annual meeting in Washington, D.C.

Martin, of Batavia, Ill., formed Martin Design Partnership, Ltd. in 1991, and has, according to a press release, promoted a design approach that expresses efficient, classic design concepts that offer a unique golf experience.

Greg Martin

"I am intrigued by what inspires our membership," Martin says. "While we are moving past the recent economic challenges, there will be aftershocks. It is a new world and the landscape has shifted. But the well-developed skills of ASGCA members are unique."

Martin will serve as ASGCA president through May 2017.

PHOTOS BY: ASSOCIATED PRESS; ISTOCK.COM/WELLGLAD (GOLF BALL)

//AWARD SEASON

2016 TOCA meeting fetches *Golfdom* 17 awards

It was just a different chapter of the same story for *Golfdom* at the 2016 Turf & Ornamental Communicators Association (TOCA) award show.

The annual TOCA awards, held this year in Omaha, Neb., was a success for *Golfdom*, earning an industry-leading 17 awards, including 10 first-place and seven merit.

"The 2016 TOCA awards results illustrate that *Golfdom's* content is at the top of the market year in and year out," said Kevin Stoltman, president and CEO of North Coast Media.

Golfdom retained the first-place award for series of columns, but "Assistant Living" writer Matt Neff dethroned last year's winner, Editor-in-Chief Seth Jones. The EIC didn't leave empty handed, earning a first-place in environmental stewardship for the August 2015 cover story, "Propane to the People."

Pete Seltzer, vice president of graphic design and production for North Coast Media, was *Golfdom's* big winner of the night with four first-place awards and two merits. His haul included the top print magazine cover designs for the April 2015 cover, "A Masterpiece of Minimalism."

For a complete list of *Golfdom's* awards visit **Golfdom.com**.

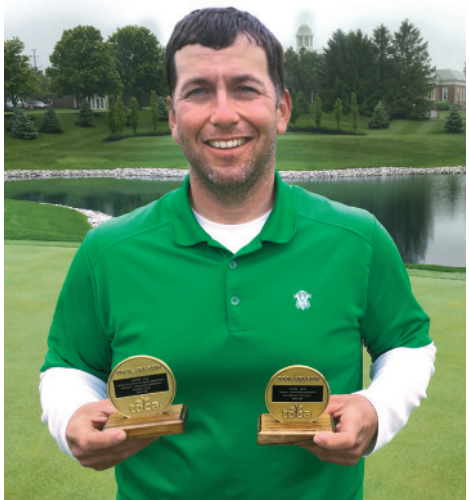
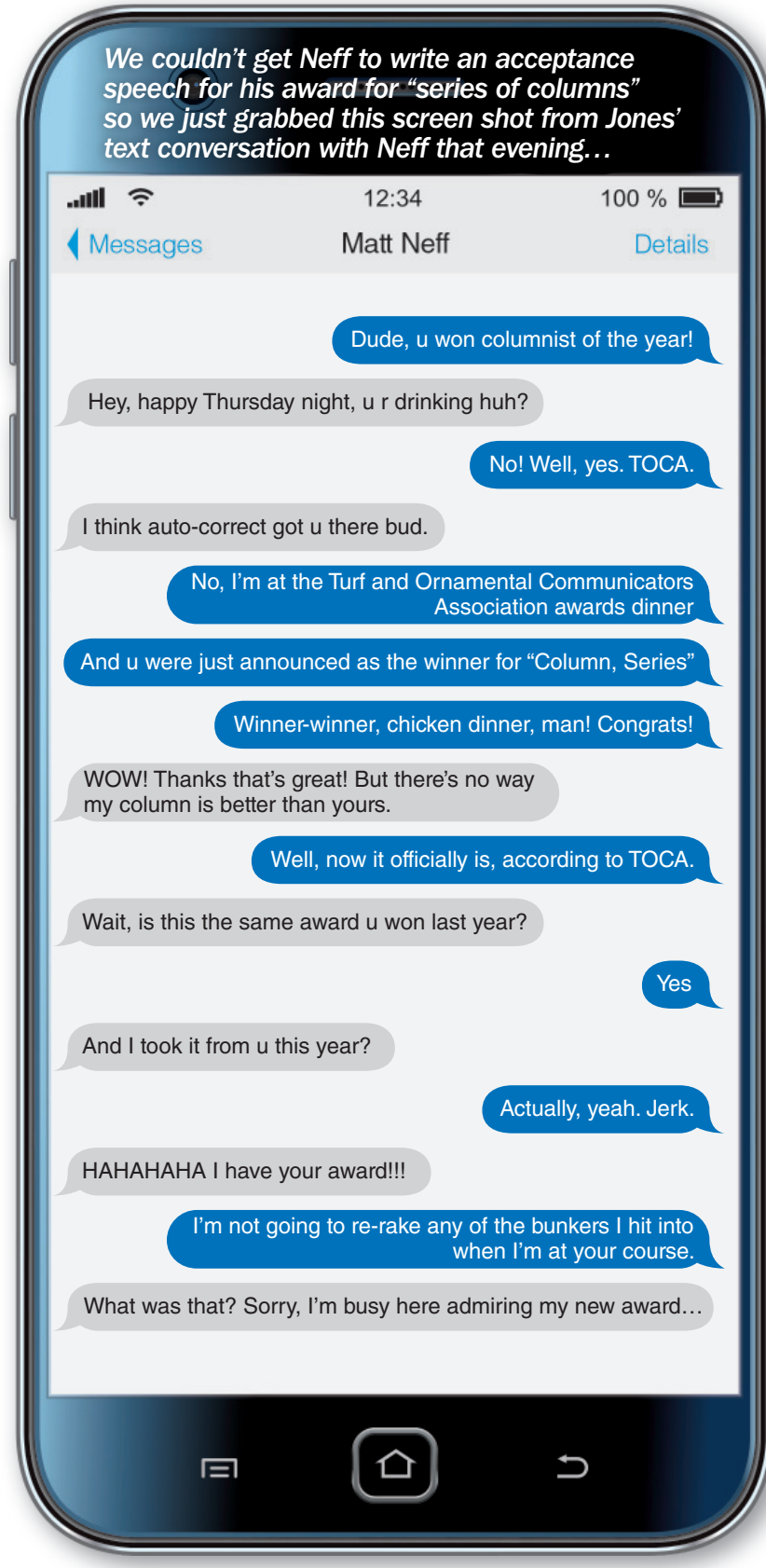


PHOTO BY: GRANT B. GANNON; ISTOCK.COM/ET-ARTWORKS (PHONE)

We couldn't get Neff to write an acceptance speech for his award for "series of columns" so we just grabbed this screen shot from Jones' text conversation with Neff that evening…



//SUBMISSION REQUEST

GOLFDOM, JACOBSEN NOW ACCEPTING HERB GRAFFIS BUSINESSPERSON OF THE YEAR NOMINATIONS

The last two Herb Graffis Businessperson of the Year recipients range from a North Carolina-based Excel wizard/superintendent in his early 30s to a DIY'er from Minnesota with more than 25 years at his current club. Who will be the next winner? We don't know, but you do.

***Golfdom,* in partnership with sponsor Jacobsen, is now accepting your nominations for the 2017 Graffis Award.**

The award, named in honor of *Golfdom's* founder, World Golf Hall of Fame member Herb Graffis, is presented to an individual who shares Graffis' foresight on the golf industry and uses it to help advance the business.

The winner receives expense-paid trips to the 2017 Golf Industry Show and the 2017 *Golfdom* Summit and will be profiled in a *Golfdom* cover story. To make a nomination, visit Golfdom.com.

//GOLF HAT TRICK

National Black Golf Hall of Fame inducts another Powell

Superintendent Larry Powell recently became the third member of his family and one of four new inductees into the National Black Golf Hall of Fame (NBGHF), at the Peachtree Hotel and Conference Center in Peachtree City, Ga.

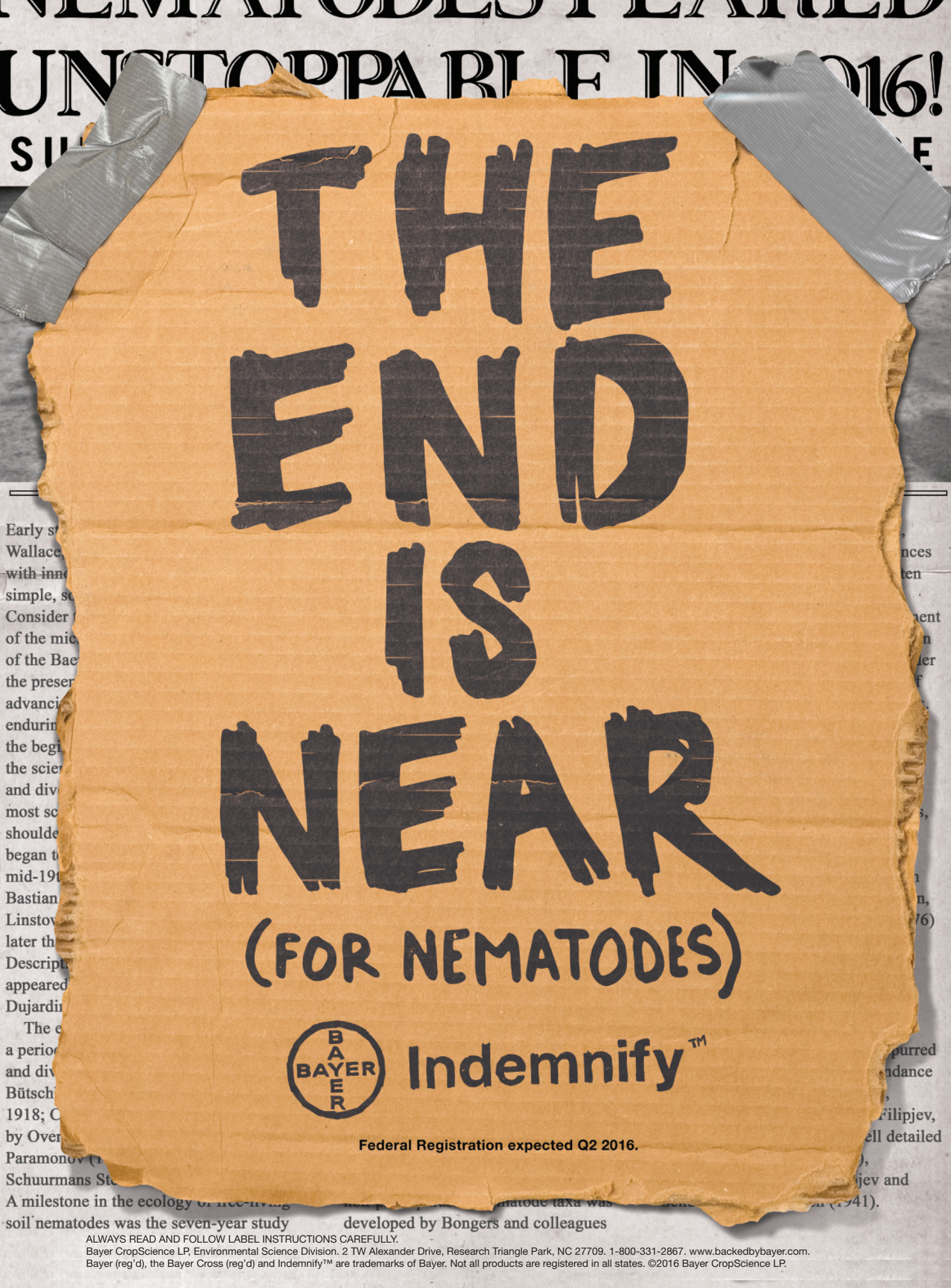
Powell, superintendent at Clearview Golf Club, East Canton, Ohio, joined 2016 NBGHF inductees European Senior Tour player Jerry Bruner and Ann and Tom Cousins, who helped rebuild Atlanta's historic East Lake Golf Course and the surrounding community. The Chicago Women's Golf Club, the country's second oldest African American women's golf club, also was recognized.

Powell, who has been mowing fairways since he was 8, is into his fourth decade as caretaker for the 130-acre facility.

Larry Powell

"This a great honor, and one that I never expected," says Powell. "The people who have gone before me were outstanding people with heart and determination."

Since it began in 1986, the NBGHF has inducted 113 members. Powell's father, Bill, was inducted in 1996. His sister Renee's induction was in 2006.



soil nematodes was the seven-year study developed by Bongers and colleagues

Golfdom Gallery

1 Happy birthday, National Golf Foundation! We were happy to be invited to celebrate our brother in the industry (Herb and Joe Graffis founded *Golfdom* in 1927, NGF in 1936) at the Union League Club of Chicago.

2 Star of Texas It was a thrill to be at Jordan Spieth's first PGA Tour win in his home state at the Dean & DeLuca Invitational at Colonial CC, Fort Worth, Texas. We even saw three of his birdies on the back nine on Sunday.

3 Last day on the job Colonial assistant superintendent Greg Caldwell (left) with Harry Schuemann, PGA Tour Agronomist. It was Greg's last day, he now heads to join the team at the Greenbrier in West Virginia.

4 Scoreboard The team at Colonial CC was definitely winning over the rain. (L to R) Brian Cloud, GCSAA; Pat Cooper, WinField Solutions; Scott Ebers, CGCS, Colonial CC; Sean Kleinfelter, Champions GC; and Nathan Filloon, Wichita Falls CC pose for a photo in front of the scoreboard on 18.

5 This Bud's for you Following the conclusion of the Dean & DeLuca, the crew was treated to a couple cold ones. Bart Bellmon, Andrew Lewis, Caldwell, *Golfdom* EIC Seth Jones and Ebers enjoy the moment.

6 The good Old Elm Craig Shepard, ProGro Solutions, Thomas Simpson, assistant superintendent, Aaron Harvey, assistant superintendent, and Superintendent Curtis James take a spin around the Old Elm Club, Highland Park, Ill.

7 The world needs ditch diggers, too Our own Joel Jackson, CGCS-Ret., found himself in an unlikely place: a pretend Bushwood CC, home course of Caddyshack. Only in L.A.

PHOTOS BY: SETH JONES (1-4, 6)

"I only hope I can one day live up to the high expectations that have been set by the best in the turf industry."

JARED NEMITZ, *superintendent, The Peninsula Club, Cornelius, N.C.*

Don't call me Ishmael

My name is Jared Nemitz. Yep, the same guy from The Peninsula Club you saw on the cover of *Golfdom* a couple of months ago. I am sure you're wondering, "How is this guy back in the magazine again?" Don't worry. I'm wondering the same thing.

I want to thank all of you who sent such kind words to *Golfdom* Editor-in-Chief Seth Jones and me about the article. Seth did an amazing job in his presentation of my story. The piece also gave me the chance to meet the architect of my golf course, Rees Jones. He was truly wonderful at the award presentation. It was an honor to have been recognized, and extremely humbling. I only hope I can one day live up to the high expectations that have been set by the best in the turf industry.

Seth and I have gotten to know each other fairly well over this past year. He came to The Peninsula Club to cover the Future Turfgrass Managers Event for Jacobsen. I also attended the *Golfdom* Summit in Orlando, Fla., and Seth and I worked together on the cover story. Sometime during those events he thought I might want to try writing a column in my spare time. When he offered me this column I thought Seth must spend too much of his own time three sheets to the wind while watching Kansas sports.

In all seriousness, the opportunity to contribute to *Golfdom* as a columnist is one that I am extremely fortunate to have. This will give me a chance to meet new people and have conversations that I may not have had otherwise. There are many stories and discussions that I cannot wait to delve into and share with all of you.

But before I commit to this column, I should probably clear up a few things. When the article came out I received many questions or comments that I should answer. Here they are:

1. I am not related to the great hero Admiral Chester Nimitz. The "true" admiral served in World War I and became Chief of Naval Operations of the U.S. Pacific Fleet land and sea forces during World War II. Not only did he reach the highest rank in the Navy, but after the end of the war the first nuclear supercarrier was named after him, the state of California started celebrating Nimitz Day and a glacier in Antarctica was given his name. I grow grass for a living.
2. What about QualiPro's new nematicide? Any relation there? No. Nimitz Pro G and I have no relation. However, I think that is much more in my realm than *THE* Admiral Nimitz. Maybe "Nemitz, the Nematode of Ultradwarfs" would better suffice.
3. I am 33, even though some of my members swear I am not that old.
4. While I do keep Excel records on everything from weather, soil organic matter to topdressing sand, my family is off limits. After trying to track how much kids would cost after 18 years I stopped because my wife was scared that we may not be able to retire until we are 89. Rachael does allow me to monitor heights of the children (HOC) on the door frame, so I have that going for me.
5. Plasma story. 100 percent true. Two times per week. Rent always paid on time and always with plasma money.

I hope that you will enjoy "Admiral's Cove" and I look forward to this new endeavor as I share a column or two over the next year. Please feel free to contact me with anything you think should be highlighted or talked about.

I have never done anything like this before, and it may be a complete shipwreck. But hey, where's the fun if we don't try something outside of our comfort zone?

Jared Nemitz is superintendent at The Peninsula Club, Cornelius, N.C. He can be reached at jared.nemitz@thepeninsulaclub.com or followed at @jarednemitz.

"I think all can agree that Oakmont has had an influence on the game that is far reaching when the conversation is on greens speed."

SEAN TULLY, *superintendent, Meadow Club, Fairfax, Calif.*

Oakmont: A challenging history

Great golf courses often rely on sound golf course architecture to present a true test of golf. Some of these courses take that test to another level by hosting a golf tournament, and a select few take on hosting a major golf tournament, which is golf at the highest level.

Oakmont is hosting its ninth U.S. Open this month, and if ever a course was made for testing golfers at the highest level, the USGA has found it. As a course with large, undulating, faster-than-fast greens, long approaches into greens and a plurality of bunkers, the course will be more than enough of a test for today's best golfers.

The idea that Oakmont is special shouldn't be lost on anyone. The 2016 U.S. Open will be the course's 19th major event, and the venue has been on the map since it first hosted the U.S. Amateur in 1919. It has long been said — and rightfully so — that the course is a testament to the work of H.C. Fownes and son W.C. Fownes.

Along with the design of the course, it also is how the course is prepared and presented that gives it an overriding "penal design," with some of the fastest greens in golf, both then and now and the shift from an open-links style course to one of a parkland course with trees bordering most every hole.

As for greens speed, Oakmont is where Edward Stimpson first developed his idea for the Stimpmeter in reaction to conditions at the 1935 U.S. Open. It's hard to say how much faster the greens at Oakmont were during previous U.S. Opens, but in 1976 — when the USGA was developing a range for greens speed for daily and tournament play with the soon-to-be introduced and improved Stimpmeter — the greens speed at Oakmont was recorded at 10 feet 4 inches. The average for the 700-plus courses tested that year was only 6 feet 5 inches. It's interesting to note that the average green speed today is closer to the range of Oakmont back in 1977.

In that way, Oakmont has had a huge impact in the way greens speed has evolved over the years. I would say that Oakmont's impact on the modern game, specifically greens speed, has been far greater than that of the greening of the game and perception of perfection that always is charged of Augusta National.

Trees have changed many golf courses, and Oakmont was not above the fray. The reasons given for adding trees are many, and at times they probably seemed right. It is a testament to Oakmont that they could take out as many trees as management has, recovering broad vistas and improving turf quality and playing conditions. Taking out more than 9,000 trees is a big concept to wrap anyone's head around, let alone create a budget for.

As with anything at Oakmont, it's the culture of the club that shines through and allows such a wonderful course to be presented by John Zimmers and his staff. A quote from a book celebrating the club's 25th anniversary sums up why Oakmont has been a great golf course while allowing itself now to recapture the true essence and intent of the course as the Fowneses intended.

"…the course has developed logically and consistently, so that at all times it has been an object lesson in the latest and best ideas of golfing architecture, and as such, has undoubtedly influenced for the better the more recent courses here and elsewhere in the United States."

I think all can agree that Oakmont has had an influence on the game that is far reaching when the conversation is on greens speed. It's hoped that going forward it can have the same influence on golf courses in regard to tree management.

Sean Tully is superintendent at the Meadow Club in Fairfax, Calif. He can be reached at stully@meadowclub.com or followed at @tullfescue.

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Reverse the course

Forest Dunes Golf Club's agronomy crew is preparing for the opening of North America's first 18-hole reversible course.

BY CHRIS LEWIS

Reverse the course

For more than 20 years, golf course architect Tom Doak has envisioned a golfing concept so unique and so rare that it never has been initiated in the United States — an 18-hole reversible course; essentially, two courses in one.

Renowned for "minimalist" courses like Oregon's Pacific Dunes and Colorado's Ballyneal, in which he routed his designs according to the natural features of the land, Doak first shared his vision in 2012 with Lew Thompson, owner of Roscommon, Mich.'s Forest Dunes Golf Club.

Thompson recently had purchased the 1,440-acre property, which included a par-72 Tom Weiskopf design, and then built Lake AuSable Lodge, a 14-room hotel, near the clubhouse. After finalizing the hotel, he was interested in developing a second course that would entice guests to stay and play at the club for multiple days.

Shortly after discussing the concept with Doak, Thompson approved construction of The Loop, North America's first-ever 18-hole reversible course. By featuring 18 greens that could be played in two different routings — clockwise and counterclockwise — on alternative days, the course would exceed Thompson's original expectations.

Not only would guests be welcomed to play three separate layouts, but because The Loop's 36-hole design would be developed in the same amount of space as a typical 18-hole layout, Thompson has the option of building a fourth course.

Continued on page 18

PHOTO BY: BRIAN WALTERS

The 200-acre plot of land where The Loop was constructed fit Doak's design perfectly because of the flat topography that allows for golfers to hit shots into greens from a variety of angles on the fairways.

Continued from page 17

Constructing The Loop

Ground broke during the fall of 2013 as a 200-acre site located west of the Weiskopf course was cleared and excavated.

The property's flat topography was ideal for Doak's reversible design, as it allowed golfers to hit shots into the greens from a variety of angles. Because the layout of the course will vary from one day to the next, it was important that the greens be set up to accept shots from different areas of the fairways.

To provide golfers a more challenging layout that was flat, but not excessively so, Forest Dunes' agronomy team worked alongside design associates from Doak's Renaissance Golf Design to develop some broad valleys near the greens and tees.

"The valleys were carved out to generate fill for mounding and create more rolling terrain, so that the course's top lines were raised just enough that they were visible from the tees," says Brian Slawnik, senior design associate for Renaissance Golf Design. "Most of the natural terrain dictated the layout though, so not much earth was moved."

Aside from maintaining a relatively flat layout that will ease the irrigation process and lower maintenance costs, the designers and agronomy crew also limited the number of formal bunkers to approximately 40, opting for native sand hazards instead. In doing so, the crew was able to reduce turf area considerably, another critical component in irrigation cost decline.

"We also didn't hardline the edges of the irrigated turf," Slawnik adds. "Our hope is that the manicured turf will fade naturally as it transitions out to the native edges, so that they are not overwatered and remain as playable as possible."

As a means of further cost reduction, Forest Dunes didn't hire outside construction companies (a standard operating procedure for Renaissance Golf Design), and all equipment, aside from a bulldozer and excavator, had been previously purchased by the club. The agronomy team worked with Renaissance Golf Design associates on all aspects of construction until the final hole was seeded on Aug. 27, 2015.

"Constant communication with Brian Slawnik and the Renaissance team was key to our success," says Brian Moore, Forest Dunes director of agronomy. "We met daily to discuss what needed to be completed, and really had to work well together as a team until we achieved our goals."

Minimal maintenance

Although The Loop has only 18 maintained greens, its wide fairways, which were constructed specifically for the reversible layout, have resulted in a turf maintenance area of 95 acres — nearly twice as much as the average golf course.

Brian Moore

In response, Moore and his 10 staff members intend to mow the back nine one day, starting with the 10th hole, then mow the other nine the next day, as the holes will alternate every other day. For instance, one day a hole will play as the 18th, but the next day it will play as the first, and vice versa.

In addition, the agronomy crew is preparing only two heights of cut: 1/8 inch for greens and ½ inch for fairways. To ensure that

Continued on page 21

The Forest Dunes agronomy team worked with Renaissance Golf Design associates on all aspects of construction until the final hole was seeded on Aug. 27, 2015.

PHOTOS BY: BRIAN MOORE

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FIRST THIS WAY, THEN THAT WAY

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As a means of further cost reduction, Forest Dunes didn't hire outside construction companies, and all equipment, aside from a bulldozer and excavator, had been previously purchased by the club.

PHOTOS BY: BRIAN MOORE

Continued from page 18

fairways don't require frequent mowing, the entire course was grassed with a blend of fine fescue varieties, including Seabreeze Creeping Red, Navigator II Creeping Red, Radar Chewings and Chariot Hard.

"We have straight sand soil here, which is a good match for fine fescue," says Moore. "Although fescue grows much slower than other grasses and is extremely tolerant to drought, its greatest downfall is its lack of wear tolerance, a potentially significant issue for a reversible course."

To combat this lack of tolerance, The Loop will be a walking-only course, while its tees and green surrounds will have Puritan Colonial bentgrass for further protection. Additionally, it's expected that alternating play on the two routings every other day will better distribute wear and divot patterns.

The irrigation design firm Michael Kuhn & Associates, Inc., was hired to help minimize irrigation costs on The Loop's wide fairways. The two-row system installed is designed to keep the water on the maintained turf.

"Since fine fescue also requires less fertilizer inputs, my ultimate goal is to use 0.5 pounds of nitrogen per 1,000 square feet each year," Moore adds. "Overall operating costs should decline as a result."

During the spring of 2015, Moore and his crew received a custom blend fairway pre-plant fertilizer from Harrell's: a 25-8-12 Polyon product with a micro-nutrient package. Starting in May, 12 pounds of the product were applied per 1,000 square feet of fine fescue, resulting in 3 pounds of nitrogen per 1,000 square feet.

"The Polyon gave us an extended, controlled release of nutrients over a four-month period," Moore states. "Although the first fairways that were seeded in May required a supplemental feeding in September, the fairways seeded in August did not require another feeding."

Because of the fertilizer's initial success, Moore will apply a similar product in early to mid-May 2016, but rather than 3 pounds of nitrogen per 1,000 square feet, they'll apply only 1.25 pounds of nitrogen per 1,000 square feet, 0.25 pounds of which will be ammonium sulfate. In late August or early September, Moore will repeat the process but diminish the total even further by applying only 1 pound of nitrogen per 1,000 square feet.

Conserving natural and financial resources

In 2015, Moore and his crew worked with Michael Kuhn & Associates, Inc., an irrigation design consulting company based in Auburn Hills, Mich., to develop a system that will irrigate only The Loop's maintained turf areas.

The consultants, alongside Moore's crew, designed a two-row system that will keep water in the middle of the maintained turf so that it doesn't spray onto edges and native grasses. Wider fairways will be watered with either a three- or a four-row system, again spraying water only on the maintained turf. The implications will be twofold: Forest Dunes will notice considerable water and cost savings, and native plants will continue to grow as they have for years.

"From a playability standpoint, keeping water off of the native plants is key," Moore says. "If they remain thin, golfers will be able to find their balls and have an opportunity to get them back into play."

Beginning on June 27, 2016, the public will be welcomed to play The Loop. However, for this season only, golfers must be overnight resort guests — a policy that should spark their interests in playing each of the club's golf courses.

"Renaissance Golf Design has always tried to build courses with features that lead people to want to go out and play again and again," Doak says. "But The Loop has taken that to another level."

"The Loop has exceeded our team's expectations," adds Chad Maveus, general manager and director of golf for Forest Dunes. "Once people start playing it, Forest Dunes will become one of Michigan's leading destinations for golf."

Michigan-based writer Chris Lewis specializes in reporting on golf in the U.S. A regular contributor to *Golfdom*, he last wrote about fraze mowing in the magazine's September 2015 issue.

The fine fescue varites installed on The Loop are drought tolerant and match the property's soil profile but it lacks wear resistance. To combat this The Loop will be walking-only.

PHOTOS BY: (TOP) BRIAN MOORE, (RIGHT) BRIAN WALTERS

With propane's history as an engine fuel for forklifts and school buses, propane dealers are now trying to appeal to the golf industry.

PROPANE HAS A NEW HOME AT THE VINOY RESORT & GOLF CLUB IN FLORIDA THANKS TO RESULTS SEEN AT THE COURSE DURING AN ELECTIVE PROGRAM.

BY GRANT B. GANNON

PROPANE (PROVIDES SAVING) POWER

"The best thing we have seen is there has been no change in the quality of mowing or anything." That's Scott Corwin, director of grounds at the Vinoy Renaissance St. Petersburg (Fla.) Resort & Golf Club, speaking about the performance of propane equipment on his course.

Corwin's Vinoy, a Marriott Golf property, was one of eight courses enrolled in a program led by the Propane Education & Research Council (PERC) and Audubon International. The program was the subject of a *Golfdom* article in the August 2015 issue. Each participating course was loaned propane-powered technologies for at least a year. In return, the courses agreed to record performance data.

Marriott Golf learned about the opportunity in late 2014 through its connection with Audubon International. The company enrolled the Vinoy, Stone Mountain (Ga.) Golf Club and Desert Springs Resort, Palm Desert, Calif., in an attempt to study propane's effect on a property's carbon footprint and fuel-cost savings.

"We're constantly looking at new ways we can improve our golf course operations," says David Robinson, CGCS, senior director of golf grounds, Marriott Golf. "We look at our carbon footprint at all of our properties. We've done the calculations, so this was a great next step to enable us to reduce our carbon footprint even more." *Continued on page 24*

PHOTO BY: GRANT B GANNON

Continued from page 23

"When we got approached a year and a half ago," Corwin adds, "I talked to Eric (Kulaas, equipment tech supervisor at the Vinoy), and of course the first thing in my mind was we were getting free equipment for a year."

Scott Corwin

R&R Products Director of Propane Applications Jim Coker dropped off a mini-fleet of equipment on Feb. 17, 2015, including a Reel Max 544 LP fairway mower, a Reel Max 331LP finish-cut reel mower, a Greens Max 2200LP riding greens mower and a Sand Max 521LP bunker rake.

More than a year later, Robinson says that the results on the three Marriott Golf properties varied (see "Stone Mountain pulling the plug," page 27), but overall were "great," and the equipment received positive feedback. But Corwin's and Kulaas' experience stood out from the rest.

"THE VINOY REALLY EMBRACED IT TO ANOTHER LEVEL. WE WERE HOPING THAT WOULD BE THE CASE AT ONE OF THE PROPERTIES SO WE COULD STUDY EVEN MORE."

— DAVID ROBINSON, CGCS

David Robinson

The pair has embraced the new equipment with such enthusiasm that they have purchased the loaned equipment from R&R Products, as well as a propane-powered blower, and are looking to convert more of their equipment from diesel to propane.

"The Vinoy really embraced it to another level," Robinson says. "We were hoping that would be the case at one of the properties so we could study even more."

The once and future cost

"There's this misconception when you look at other alternative fuels that there are other hidden costs in converting the new fuel," says Jeremy Wishart, PERC's deputy director of business development. "It just so happens with propane (that) the cost of the equipment is less, the cost of the fuel right now as the national average is 30 percent less (than) cost of gas and diesel."

Jeremy Wishart

Over the year that the propane equipment was on loan to the Vinoy, Corwin saw significant savings on fuel. The course spent 25 percent less on the fuel for the Sand Max 521LP and Greens Max 2200LP, and 45 percent less for the Reel Max 544 LP and Reel Max 331LP.

After a steady decline for two years, the national average for diesel reached $1.99 per gallon last February, the lowest price seen since January 2005, according to EIA.gov. Corwin remembers March 2012, when the average was at the highest this

Continued on page 26

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Over 90% of propane fuel is produced domestically and averages 30% less than gasoline and even greater savings over diesel. Propane fuel delivery services are widely available with tanks that are easy to switch and prevent employee fuel theft.

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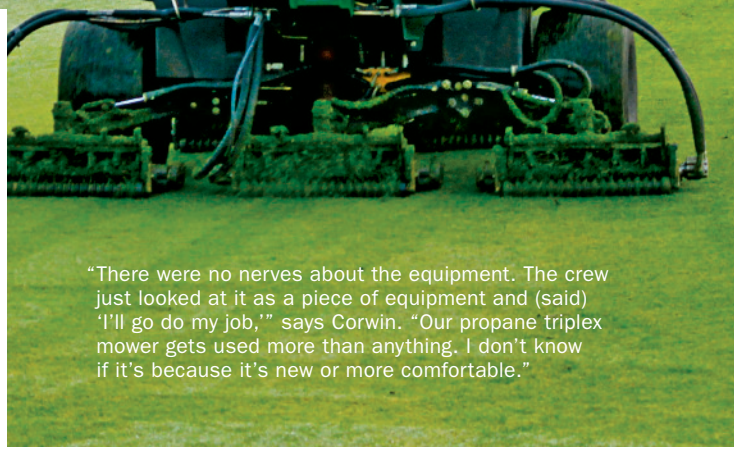


"There were no nerves about the equipment. The crew just looked at it as a piece of equipment and (said) 'I'll go do my job,'" says Corwin. "Our propane triplex mower gets used more than anything. I don't know if it's because it's new or more comfortable."

Continued from page 24

century, and he and thinks the price will be trending up again sooner rather than later.

"At one point we were paying $4 per gallon," Corwin says. "So when gasoline increases — which it will again, it won't stay this low forever — then that's when we will see true savings again."

Another feature that differentiates propane from diesel and gasoline is the ability to negotiate with a propane dealer and lock in a price even lower than the national average, something that Corwin only learned about during a recent visit from Coker.

"It effects your budget when those prices fluctuate, but if you purchase a certain amount you can set a price for the entire year," Coker says. "It works because the propane retailer can pre-buy the propane knowing how much you use, and lock in a price."

Corwin is a superintendent geared toward the future and helping his course succeed, but Tier 4 engines and their upcoming incarnations have him worried.

"One thing that people are missing the boat on is that technology is a good thing, but it can be bad," he says. "There's Tier 4 right now, but next thing you know it'll be Tier 5. It gets bigger and better, but what's that going to do for your equipment maintenance budget?"

Despite Marriott Golf being able to purchase equipment at "good" pricing, Robinson confirms they are seeing a 15-percent to 20-percent increase in the cost of equipment because of Tier 4.

"That's a big number when you already start high," Corwin adds. "Basically you are at 15 to 20 percent added on to a $40,000 piece of equipment. I just have to shake my head at the price."

Continued on page 28

PHOTO BY: GRANT B GANNON

STONE MOUNTAIN PULLING THE PLUG

Of the eight courses that took part in the PERC program, six of them were in the process of purchasing or already had purchased its demo equipment. One of the courses in the minority is Stone Mountain (Ga.) Golf Club by Marriott.

Stone Mountain GC was the first course to receive its equipment. That was in mid-October 2014, four months before the Vinoy, and it reported a fuel savings of $2,000 per month, according to PERC. But when the program came to an end, all four pieces of demo equipment were returned.

Interim Superintendent Matt Park calls PERC's program "great," and they had few to no issues with the demo products. He adds that a couple of distributors came to the course asking if he was interested in propane conversion kits for other equipment, but ultimately the owners decided to go in another direction.

"It was about the middle of the study when the course started taking lease agreement bids. Just the fact that we had the ball rolling with those negotiations, we never discussed keeping the propane equipment with ownership," says Park. "We eventually decided on a package with Toro and signed a lease with them."

That package does not include any standard or converted propane equipment. Park says perhaps ownership made the decision to stay with a diesel fleet because the course was already set up for that equipment.

When the program began, Stone Mountain GC's director of grounds was Anthony Williams, CGCS, but he stepped down from his role near the end of the program in January 2016.

Eric Kulaas, the Vinoy's equipment tech supervisor, changes a fuel tank on the clubs' stand-on blower, which has been converted to use propane.

Continued from page 26

Corwin sees only more bills piling up by investing in Tier 4 technology. He notes that if a mower breaks down, his mechanics aren't going to be able to work on them without computers, and it will have to be sent to the manufacturer for repairs. According to Kulaas, that currently costs $100 an hour, and he expects the price to increase with Tier 4 and beyond.

More than money

As AC/DC sings, "Come on, come on, listen to the money talk," but Corwin and Robinson agree that enlisting in the program also was about reducing emissions and improving employee and member safety.

"Yes, the savings and dollar amounts are great, but when we approach these different environmental programs and initiatives, that's not the first thing we look at," Robinson says. "The first thing is the impact to the environment and associates, employees, members and guests, and ultimately what it does long term in a positive way for the golf course."

Though this program is an attempt to gauge propane emissions at the eight golf courses, PERC says that in general, propane reduces greenhouse gas (GHG) emissions and carbon monoxide (CO) emissions by 15 percent and 40 percent, respectively, compared with gasoline and diesel. They also report that propane is 64 percent better in GHG emissions and 50 percent better in CO emissions than current Environmental Protection Agency minimum regulations.

"Eric and I, we are getting to the end of our careers, and I was looking at PERC's program and thought it would be a good way to finish out and do the right thing for the community by looking into an alternative fuel," Corwin says. "This just enhances the Vinoy. There's thousands of Vinoys out there, and this just sets us apart and it gets our name out there.

"It sounds boring, but there hasn't been any difference," he continues. "It's just a different habit to fill the machine with (propane). That's it."

PHOTO BY: GRANT B GANNON

Hosted by Clark Throssell, Ph.D. | *clarkthrossell@bresnan.net*

Super Science

// **PICK YOUR POISON**

CHEMICALS CONTROL LARGE PATCH, DEPENDING ON DEPOSITION

By Jesse J. Benelli

Seasonal large patch (*Rhizoctonia solani*) epidemics are observed on zoysiagrass fairways in Tennessee each spring and fall. Golf courses with a history of large patch often will budget for two to three fairway fungicide applications. However, disease breakthrough commonly is observed despite the use of fungicides.

One possible explanation for this is poor fungicide deposition in the lower plant canopy, where infection occurs. Our objective was to determine the amount of protection provided by fungicides deposited on either the upper or lower plant canopy. Greenhouse experiments were conducted in 2015 in Knoxville, Tenn., to evaluate large patch control using fungicides applied on the stem, sheath or leaf parts of zoysiagrass. The fungicides Heritage (azoxystrobin, Syngenta), Prostar (flutolanil, Bayer), Torque (tebuconazole, Nufarm) and Daconil Ultrex (chlorothalonil, Syngenta) were applied at the high-labeled rate using a pipette to dispense a single coarse droplet on the leaf, sheath or stem.

Zoysiagrass plants were inoculated with *Rhizoctonia solani* and kept in a humid growth chamber. Measurements of visual disease severity (0-100 percent) were collected every seven days. On most rating dates, zoysiagrass treated with fungicides applied on the sheath or stem exhibited significantly lower large patch severity compared to applications on the leaf. Large patch control using Heritage, a xylem mobile fungicide, was most affected by the site of application. At 28 days after treatment, leaf applications of Heritage exhibited 74-percent disease severity, whereas the sheath and stem applications exhibited less than 5-percent disease severity. Daconil Ultrex, a contact fungicide, was least affected by the site of target application. In summary, all fungicides we tested exhibited significantly better large patch control when deposited lower in the plant canopy. Research is being conducted to develop strategies that improve fungicide penetration and deposition in the field. The use of higher spray rates (2 to 4 gallons per 1,000 ft^2) and the incorporation of super-spreading surfactants may help distribute the fungicide solution lower in the plant canopy.

Seasonal large patch epidemics disrupt the uniformity of golf course turf.

PHOTO BY: JESSE BENELLI

Jesse J. Benelli is a Ph.D. candidate, and Brandon Horvath, Ph.D., is a turfgrass pathologist at the University of Tennessee-Knoxville. You may reach Jesse Benelli at jbenelli@vols.utk.edu for more information.

Acknowledgment: *The authors wish to acknowledge the USGA and WinField Solutions for funding this research. They would also like to thank golf course superintendents Trey Cutshall (the Farm Golf Club) and Jeff Dudych (Gettysvue Golf and Polo Club) for participating in the field research.*

NEWS UPDATES

EPA CANCELS SYNGENTA'S AVID NEMATICIDE SLN REGISTRATION

The Environmental Protection Agency has notified Syngenta that its Avid 0.15 EC miticide/insecticide 24(c) Special Local Needs (SLN) registration in turf will be canceled effective June 30, 2016.

The cancellation affects the use of Avid on golf course greens to control nematodes in Alabama, Florida, Georgia, Louisiana, Missouri, Mississippi, North Carolina, New Jersey, New Mexico, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas and Virginia.

Superintendents will have one year after the cancellation date to continue using existing product under the 24(c) SLN. The Avid + Heritage fungicide and Avid + Heritage Action fungicide Multipaks also are available for use under the 24(c) SLN until June 30, 2017, according to the company.

"Syngenta remains committed to researching new nematode management solutions for golf course superintendents," says Gregg Wisniewski, insecticide brand manager at Syngenta. "We look forward to bringing new innovations for nematode control to the market in early 2017."

This cancellation does not affect the availability of Avid for ornamental plants.

"THE ONLY WAY TO TRULY KNOW WHICH BACTERIA SPECIES IS CAUSING A PROBLEM ON YOUR COURSE IS TO SEND IT TO A REPUTABLE DIAGNOSTIC LAB."

Joseph A. Roberts, Ph.D.

(see story on page 30)

//UNFORSEEN CIRCUMSTANCES

Managing the unexpected

What we know about bacterial diseases of turfgrasses

By Joseph A. Roberts, Ph.D., and Paul R. Giordano, Ph.D.

Concerns about bacterial etiolation (Figure 1) and decline exploded in the golf course industry more than five years ago. While etiolation had been observed for years, the abnormal elongation sometimes observed in putting greens usually was an unsightly occurrence that developed during wet conditions and rarely resulted in turf loss.

Those concerns in 2010 and 2011 were not narrowly focused on widespread etiolation, but also on the mass turfgrass decline that followed etiolation symptoms during environmental stress periods. The rapid rise of the conditions caused considerable controversy because the tools that superintendents normally use to combat turfgrass diseases provided little to no control.

Seeing the need across the industry, research teams from multiple universities responded with projects geared toward understanding current management practices and their impact on developing bacterial diseases. While many questions still exist surrounding the outbreak in 2010-2011, researchers now have some answers on how to limit these problems.

FIGURE 1

Creeping bentgrass putting green turf exhibiting etiolation symptoms as a result of infection with *Acidovorax avenae*. Symptoms include abnormal elongation of turfgrass stems and leaves that develop rapidly overnight.

PHOTOS COURTESY JOSEPH ROBERTS

IS BAD BACTERIA ON MY COURSE?

It's estimated that a single gram of soil can contain up to 1 billion bacteria, most of which are benign or beneficial. Bacterial pathogens on turf are relatively rare, but the pathogenic species of interest tend to be cosmopolitan, meaning they may be found in any number of environments and are likely present to some degree in just about all turfgrass stands. Only when conditions are conducive and levels of inoculum exceed disease-causing thresholds do they become pathogenic on our greens, tees and fairways. The only way to truly know which bacteria species is causing a problem on your course is to send it to a reputable diagnostic lab, which will conduct a thorough analysis of the signs and symptoms and then undertake the laborious process of isolation and characterization.

Thousands of microscopic bacterial species live in turfgrass systems, so the job of discerning which one is the cause of a disease can be challenging. First, we must isolate the most prevalent bacterium from the samples. Diagnostic labs use a technique known as serial dilution to detect organisms in high enough abundance and discard those in low numbers living on or within diseased turf plants. Once a few viable candidates emerge in culture media they are grown and later tested for their ability to infect healthy turfgrass plants.

Using these basic techniques, certain species of *Xanthomonas*

have been well characterized as turf pathogens. These cause bacterial wilt on *Poa annua* as well as older vegetative cultivars of creeping bentgrass (*Agrostis stolonifera*) such as Toronto. Only recently have we characterized new hosts for *Xanthomonas* species, including newer cultivars of creeping bentgrass and perennial ryegrass.

Beginning in 2009, isolation and DNA sequencing found a "new" bacterial turf pathogen in the *Acidovorax* genus from infected creeping bentgrass samples taken throughout the Transition Zone and much of the mid-Atlantic region. This sparked the research efforts to better understand the threat bacteria pose to high-value turf areas across the country.

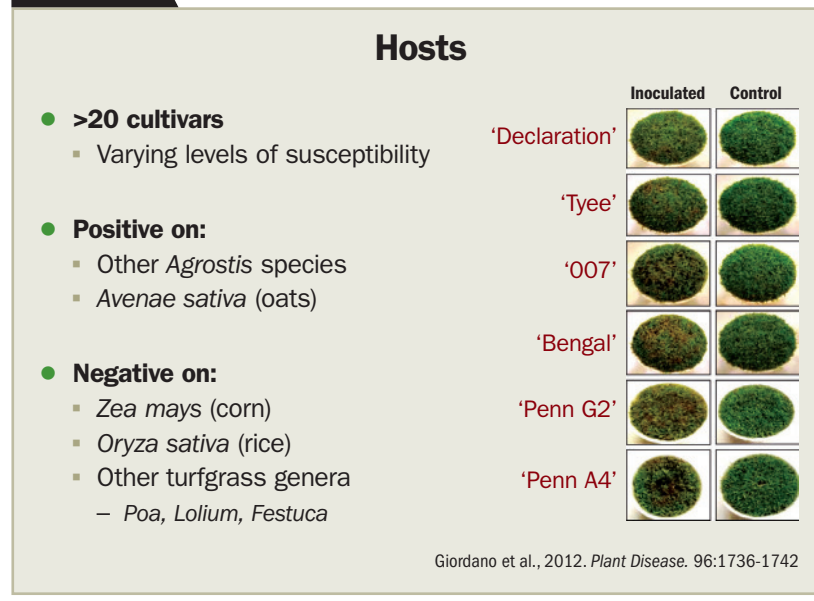
DIFFERENT SPECIES, DIFFERENT IMPACT?

An early objective of the initial research on *Acidovorax* was to determine if the disease was specific to particular turf species as well as individual bentgrass cultivars. Only moderate-to-light infection symptoms occur when *Acidovorax* is inoculated onto *Lolium, Poa* and *Festuca* species. All *Agrostis* species (*stolonifera, tenuis, canina*) are susceptible, and all cultivars of creeping bentgrass (*A. stolonifera*) are susceptible to *Acidovorax* to some extent.

There are, however, some significant differences in the susceptibility of Declaration and Tyee when compared to the other cultivars (Figure 2). Research done at the University of Rhode Island by Nathaniel Mitkowski, Ph.D., confirmed similar results with several other cultivars of creeping bentgrass. These results showed the non-specific nature of *Acidovorax* and its ability to infect creeping bentgrass. However, recommendations regarding particular cultivars to turf managers battling the disease are unwarranted until extensive field studies can confirm truly resistant/tolerant cultivars.

The problem became more complex as researchers investigated more samples from around the country. Not only was *Acidovorax* causing etiolation and decline symptoms on creeping bentgrass putting greens, but in some cases our old friend *Xanthomonas* was found, either alone or in tandem with *Acidovorax*, complicating the matter and confusing researchers even more. Inoculations with *Xanthomonas translucens* resulted in etiolation symptoms on creeping bentgrass putting green turf, and isolations of this bacterium also have been widely distributed in recent years.

FIGURE 2



Cultivar inoculations of creeping bentgrass with *Acidovorax avenae* subsp. *avenae* (isolate MSU4). Note the varying disease severity, with cultivars such as Declaration, Tyee and 007 exhibiting significantly less disease symptoms than Penn G2 and Penn A4. Plants were kept in a growth chamber at ~86°F with high relative humidity. Pictures taken 14 days post inoculation.

BIOSTIMULANTS, PGRs AND FERTILIZATION

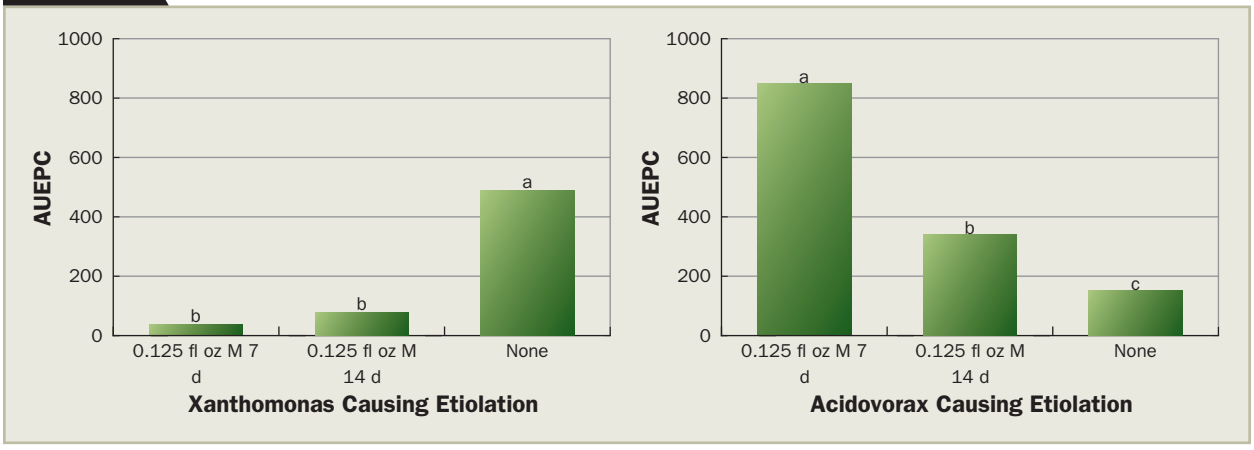
Etiolation symptoms perplexed many superintendents and researchers because the rapid overnight growth associated with the disease was difficult to explain. Superintendents often encounter fungal pathogens that cause chlorosis (i.e., yellowing), dieback, and/or thinning, but what is it about bacterial infection that results in rapid growth? And why are only individual turfgrass plants infected?

Symptoms intensified at some locations in areas where biostimulants and plant growth regulators (PGRs) were applied, particularly in overlapping areas that received double the application rate. Many biostimulant products contain plant hormones and nutrient packages that can impact plant physiology so as to cause abnormal growth, and their use has skyrocketed in the past decade. In addition to plant hormones, some biostimulants also claim to stimulate the microbial community within the soil, or even contain beneficial microbes, so their use could also stimulate *Acidovorax* or *Xanthomonas* bacteria.

Seeing the potential relationship, researchers at North Carolina State University decided to examine how selected biostimulant applications impact bacterial etiolation development. First, multiple biostimulants were selected by carefully examining application records from golf courses in

Continued on page 32

FIGURE 3



Impact of Primo Maxx applications on bacterial etiolation caused by *Xanthomonas translucens* (left) or *Acidovorax avenae* (right). Primo Maxx applications were applied at the designated rate (per 1,000 sq. ft.) and frequency. Area under progress curves values are shown for etiolation in Fall 2011 (*Xanthomonas*) and Summer 2013 (*Acidovorax*). Letter designations represent significant differences at the 0.05 probability level.

Continued from page 31

mid-Atlantic and southeastern U.S. that submitted etiolation samples. Next, they tested the most frequently used biostimulants alone and in combination with multiple rates of trinexapac-ethyl (i.e., Primo Maxx, Syngenta Crop Protection) applications, as both biostimulants and growth regulators are typically applied in conjunction to manage creeping bentgrass during summer stress periods. Biostimulants tested across three years included Knife Plus (Floratine), CytoGro (BioPro Technologies), Astron (Floratine), BioMax (Harrells) and PerkUp (Floratine). All were applied according to label specifications. Interestingly, none of the biostimulants tested had a significant effect on bacterial etiolation development, and results were consistent across all three years, regardless of whether the biostimulant was mixed with Primo Maxx.

THE PRIMO MAXX EFFECT

The more interesting side of the previous study was the effect of Primo Maxx on bacterial etiolation. Primo Maxx was speculated as a cause of etiolation symptoms on annual bluegrass well before the outbreaks on creeping bentgrass in 2010-2011, but the rarity of the condition limited researchers' ability to determine the true effect. Interestingly, Primo Maxx did have a significant effect on bacterial etiolation in the previous study, but effects were different depending on the bacterium (i.e. *Acidovorax* vs. *Xanthomonas*) causing etiolation symptoms.

In the fall of 2011, when etiolation was observed to be caused by *Xanthomonas*, Primo Maxx applications (0.125 fl. oz. per 1,000 sq. ft. every 14 days and seven days) significantly reduced bacterial etiolation symptoms compared to non-treated areas (Figure 2). However, when the same treatment structure was applied during the summer of 2012 and 2013, when *Acidovorax* was causing bacterial etiolation, researchers observed significantly higher bacterial etiolation where Primo Maxx (0.125 fl. oz. per 1,000 sq. ft. every 14 days and seven days) was applied (Figure 2; 2012 data not shown). Etiolation was highest in areas that received more frequent applications (i.e., seven days versus 14 days). Another interesting note regarding all three years of the study: Regardless of the bacterium causing etiolation, the turf quality of Primo Maxx-treated plots always was significantly better than the non-treated control, meaning that as long as etiolation symptoms were mowed off with daily mowing, researchers saw no detrimental effects as a result of increased bacterial etiolation.

Seeing the relationship between Primo Maxx applications and etiolation symptoms, the researchers decided to test additional PGRs against bacterial etiolation caused by *Acidovorax avenae,* as additional modes of growth regulation were suspected of having variable effects on the symptom development. Flurprimidol (i.e., Cutless, SePro Corp.) and paclobutrazol (i.e., Trimmit, Syngenta Crop Protection) are known as early-GA-biosynthesis inhibitors, while Primo Maxx is considered a late-GA-biosynthesis inhibitor. In 2013 and 2014, researchers evaluated multiple rates of Primo Maxx (0.125 fl. oz. per 1,000 sq. ft. and 14 days and 0.250 fl. oz. 14 days), Cutless (0.07 oz. per 1,000 sq. ft. 14 days and 0.14 oz. per 1,000 sq. ft. 14 days), and Trimmit (0.09 fl. oz. per 1,000 sq. ft. 14 days and 0.18 fl. oz. per 1,000 sq. ft. 14 days) on creeping bentgrass inoculated with *Acidovorax avenae*. Not surprisingly, Primo Maxx applications increased etiolation symptoms similarly to those seen in the previously mentioned study, and reducing the same application from seven days to 14 days significantly reduced symptoms (Figure 3). However, both Cutless and Trimmit applications at both rates had reduced etiolation symptoms no different than the non-treated control, indicating that

the alternate mode of action provided by these compounds was able to limit etiolation caused by the *Acidovorax* bacterium (Figure 3).

And while Cutless and Trimmit may have provided a reduction in etiolation symptoms throughout the season, Primo Maxx applications still provided the best turf quality when etiolated plants were removed through daily mowing. This was surprising, because researchers thought the continued etiolation would have resulted in bacterial decline of Primo Maxx-treated plots. Trimmit and Cutless applications did cause some phytotoxicity discoloration early in the season. While the discoloration dissipated as the season progressed, this can be a concern when applying early GA-biosynthesis inhibitor PGRs.

Based on these results, questions still surround the use of combination PGR products. It may be possible to combine different modes of action to achieve the improved turf quality associated with Primo Maxx applications while limiting etiolation development through the addition of Cutless or Trimmit. Also available is a newer PGR in prohexadione calcium (i.e., Aneuw, Nufarm Americas), which has a similar mode of action to Primo Maxx. Future research will improve our knowledge of how all of these products, alone and in combination, impact etiolation caused by both *Acidovorax* and *Xanthomonas.*

FERTILIZATION EFFECTS

Along with PGRs, anecdotal evidence from golf course superintendents struggling to combat etiolation point to certain fertilization effects on disease outbreaks. One in particular is the effect of ammoniacal forms of nitrogen (N), most notably ammonium sulfate, and the potential for disease flareups when used.

In order to confirm or disprove this observation, field studies were set up to investigate the effects of ammonium sulfate applications at higher (0.2 lbs N per 1,000 sq. ft. 14 days) and lower (0.1 lbs N per 1,000 sq. ft. 14 days) rates on stands of creeping bentgrass inoculated with the Acidovorax bacterium, as well as sites with naturally occurring infection. Applications of ammonium sulfate consistently rank among the top treatments for etiolation severity in several field studies, although the results are not always statistically significant. When compared to other nitrogen carriers such as urea, treatments of ammonium sulfate, particularly at the higher application rate of 0.2 lbs N per 1,000 sq. ft., showed elevated outbreaks of etiolation symptoms.

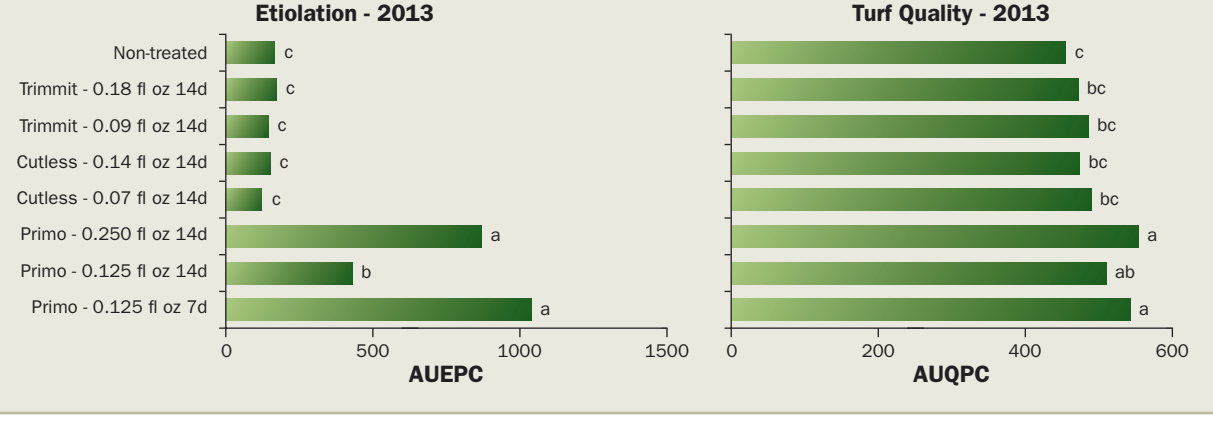
While a few simple studies have demonstrated this effect, many questions remain regarding nutritional components of the etiolation phenomenon in turfgrass, especially as it relates to bacterial infection. One hypothesis revolves around the acidifying properties of ammonium sulfate, which could be encouraging a more conducive environment for *Acidovorax avenae,* allowing for an increased proliferation and activity of the pathogen during times of environmental and mechanical stress on the plants.

RECOMMENDATIONS

There still are questions regarding the development of bacterial etiolation and/or decline, including how these infectious bacteria contribute to the rapid growth overnight. A similar disease — called foolish seedling — occurs on rice, in which a fungus, Fusarium fujikuroi, produces a gibberellin hormone that causes

Continued on page 34

FIGURE 4



Impact of plant growth regulator applications on season-long bacterial etiolation (*Acidovorax avenae*) and turf quality observed in 2013. Product applications were applied at the designated rate (per 1,000 ft^2) and frequency. Area under progress curve values are shown for etiolation (AUEPC) and turf quality (AUQPC). Letter designations represent statistical differences at the 0.05-probability level.

Continued from page 33

infected plants to grow taller than the surrounding individuals. The initial research of gibberellin plant hormones developed as a result of this particular disease. It was only later that scientists discovered gibberellins as naturally occurring hormones in plants. There also are numerous bacteria capable of synthesizing gibberellins, and based on recent research, it's likely that *Acidovorax avenae* does as well. Researchers currently are working to confirm this theory. In the meantime, there are some recommendations for managing bacterial etiolation in creeping bentgrass putting greens.

1) Try to get an accurate diagnosis by a university laboratory that is capable of identifying the bacteria involved. Knowing which bacteria are present can help in formulating a management plan for the future.

2) Minimize plant stress, because bacterial decline symptoms identified in 2010-2011 always were associated with environmental stress periods.

3) Raise mowing heights to avoid scalping etiolated plants, and support turf health through regular fertilization and irrigation.

4) When questioning effects of a chemical application on symptoms, utilize a test area for applications. It's best to look at products individually, because applying several products in a single mix-tank creates difficulty in drawing conclusions regarding specific applications. Adjusting growth regulator programs to include early-GA inhibitors like Cutless and Trimmit can help, but some phytotoxicity is observed with these applications.

We learned a lot from the 2010 and 2011 outbreaks. As with any emerging pest, especially in a case involving microorganisms from a different kingdom, it takes time to understand and develop new management practices. Continued research will provide additional information and potential management strategies.

Joseph Roberts, Ph.D., is a turfgrass pathologist at the University of Maryland, and Paul Giordano, Ph.D., is a technical specialist in Canada for Bayer Environmental Science. Reach Joseph Roberts at robertsj@umd.edu for more information.

Acknowledgements

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"UV-C has been evaluated and tested in plants as a possible disease-controlling agent."

KARL DANNEBERGER, PH.D., *Science Editor*

UV light, cancer and more

Sunlight is made up of the visible light spectra, which is comprised of wavelengths between 380 nm and 700nm. Bookending the visible light spectra is ultraviolet (UV) and infrared wavelengths. Ultraviolet wavelengths are associated with skin tanning and cancer in humans.

While part of the light spectrum, ultraviolet is invisible to the naked eye. Ultraviolet radiation is broken down by wavelength into three main groups, UV-A, UV-B and UV-C. UV-A is the longest of the three wavelengths at 320 nm to 400 nm and is closest to the visible light spectrum. Ninety-five percent of UV radiation is UV-A. UV-A penetrates deeper into the skin than UV-B. Tanning, skin aging and wrinkling are associated with UV-A. Until recently, however, scientists didn't associate UV-A with damage to epidermis cells (outermost cells), which are the cells most associated with skin cancer.

UV-B causes sunburn. This wavelength damages primarily the human skin's epidermal, or top layer. It's this damage in the epidermal layer that leads to skin aging and skin cancer. Generally, the greatest amount of UV-B occurs from April to October between the hours of 10 a.m. to 4 p.m. However, UV-B occurs year round.

UV-C is the shortest of the ultraviolet wavelengths (less than 290 nm). UV-C receives little attention compared to UV-A and UV-B because these short wavelengths are absorbed by the ozone layer and fail to penetrate to the earth's surface, so the impact of natural UV-C on Earth's biological systems (either humans or turf) is non-existent. However, artificially produced UV-C around 254 nm has been used for more than a century as a sterilizing tool for microbial contamination. With the increased resistance to antibiotics in hospitals, UV-C lamps are being increasingly used as germicidal/disinfectant treatments for microbes. UV-C is not known to cause cancer in these situations, probably because of its lack of penetration through dead cells on the skin surface.

UV-C has been evaluated and tested in plants as a possible disease-controlling agent. It has been used in small, controlled environments like greenhouses and in post-harvest situations with fruits and vegetables. UV-C is highly absorbed by organic substances like DNA, which can result in severe damage to microbes. In general, UV-C is absorbed by the cell proteins and DNA, causing damage through metabolic disruption, while the DNA is altered so the organism can no longer replicate.

Interestingly, UV-C radiation is associated with physiological changes in plants at low doses. In some studies on fruits and vegetables, treatment post-harvest resulted in greater stress resistance. In the widely used research plant Arabidospsis, UV-C induced damage in the plant resulted in greater plant resistance to downy mildew. To induce better stress resistance, low doses, called hormic doses, of UV-C are applied in short pulses.

So what about using UV-C for disease control in turf? Most golf courses aren't small, contained units like a greenhouse or storage facility, so the idea of a UV-C machine traveling across a golf course doesn't sound practical or financially feasible, except perhaps for specific green use. However, UV-C devices for controlling diseases on athletic fields are being proposed and tested.

Would such devices work? Research shows the potential for directly killing microbes through mutations to plants, making them resistant to pathogens. I suspect the potential for disease control in turf is feasible.

Now that UV-C has been used on annual crops in greenhouses and in post-harvest situations, what are its long-term effects on perennial turf? Can mutations induced to enhance disease resistance also be detrimental to plants? How intense should be the doses and frequency? In the absence of UV-C DNA damage, can repair occur, or will continued exposure at high UV-C intensity result in detrimental effects?

Given all this and with interest growing, science will have to tell us the positive and negative impacts of UV-C on turf.

Karl Danneberger, Ph.D., *Golfdom*'s science editor and a professor at The Ohio State University, can be reached at danneberger.1@osu.edu.

University/industry cooperation is vital to research

Field day season almost is upon us, and if you attend a university field day you undoubtedly will see several research projects that are university/industry collaborations. There is a long history in the turf world of university/industry cooperative research that benefits the turfgrass industry and the involved universities.

The benefits of collaborative research are many. For superintendents, the benefits include an opportunity to see the performance of new products versus existing products in side-by-side comparisons. A university scientist also can try various product rates, product mixtures and application timings in all combinations — combinations that would be impractical for superintendents to try on their own.

In addition, university research plots offer the perfect place to see what damage applying excessive rates of a product might cause, which of course are tests that superintendents would be reluctant to try on their own golf courses. In many cases, the ultimate benefit to superintendents of university/industry cooperative research is sound-use information for a product label and the backbone of recommendations found in university publications on disease, insect, weed and nematode control.

The benefits are many for university scientists as well. There is no better way for a university scientist to learn about product performance than conducting an experiment to understand what a product is and is not capable of doing. University/industry cooperative research offers scientists an opportunity to learn about new products, stay current on existing products and consider the gaps that no product currently is meeting. Results from these cooperative research projects help university scientists make product use recommendations to superintendents and also help keep university publications current on pest management.

University/industry cooperative research also provides a great educational experience for undergraduate and graduate students learning about turfgrass research. Working under the direction of a university scientist or a skilled technician, students gain hands-on experience in all aspects of conducting a field experiment, including treatment preparation, experimental design, field layout, treatment application, turfgrass maintenance and data collection, statistical analysis and writing reports.

University turf programs also benefit financially from conducting cooperative research with industry. Industry provides the funding for many cooperative projects at universities, from side-by-side product comparison research projects to a more in-depth study of rates, timings and potential product mixtures, to basic science on determining the mode of action of a specific product.

The financial connection between universities and the industry raises concerns from some people about whether university scientists can remain unbiased when receiving funding from industry. My experience conducting industry-sponsored research taught me that if a product doesn't perform to the sponsor's expectations, the sponsor is the first to want to know, so that the company can determine the cause of the poor performance. In this regard, companies are like the rest of us. If there is a problem, we want to know it first so we can address the problem before it gets worse. Companies are no different. In the 15 years that I conducted industry-sponsored research, I found that the sponsor wants to know the outcome of the experiment, whether the results are good, bad or indifferent.

Industry benefits from the university/industry cooperative research by having their products evaluated by unbiased university experts. By conducting industry-sponsored research, university scientists can identify strengths and weaknesses of products, suggest ways to improve product performance and identify opportunities for new uses of existing products or products under development. Industry also gains critical information to improve and expand product labels. In addition, funding university research is important, because in this manner industry supports universities and the turfgrass industry to advance the science that we all use to meet the expectations of golfers.

University/industry cooperative research is a critical part of the success that we all experience and enjoy in the turfgrass industry.

Clark Throssell, Ph.D. is a turfgrass scientist and can be reached at clarkthrossell@bresnan.net.

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NEW PRODUCT HIGHLIGHTS // **THIS AND THAT**

LONGHORN WAY

EVERYTHING IS BIGGER IN TEXAS, INCLUDING IRRIGATION EFFCIENCY.

By Seth Jones

1. Jacobsen HR700

JACOBSEN offers the HR700 wide-area rotary mower. Featuring an industry-first 14-foot wide cutting width, the HR700 has the ability to cut up to 25 percent more grass than traditional 11-foot rotary mowers. Built on an extremely nimble platform, the HR700 delivers a zero-uncut circle and easily maneuvers around obstacles. With a transport width within the front deck, the HR700 mower will go places others can't. A new AdaptiCut system automatically adjusts mow speed to ensure consistent cut performance, even through the thickest grass.

Jacobsen.com

2. TurfEx TT5000

TURFEX introduces the TT5000 Spread-N-Spray. The unit boasts a standard height-adjustable boom kit that maximizes spray width while minimizing waste. A 17-gallon tank system has a single rapid-fill port for easy filling. The TT5000 includes a front-mounted 84-inch stainless steel boom, which can spray from 12-feet to 3-feet widths. A 12-inch polyethylene spinner throws a spread pattern up to 14 feet wide, while the stainless steel flow gate with adjustable precision-agitation distribution promotes consistent application.

Turfexproducts.com

3. DS 3000 T Brushcutter

The professional DS 3000 T Brushcutter from **EFCO** was developed with the intensive user in mind. It has a powerful 2-stroke engine that delivers 30cc/1.5HP, providing users the performance they need to tackle any job. Its ergonomic bike handle provides increased operator comfort by reducing vibrations. The clutch housing is made with aluminum for reduced weight and increased durability.

Efcopower.com

4. Nordic Plow

The **CORE COLLECTOR** plow for aerators from Nordic Plow is an efficient attachment that clear cores from greens, the company says. The patent-pending, lightweight, rounded edges won't damage turf, and can also be used over paver bricks, stone, irregular pathways and winter tarps. The Core Collector comes in 49 inches and 64 inches, and can be attached to most aerators as well as utility vehicles and zero-turn mowers.

Nordicplow.com

5. Spraying Simple App

MASTER MANUFACTURING announces the new free Spraying Simple app for download on iPhone & Android phones. The Spraying Simple app is designed to assist spraying applicators by accurately determining how much liquid they need for a particular spray job, paired with a speedometer function to monitor speed for the proper application rate. Map or walk your spray area and integrate your spray equipment to calculate the needed liquid for your project.

Master-mfg.com

6. Sensaphone Soil Moisture Sensor

The new **SENSAPHONE** Soil Moisture Sensor helps golf course managers irrigate more efficiently. The sensor measures water content in soil so users can be alerted when moisture conditions fall outside the desired range. Instant notification prevents over- or under-watering, minimizes water usage, promotes growth and increases turf quality. The Sensaphone Soil Moisture Meter is compatible with most Sensaphone monitoring systems.

Sensaphone.com

TIPS FROM CHAD FISHER

While at the 2016 Dean & DeLuca Invitational at Colonial CC in Fort Worth, Texas, we caught up with Chad Fisher, who works in golf outside sales for Longhorn Inc., a distributor of Rain Bird.

He showed us the IC System, and talked to us about the benefits of its two-wire system. The IC System is more intelligent than a decoder-based system, as there's a microprocessor computer in each of the decoders. So it's giving superintendents two-way communication with the controller at all times.

"When you set it out initially each head has a long address, as it pings it, it pings it back with a short address," Fisher says, "which makes the response time a lot quicker on a ping. You can diagnose a course's electrical problem in real time."

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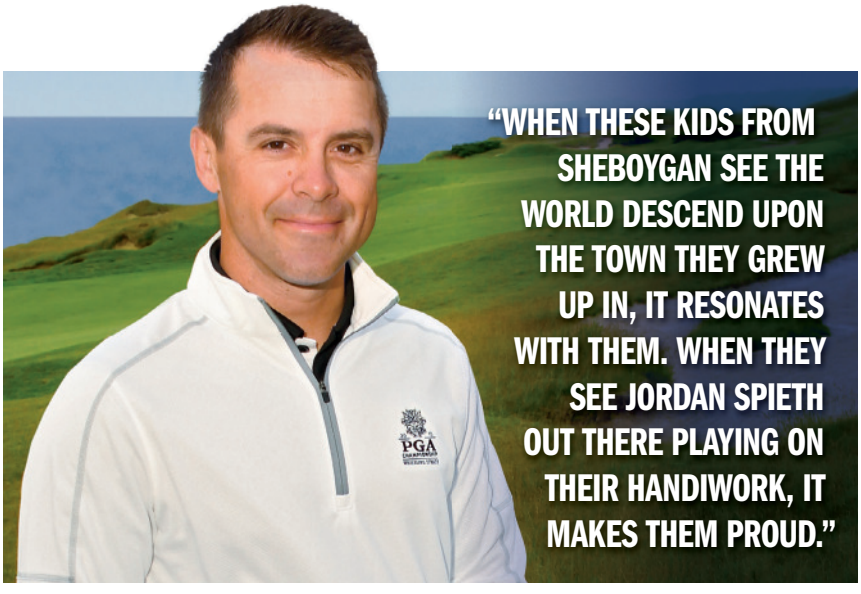
The 19th Hole with...

Chris Zugel

CGCS // Straits Course, Whistling Straits, Kohler, Wis.



After golf, what's your drink of choice? Coors Light. Or coffee, depending on the time of day. Usually I'm running late for one of the kids' extracurricular activities, so I normally miss out on the 19th hole.

What are your sports teams? I'm a Brewers fan, Red Sox fan and Packers football.

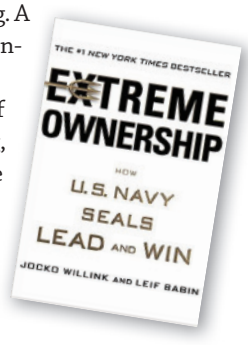
So what's new in Kohler? We're pretty much done restoring the course from the 2015 PGA Championship, but you'd be surprised how many zip-ties I still pick up in a day. Now we're looking towards the 2020 Ryder Cup.

Since Mr. Kohler won the Old Tom Morris Award, has be brought it by the shop to show it off like the Stanley Cup? He hasn't brought it by the shop, but I can tell you he really treasures that award. I'm sure I'll have to be in his office to see it.

Tell me something unique about your crew. They're all really, really tall. Well, I should preface that by saying I'm not tall, but the average height is 6'5". I think they could give the Golden State Warriors a run.

Best celebrity sighting you've had at the course? There are so many celebrities that play out here, but I'd be lying if I told you I knew they were out there. All the golfers look the same to me — unless they're football or basketball players, they look a little different than normal-sized people.

Read any good books lately? I've been into the book "Extreme Ownership: How Navy SEALs Lead and Win" by Jocko Willink and Leif Babin. The principals in the book, I use them at home, at work, it's amazing. A big part of it is owning everything... take ownership of what you're doing, you're responsible for your actions, and how it passes down through the ranks.



You worked for the groundskeeper staff for the Brewers for a year, do you ever miss it? I do miss working for them, the staff there was great, the organization was like a family. The hours were tough though, especially having kids. I like being done with work when the sun is still up.

Next time I'm in Kohler, what's one thing I have to order? If you're at Whistling, get the potato leek soup. If you're at Black Wolf Run, get the sausage corn chowder. And if you're at the American Club, get the fried cheese curds.

That's a guarantee on the cheese curds. OK, fill in the blank, "In high school, I was voted _____?" I haven't even thought of this since high school — I was voted best legs. I'm pretty sure they were just making fun of me.

As interviewed by Seth Jones on May 27, 2016.

MAIN PHOTO: EPIC CREATIVE / ISTOCK.COM (BHOFACK2-CHEESE CURDS)

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WATCH THE VIDEO AT CUBCADETGOLF.COM/TRUEDGE

Cub Cadet

All the best to the Oakmont Country Club Grounds Team for a great 2016.

John Deere Golf is proud to work with and support Superintendents **John Zimmers/David Delsandro** and their staff in this very important year for them. No course in the United States has held more combined championships than Oakmont, a course that demands excellence from all who set foot on its hallowed grounds. Once again, all the best to **John Zimmers**, **David Delsandro**, their staff, and their volunteers.

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