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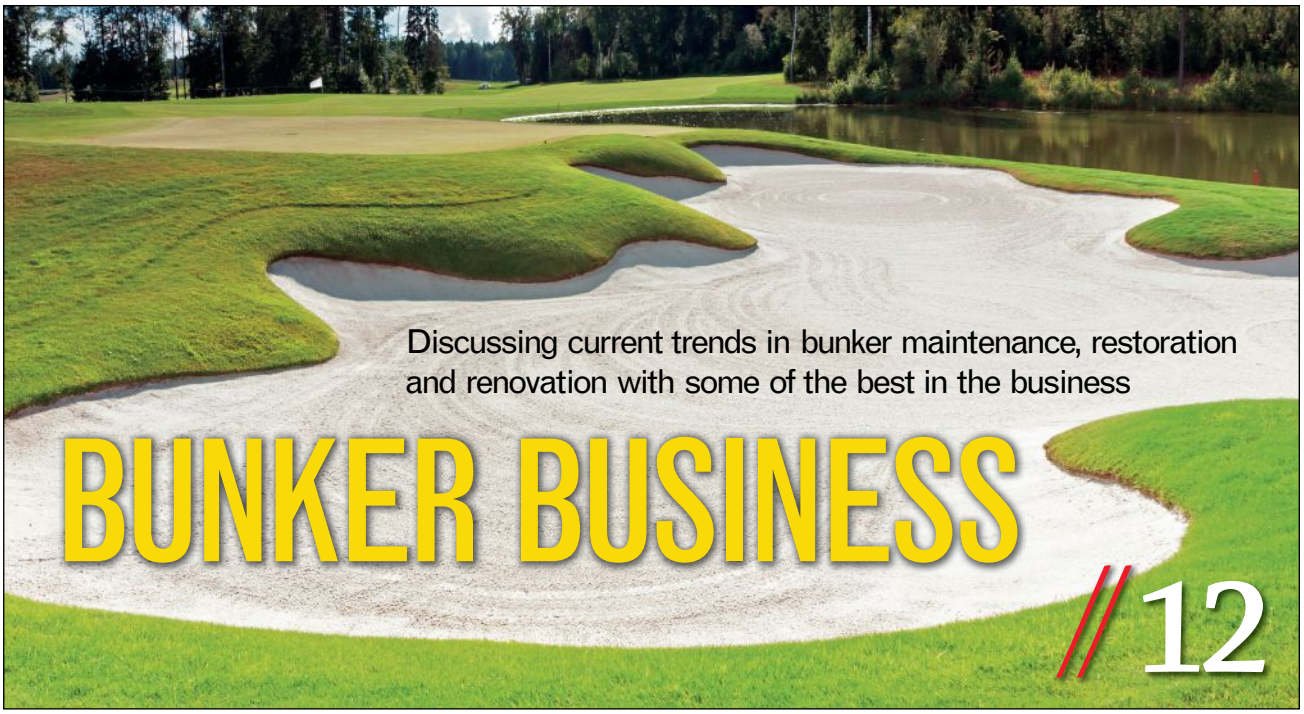

Discussing current trends in bunker maintenance, restoration and renovation with some of the best in the business

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EDITORIAL

EDITORIAL DIRECTOR, EDITOR-IN-CHIEF & ASSOCIATE PUBLISHER Seth Jones
785-542-2627 / sjones@northcoastmedia.net

ASBPE 2021 GOLD NATIONAL AWARD asbpe.org

EDITOR Christina Herrick
216-675-6009 / cherrick@northcoastmedia.net

ASSOCIATE EDITOR Rob DiFranco
216-675-6001 / rdifranco@northcoastmedia.net

DIGITAL MEDIA SPECIALIST Sydney Fischer
216-675-6002 / sfischer@northcoastmedia.net

ART DIRECTOR Pete Seltzer
216-706-3737 / pseltzer@northcoastmedia.net

CONTRIBUTING EDITORS
Karl Danneberger (*Science*), Alan FitzGerald, Mike Kenna (*Research*), Jim Moore

BUSINESS

CLEVELAND HEADQUARTERS
1360 EAST 9TH ST, 10TH FLOOR, CLEVELAND, OH 44114

GROUP PUBLISHER Bill Roddy
216-706-3758 / broddy@northcoastmedia.net

PUBLISHER Craig MacGregor
216-706-3787 / cmacgregor@northcoastmedia.net

WESTERN REGIONAL SALES MANAGER Jake Goodman
216-363-7923 / jgoodman@northcoastmedia.net

EASTERN REGIONAL SALES MANAGER Dan Hannan
216-363-7937 / dhannan@northcoastmedia.net

EXECUTIVE SALES ASSISTANT Petra Turko
216-706-3768 / pturko@northcoastmedia.net

MARKETING & EVENT MANAGER Allison Blong
216-363-7936 / ablong@northcoastmedia.net

MGR., PRODUCTION SERVICES Karen Lenzen
216-978-3144 / klenzen@northcoastmedia.net

SR. AUDIENCE DEVELOPMENT MANAGER
Antoinette Sanchez-Perkins
216-706-3750 / asanchez-perkins@northcoastmedia.net

AUDIENCE MARKETING MANAGER Hillary Blaser
216-440-0411 / hblaser@northcoastmedia.net

MARKETING/MAGAZINE SERVICES

SUBSCRIBER, CUSTOMER SERVICE
847-513-6030 / golfdom@omeda.com

LIST RENTAL Brahm Schenkman
800-529-9020 / bschenkman@inforefinery.com

REPRINTS & PERMISSIONS Wright's Reprints
northcoastmedia@wrightsmedia.com

CORPORATE

PRESIDENT & CEO Kevin Stoltman
VP OF FINANCE & OPERATIONS Steve Galperin
VP OF CONTENT Marty Whitford
VP OF MARKETING Michelle Mitchell
VP OF GRAPHIC DESIGN & PRODUCTION Pete Seltzer

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"Six of the eight panelists stated that their budgets were up about 20 to 25 percent. One said it was up about 10 percent, and only one said it remained the same."

SETH JONES, *Editor-in-Chief & Associate Publisher*

Familiar faces in Orlando

The 2023 GCSAA Conference and Trade Show in Orlando is a thing of the past, but before we put it in the rearview mirror for good, I want to share a few key takeaways from the show. These are the top three things I heard or observed:

3 Orlando should probably be, at a minimum, an every-other-year location. GCSAA reported an increase in attendance at this Orlando show from the San Diego show by a whopping 69 percent (see the story on page 8). Granted, San Diego had a few bad breaks going against it regarding the pandemic, as I wrote in my Q&A with GCSAA CEO Rhett Evans in the January issue. But Orlando is so successful every time the show goes there.

Trust me; I'd rather hang out in San Diego's Gaslamp Quarter over the cookie-cutter bars on Orlando's International Drive. And I might be the only guy who wishes San Antonio — and that food — would come back into the rotation.

However … the aisles in Orlando don't lie. The show was packed. In the first few hours of the show, I found myself ducking out of the John Deere booth based on the overwhelming number of people there. I felt like I was at nearby Disney World fighting one of those crowds. I headed over to the USGA booth to see if I could check out the new GS3 (see page 9 for more on that). I saw that crowd and told myself, 'maybe later.'

Thursday afternoon quieted down, but every exhibitor I talked to agreed: there's just no competing with Orlando as a show venue.

2 Maintenance budgets are enjoying the golf boom. For the last few years, my friends at FMC have asked me to moderate a panel discussion with about eight superintendents. It goes on for an hour, and we talk about the industry in general. The conversation is lively and fun.

I wish I could tell you it was conducted before a room of 500 people eagerly listening and learning, but let's just say it's more of an *intimate* panel.

One of the best discussions came when I opened it up to the floor for questions (because, as I've stated before, sometimes my common sense isn't so common). The question was: based on the recent golf boom the industry has experienced, how does your maintenance budget look going into 2023?

The answer? Six of the eight panelists stated their budgets were up about 20 to 25 percent. One said it was up about 10 percent, and only one said it remained the same.

This came along with complaints of too much traffic on the golf course to get the work done, desperation to find people to fill out their crews and delays in equipment deliveries. But still, as I stood there and listened to these men talk about having more in the maintenance budget bottom line, I couldn't help but think about how opportunistic this time is in our industry.

1 Most of you haven't aged a day. After missing so many people in San Diego last year and the canceled show in 2021, it has been a few years since I saw many of the folks I saw in Orlando. What an interesting thing for someone like me, who regularly travels to chapter events and tournaments and sees a lot of people every year.

A commonly-shared feeling I had with people was shock over how old our kids have become.

"I heard Evey is old enough to drive now," my old friend Anthony Williams said to me, incredulous. "Was it really that long ago that you were showing me baby photos?"

It was that long ago. Time is flying by. But though I hadn't seen these folks in a few years, they still looked the same. Maybe it's something in the irrigation systems. Or, more likely, it's just great to be back.

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NEWS, NOTES AND QUOTES

//A WELCOME RETURN

The GCSAA Conference and Trade Show returned to form in Orlando, with attendance jumping up 69 percent from the 2022 show in San Diego — a 4,500 attendee increase.

GCSAA CONFERENCE AND TRADE SHOW ATTENDANCE SOARS

Attendance for the GCSAA Conference and Trade Show was up 69 percent from the 2022 show in San Diego, according to the association.

The Golf Course Superintendents Association of America (GCSAA) says total attendance in Orlando was 11,000 compared to 6,500 in-person attendance in 2022. GCSAA said the 2023 numbers are comparable with the 11,700 who attended the last pre-pandemic event held in Orlando in 2020. A total of 6,300 people attended seminars, which was up 70 percent from 2021 and was the highest number since 2008.

Highlights from the conference include the launch of GCSAA Interactive Facility Tours, the announcement of a partnership between GCSAA and The Warrior Alliance and the presentation of the Col. John Morley and Old Tom Morris Award to John Newton, CGCS retired, and Johnny Morris, founder of Bass Pro Shops, respectively.

GCSAA also launched its Interactive Grass Learning Stage, built through a collaboration of the Golf Course Builders Association of America, GCSAA, United States Golf Association and American Society of Golf Course Architects at the trade show.

The show also featured the annual GCSAA Turf Bowl, presented in partnership with John Deere, which saw the team from Penn State University top 62 other teams to take home the title (see more on page 10).

The 2024 GCSAA Conference and Trade Show will head west to Phoenix from Jan. 29-Feb. 1, at the Phoenix Convention Center.

//THE PRIDE OF NEW JERSEY

RUTGERS STUDENT WINS FIRST POWELL SCHOLARSHIP

The GCSAA named Travis Campbell, a Rutgers Center for Turfgrass Science student, the inaugural Larry Powell Scholarship winner.

"Growing up, I was always working on my game to become the best player I could be, but now, I work every day to gain knowledge and live up to my potential in the turf industry," Campbell said. "I am extremely honored to be associated with Larry Powell as the first winner of this scholarship. I thank GCSAA for creating this scholarship for underserved populations such as my own."

Travis Campbell

As part of Campbell's turf management curriculum at Rutgers, he completed a 10-month internship at Carmel CC in Charlotte, N.C., in 2022. During his internship, Campbell was part of the daily conversation with the superintendents and assistant superintendents, discussing plans for what they wanted to accomplish.

//WEARY WEATHER

NGF: ROUNDS PLAYED DOWN IN 2022

According to a report from the National Golf Foundation (NGF), rounds played in 2022 were down 3.7 percent from the record-setting numbers of 2021.

The NGF points towards weather as a major player in the decline. The foundation says average playable hours decreased by 6.5 percent overall in 2022, thanks in large part to bad weather in November and December which saw playable hours decrease by 19 and 30 percent, respectively.

Despite the overall drop in rounds played, the NGF says the total number has continued to outpace those seen before the COVID-19 pandemic.

PHOTOS BY: WELLGLAD / ISTOCK-GETTY IMAGES PLUS / GETTY IMAGES (GOLFBALL); *GOLFDOM* STAFF

//A STIMPMETER'S NEW BFF

Rollin' with the GS3

The United States Golf Association (USGA) debuted the GS3, a tool that calculates putting green speed, firmness, smoothness and trueness, at the 2023 GCSAA Conference and Show.

The GS3 is a rechargeable smart ball that is the same size and weight as a standard golf ball, with sensors that collect more than 15,000 data points.

"We are excited to provide a tool that enables the industry to objectively quantify putting green metrics, besides just green speed," said Matt Pringle, Ph.D., managing director of the USGA Green Section. "GS3 can clarify the impact of different maintenance practices, provide benchmarks and communicate to stakeholders how the course is performing."

John Petrovsky, CGCS, Green Section education manager, shows off the USGA's new GS3 smart ball, which is the same size and weight as a standard golf ball.

Golf course administrators need a Stimpmeter to use GS3. From there, the USGA says the user will activate the GS3, select their position on the Deacon app and performs six roll tests — three each in opposite directions.

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Emily Casey
@emcaseyturf
Assistant superintendent, Seven Canyons GC, Sedona, Ariz.

Sedona weather is wild. On the left 9:30 this morning. On the right, 3 hours later. Got a little fertilizer down on the driving range before the snow hit though.

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PHOTOS BY: *GOLFDOM* STAFF (TOP); EMILY CASEY

//ROCH STAR

USGA NAMES GREEN SECTION AWARD WINNER

Roch Gaussoin, Ph.D., is the USGA's Green Section Award winner for introducing new technologies and processes that advance putting green construction and management.

As a professor and Extension specialist at the University of Nebraska-Lincoln, Gaussoin dedicated nearly 20 years to researching critical aspects of putting green construction and management. Gaussoin's collaborative approach contributed to the improvement of buffalograss, a native low-maintenance grass that requires little irrigation, has few serious pests and could advance the sustainability of golf in some regions.

The USGA recognized honorees at its annual awards dinner in Napa, Calif., on Feb. 25, during the organization's annual meeting.

The association also dished out two other awards, the Joe Dey Award to Robin Farran and the Herbert Warren Wind Award to James Roth for his book *Blessed One.*

//THE RESULTS ARE IN

GCSAA REELECTS BREEN AS PRESIDENT

GCSAA members reelected Kevin P. Breen, CGCS, to a one-year term as president of GCSAA at the association's annual meeting held in conjunction with the GCSAA Conference and Trade Show. Breen is the 86th president in the association's history and the first elected to a second term since 1947. Members nominated Breen for a second presidential term when vice president Kevin P. Sunderman, CGCS, resigned from the board to join the GCSAA staff as chief operating officer.

Kevin P. Breen

Other elected officers include Jeff L. White, CGCS, as vice president, and T.A. Barker, CGCS, as secretary/treasurer.

Alongside Breen, members reelected Paul L. Carter, CGCS, and Steven J. Hammon, as board members, while Scott Griffith, CGCS, was newly elected.

Scott Griffith

//B1G WINNERS

PENN STATE TAKES TURF BOWL CROWN

John Deere announced Penn State University as the winner of the 2023 GCSAA Collegiate Turf Bowl during the GCSAA Conference and Trade Show.

The winners received a traveling trophy, a $4,000 first-place cash prize and the opportunity to complete a paid employment assignment at the Desert Mountain Golf Club and Community in Scottsdale, Ariz.

As a part of the Collegiate Turf Bowl, Penn State University competed against 62 student teams representing 27 colleges and universities from across the U.S. The competition judged teams on overall industry knowledge and problem-solving skills in high-pressure situations.

//IT STARTS WITH YOU

RISE MEMBERS DISCUSS GRASSROOTS ENGAGEMENT STRATEGIES

Responsible Industry for a Sound Environment (RISE) held its first Industry Issues Update of 2023 at the GCSAA Conference and Trade Show, where members discussed engagement on pesticide and fertilizer issues.

RISE President Megan J. Provost urged attendees to amplify their voices through advocacy to spread awareness about pesticides and the regulatory framework that supports their availability.

"Your policymakers need to hear from you about your golf course and its maintenance practices before there is a policy issue," she said.

Superintendents Bob Searle, Abenakee Club, Biddeford, Maine, and Eric David, Naval Academy Golf Club, joined Provost to share their advocacy successes.

//NEW DIGS

Quali-Pro adds former Maryland super

Quali-Pro recently hired Ralph Meola, former superintendent at the Elkridge Club in Baltimore, as its new mid-Atlantic territory manager.

Ralph Meola

"After many years of being a Quali-Pro end user and seeing firsthand how their products have held up through the rigorous mid-Atlantic weather conditions, I am proud to join the innovative team at Quali-Pro and look forward to assisting turf managers for years to come," Meola said.

Meola began his career with an internship at Augusta National Golf Club. As his experience grew, he took on roles at various golf courses on his way to becoming a superintendent.

PHOTOS BY: JOHN DEERE; RISE

Golfdom Gallery

GCSAA Conference and Trade Show EDITION

1 Tree hugger, or...? After some of his recent projects, including the West Course at Belleair (Fla.) CC renovation, where he removed 1,000 trees (see page 12), a friend gave Jason Straka, ASGCA, of Fry/Straka Design, this T-shirt.

2 Life's a beach (Left to right) Sam Wineinger, Nufarm; Lauren Thompson, Golf Channel; T.A. Barker, Fore Lakes GC, Taylorsville, Utah; and Craig MacGregor, publisher of *Golfdom,* take in some beach time at the GCSAA Conference and Trade Show Opening Reception.

3 Know when to fold 'em GCSAA CEO Rhett Evans (right) challenged *Golfdom*'s Editor-in-Chief Seth Jones to a race at the 2024 GCSAA Conference, but Jones quickly declined for one reason: he knows he'd lose.

4 Casamigos, *por favor* A couple of old friends ran into each other at a poolside bar in Orlando; from left to right, Eric Hindes, Playa Grande Golf & Ocean Club, Dominican Republic; Jones; Glen MacDonald, Cripple Creek G&CC, Dagsboro, Del.; and Luke Fisher, River Bend G&CC, Great Falls, Va. Did Hindes really buy everyone tequila?

5 Walking into Walk-On's (Left to right) Hunki Yun, USGA; Scott Bower and Jon Moulton, both of Martis Camp Club, Truckee, Calif., share a laugh at the annual Friends of *Golfdom* party at Walk-On's.

6 Quality control (Left to right) Jeff Rampino and Erica Cardenas of Quali-Pro give *Golfdom* Group Publisher Bill Roddy a tour of the QP booth.

7 The welcoming committee It was *Golfdom* Digital Editor Sydney Fischer's first GCSAA Conference and Trade Show. It isn't a complete trade show experience until you've hung out with Quali-Pro's Allan Fulcher (far left) and Paul Blodorn (right).

PHOTOS BY: *GOLFDOM* STAFF

Bunker

BY SETH JONES and CHRISTINA HERRICK

Want to get a rise out of someone in the golf maintenance industry? Start talking bunkers.

Discussing current trends in bunker maintenance, restoration and renovation with some of the best in the business

So much time, money, effort and artistry go into maintaining 18 holes of greens, tees and fairways. The same goes for bunkers, but add in a few more emotions, like angst, agony and maybe even anger.

"It's a topic of so much scrutiny, especially among the private course contingent," says Bryce Swanson, ASGCA, Rees Jones Inc. "When we were kids, if you got a fried-egg lie, you learned how to play the shot. Nowadays, the notion of having a fried egg? For everyone, that ship has sailed."

Golfdom interviewed architects and superintendents around the country to learn the most current buzz on bunker maintenance.

Reduction and relocation

Golfplan — Dale & Ramsey Golf Course Architecture has completed more than 200 courses around the world since 1972. David Dale, principal, says these last few years, Golfplan has seen a tremendous amount of bunker-focused work. It primarily falls into one of two categories, and sometimes both: reduction and relocation.

David Dale

Their project at Brookside CC in Northern California falls in line with this theme. When the course opened in 1991, it had 73 bunkers. Thanks to Golfplan's work, it now has 64, and they're smaller in size.

The course had 37 greenside bunkers with a combined square footage of 56,240 square feet. Now it has 32 greenside bunkers with a combined square footage of 27,300. That's only five fewer bunkers but a whopping 51-percent reduction in area. The courses' 36 fairway bunkers have been reduced to 32, while the total square footage dropped from 73,300 square feet to 46,285, a 37-percent reduction. The combined total area reduction is 44 percent.

"With (golf club) technology where it's at today, many of these bunkers were just out of position now," Dale says. "Plus, that's a lot of sand for the club to try to maintain."

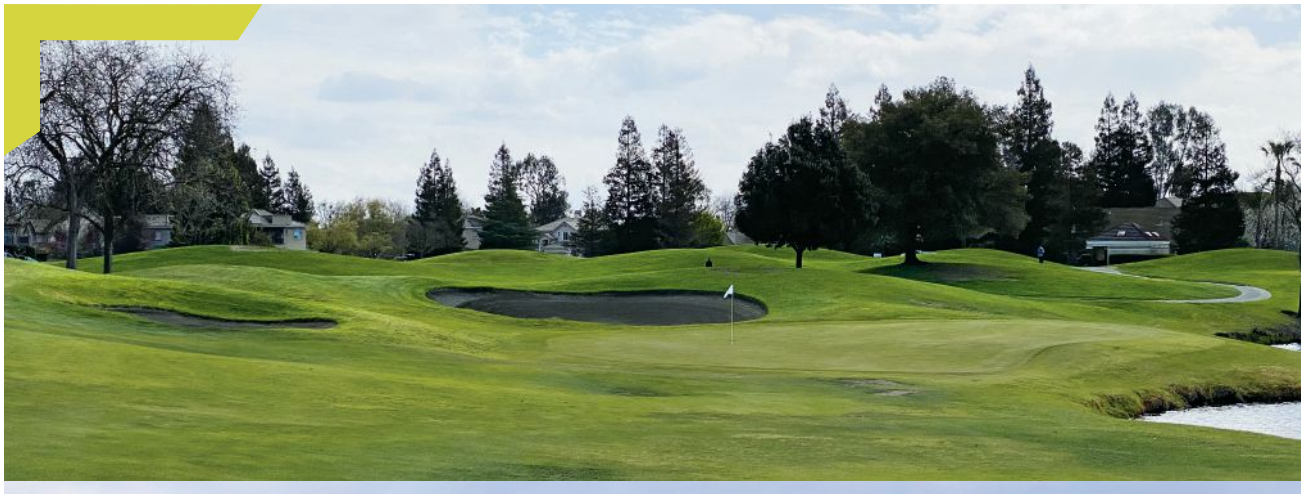
Dale adds that their international work was already heavy on bunker reductions, citing a course in Japan struggling with 130 bunkers. The reduction and relocation of bunkers brings a lot of work to Golfplan domestically, as well.

"It's good for business, but at the same time, it's really taxing on these clubs to try to come up with sand replacement every seven years, as that's about the typical life cycle of a bunker," he says. "You get sands that are contaminated, and they have to replace it — that's extremely expensive. It gets to the point that the club asks, 'What are we going to do? We can't afford this so frequently.' The logical thing is to reduce."

Ease of entering and exiting bunkers has also been a topic of discussion at the courses Golfplan works with. Dale welcomes this challenge because he says making bunkers easier to enter and exit is good for golfers as well as maintenance crews.

PHOTO BY: CATUNCIA / ISTOCK-GETTY IMAGES PLUS / GETTY IMAGES (HEADER)

Business



Brookside CC reduced its overall bunkers from 73 to 64 with a reduction in size, too. Architect David Dale says the reduction in bunkers combined for a total of 44 percent less square footage in bunkers.

PHOTOS BY: DAVID DALE

Sealed its fate

The West Course at Belleair CC, Florida's first golf course, recently underwent a full restoration to Donald Ross' original drawings, with plans to address the East Course in the next few years. Superintendent Andy Neiswender says he made a big push to address the course's bunkers with the renovation.

He says prior to the renovation, it could take up to 350 hours to get the East and West bunkers back into play. But the moment that sealed the bunkers' fate — literally — came in the form of a major rain event on the day of Belleair's member/guest tournament.

"We were in really good shape, and we

Continued on page 14

Many courses, like Brookside CC, are opting to remove bunkers to save on labor and materials, says architect David Dale.

Belleair CC during the West Course renovation. Belleair restored the course to the original Donald Ross design.

Continued from page 13

had a 2-inch rainfall the morning of the start of that event. It completely washed out the bunkers on both courses," he says. "We had no way of getting them playable before the event started, so the event had to play them as ground under repair."

He says the washout helped his membership understand the value of adding bunker liners.

"I explained to the membership, (we) spent almost the same amount of money per square foot on bunkers as we do on greens," he says.

With the renovation of the West Course, Neiswender says Fry/Straka Global Golf Course Design removed about 1,000 trees and moved around 220,000 cubic yards of material.

"When the members came out, there was nothing that looked anything like the old golf course," he says.

Located next to the Intercoastal Waterway in Clearwater, Neiswender says the course is prone to wind issues with incoming fronts, which can impact the new bunkers with severe slopes.

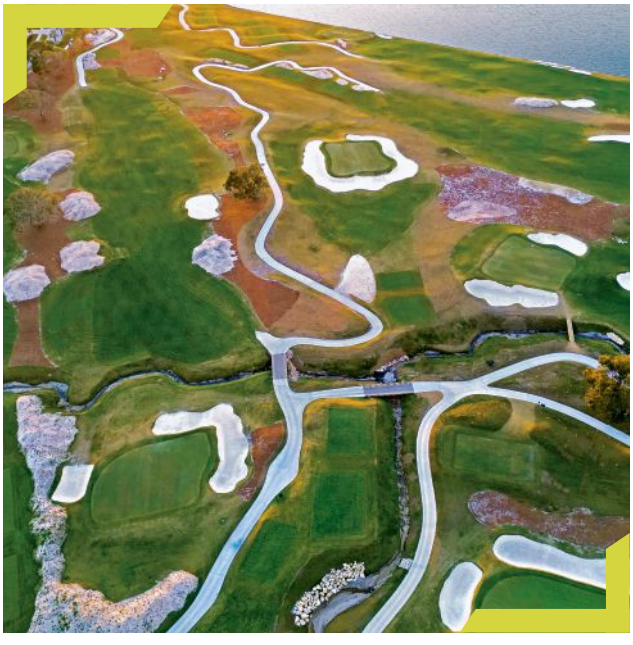
"On a windy day, some of these faces are so high that the wind dries them out and just carries the sand on, and we lose some of the sand on the faces," he says.

He says he's been impressed with how the course's Capillary Concrete liners helped mitigate issues from storms.

"We've had a couple of good rain events on them, and we've had very little issues with anything washing out," he says.

One interesting feature of the new design is the restoration of a moat bunker. Connor Lewis, founder of the Society of Golf Historians, lobbied the membership to keep the moat design.

"The members really can only access the back corner of the



Belleair CC's moat bunker is one of the original Donald Ross design elements restored with the West Course renovation.

green or they have to walk through the bunker," he says. "So, by about 9 in the morning, we have about 20 rakes all lined up on the front of the green where they've walked through the bunker with a rake and then left it on the front of the green."

Neiswender says the course plans to add a walkthrough like Ross added in his 1924 design revisions, although this time with

Continued on page 16

PHOTOS BY: DAVID DALE (TOP LEFT); BELLEAIR CC (RIGHT)

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Continued from page 14

Kafka granite, "so it still kind of looks like a bunker, but they can walk through it."

Sod bottoms

It's been a busy time for architect Tyler Rae, as his massive project at Lookout Mountain (Ga.) Club is about to open for the 2023 season. He hopes that the project garners national attention in the industry. There's also his ongoing work at Detroit Golf Club, home of the Rocket Mortgage Classic; a rerouting and reconstruction of Chicago's Northmoor CC and following the conclusion of the Principal Charity Classic, a multimillion-dollar project at Wakonda Club in Des Moines, Iowa, among others.

When it comes to bunker work, Rae has seen just about everything in his 18-year career. It would get monotonous, he says, to stick to one style. Even Donald Ross had six different styles of bunkers. Rae describes himself as an amphibian — able to adapt to any conditions.

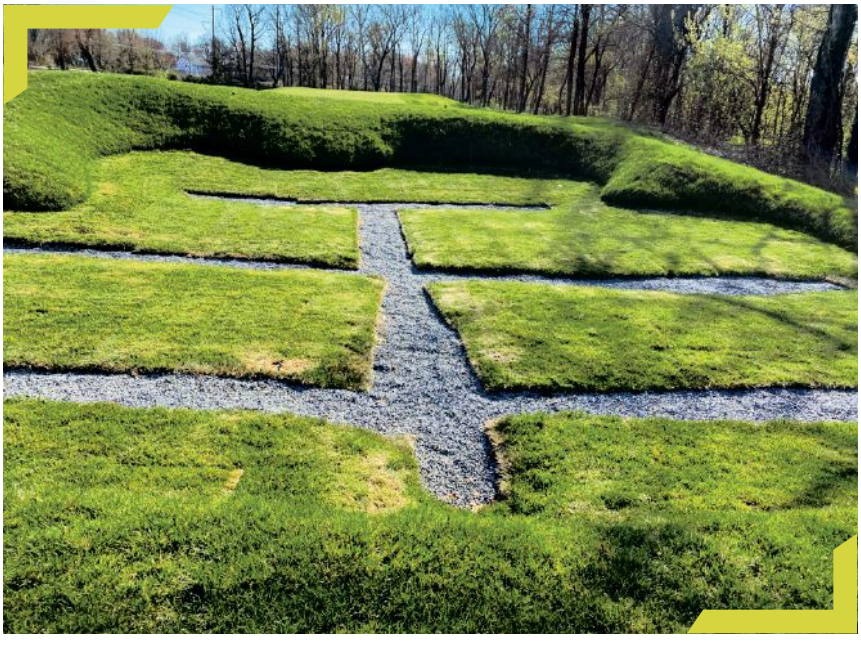
Tyler Rae

He also says he loves building different styles of bunkers from project to project depending on the location, soil makeup and typical weather patterns. That also applies to when a course wants to save a few dollars on any given aspect of a project.

Rae also points to an opportunity he's seen in the industry when design allows it: grass or sod liners in bunkers.

"If we're restoring a Donald Ross or a Seth Raynor (course) with bunkers that are primarily a bit flatter-bottomed without a big sand-flashed face, where the sand won't migrate after a heavy rain event, we're going to suggest the potential of grass liners," Rae says. "They keep the rocks, pebbles and drainage gravel from contaminating the sand. Once the sod knits in, it creates a seamless, carpet-like bottom. Beware though, if you have a high sand flash like Augusta National, this technique likely won't work."

A post-herbicide treatment of a sod bunker liner during the installation process. Sod knits in before crews apply the herbicide treatment.



Sod liners give bunkers extra life at a fraction of the cost of other bunker liners says architect Tyler Rae.

Rae says they lay the sod, let it knit in, mow it once, then spray it with glyphosate. He's seen these bunkers last 10 to 13 years, but at one-eighth of the cost. He says it was superintendents who created the idea, with Rich Shilling at Jeffersonville GC near Philadelphia being among the first, and Doug Larson at the Shore Club in New Jersey, Chris Donadio at Woodland GC near Boston and most recently John Ruzsbatzky, CGCS, at Wampanoag CC all seeing success.

Rae adds that there are several bunker liner technologies that he likes to employ

Continued on page 18

PHOTOS BY: TYLER RAE

THEY'RE SUCKING THE LIFE OUT OF YOUR ROOTS.

"

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Dr. Billy Crow
Landscape Nematologist, University of Florida

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THE SOURCE MATTERS

Continued from page 16

and has seen success with many of them.

He's recently added a new style to his own bunker repertoire. He describes it as having a 6- to 7-foot sand flash with a 20-inch lip. It creates dramatic shadowing in the afternoons.

"That might be my favorite style yet," Rae says. "The new liners allow us to be bold with our designs. It's exciting to see what other architects are designing, too. There's a lot of fantastic work right now from some talented architects."

A free drop and a refocus

The bunkers at Cottonwood Creek CC in Waco, Texas, are an anomaly. Built in 1984 and clocking almost 40 years in play, superintendent JD Franz says they're "consistently average."

Having almost 40-year-old bunkers comes with its challenges. Crews replace any crushed irrigation pipe and add sand. His steep slopes can get fried eggs. When Franz started at Cottonwood in 1997, the course planned to renovate the bunkers, but over the years, management pushed it to the back burner.

Crews mechanically rake the bunkers seven days a week. When the original management company installed the bunkers, the installation started with a small layer of cement and sand on top. And when sand, cement and water from rain mix, it makes concrete.

"For the first 10 years, every day you would have a 5-gallon bucket on the Sand Pro filled with concrete chunks," he says.

Cottonwood sits on alkaline soil. Bunkers in clay soils often get what Franz says his former boss called "a soup dish," but he speculates the concrete may keep that from happening at Cottonwood so far.

"I'd say the concrete's probably half there, but it could be that's why they haven't silted over at the same time," he says.

Pace of play is a huge concern at Cottonwood. Franz estimates golfers played around 45,000 rounds last year, so he says it's important to toe the line with bunkers.

"We don't want to raise the heights so much that they have a hard time," he says. "But at the end of the day, it is a hazard."

Franz says bunkers require so much labor, especially after rain. He's changed his strategies following rain events to deploy one crew member with a pump and one following with a mechanical rake.

"I just sent two people all day for 8 to 10 hours, and they'll be done in two days," he says. "With half an inch of rain, I used to go out there and send a guy to pump it. Now I tell (the golfer), to take a free drop for a

day. There's going to be a little water in the bottom, and then they'll be dry tomorrow."

He says this allowed him to focus on the whole course instead of devoting so much time to bunkers.

"The whole entire golf course is maintained better now, not just the bunkers," he says. "We're stretched too thin to be putting half the crew on the bunkers."

What they say, what they want

The team at Rees Jones Inc., of Rees Jones, Greg Muirhead, Steve Weisser and Swanson combined for nearly 150 years of experience in golf course design, construction and project management. Jones is happy to report that business is good, with projects on tap around the world and a recent spike in demand in southern Florida.

He adds with a laugh, "that only happens when you're good."

Swanson spoke with *Golfdom* about the wishes of Rees Jones' clients. He says bunkers are perhaps the most heavily scrutinized topic of any restoration or renovation because opinions still differ on what a bunker should be.

"People think that if you hit into a bunker, no matter what, you ought to be able to hit onto the green," Swanson says. "Go over to Scotland. In some of those bunkers, you have to play out sideways. It's not perfect. And some people say they kind of want that ... but at the same time they're saying the opposite."

Swanson echoes what others said: the number of bunkers is trending downward.

"In the early 2000s, it wasn't unheard of to see maybe 200,000 square feet of bunkers going into places," he says. "In the 1990s, the 2000s, everything was tied to selling real estate."

With many courses putting a focus on sustainability, Swanson says this has an end benefit to the golfer.

"There's more emphasis on finding balance in terms of playability and giving players an opportunity for a recovery shot," he says.

Education and communication are key, he says. Whether a course wants a look like something they'd see at Augusta or in Australia, he communicates what that means for the golfer and the superintendent.

"There's quite a bit of my time where I'm working with the superintendent and how these bunkers relate to the maintenance side of (the project)," he says. "Then there's getting members to understand what it's going to do on the back end as it relates to maintenance. If they want a sand flash all the way to the top, well, let's discuss the pros and cons."

"The mechanic fabricated a bracket to hold a 3-gallon gas can on one side, and you hung your lunch on the opposite side. You left the shop in the morning and returned at quitting time."

MATT SHAFFER, *director of golf course operations emeritus Merion Golf Club, Ardmore, Pa.*

Looking backward to move forward

The labor market is tight, supply chain issues are real and the cost of goods is skyrocketing! What is a superintendent supposed to do if these trends continue?

Sometimes, looking back at how the industry has changed may provide some solutions moving forward. I thought it would be interesting for you all to understand where the industry was 49 years ago and how it has changed since.

In 1974, at the ripe old age of 21, I graduated from college, got married and became a golf course superintendent. I had been an assistant for two seasons at two clubs and figured I'd jump right in at a club called Meadia Heights Golf Club in Lancaster, Pa. The club's claim to fame was that it was where Jim Furyk started his career.

Lower tech

Meadia Heights was a small operation by today's standards. We had an assistant, a mechanic, six additional employees and me. We triplexed greens and used a nine-unit pull gang for fairways and a five-gang for the rough. My wife cut both. She was an exceptional tractor operator; she knew how to use posi-lock and steering. She never had a spin or scuff, and her fairway edges were far superior to the edges of a triplex today.

We trimmed under the trees with a Jacobsen walking rotary (these mowers were nearly bulletproof). The mechanic fabricated a bracket to hold a 3-gallon gas can on one side, and you hung your lunch on the opposite side. You left the shop in the morning and returned at quitting time.

We sprayed some harsh chemistries, but we sprayed far less. We boom-sprayed greens with an old Cushman Truckster and a Thuron boom sprayer. We sprayed fairways with a pull-behind 400-gallon sprayer, a 20-foot boom manually lifted, and the only control was on/off. We clipped a chain to the end of the boom to leave a scuff mark so we knew where to start the return pass. Weeds were the primary target. Disease was seldom a problem because we seldom watered fairways.

Bunkers were edged and weeded by hand, and, of course, being an equipment junkie all my life, I owned one of the first riding bunker rakes called a Groomer. It had a manual lift rake, three speeds plus a reverse shifter behind your back and a Wisconsin Robin engine. We were blown away by how fast we could rake bunkers.

Manual labor

When I first started, we cut greens with 321 Jacobsen fixed-head mowers set at 3/16th of an inch on greens and Jacobsen estate mowers for tees. We cut approaches with fairway mowers and collars with a 321, set at a quarter inch.

National triplexes with manually lifted heads cut green and tee banks. Heck, we had some Ryan aerators that you manually lifted the aeration tines. I struggled with these when I was an assistant at Shawnee on the Delaware, and our superintendent Bill Templeton would yell to us, "I'll make men out of you boys yet!"

While we are on the subject of aeration, we had old topdressers that would nearly run over you hourly as you walked them backward. When you engaged them, they would leap forward! If you had a slow reaction time, this was a very bad machine for you to operate.

Our tools were more fundamental, but our golf courses were so much fun to play because it was more about playability and less of a beauty contest.

In my next column, let's talk about how those philosophies have changed as a result of innovation.

I encourage interaction, so please ask me questions. Most of you know it is nearly impossible to hurt my feelings, so bring on all criticism and believe me, I'll make it easy for you.

Matt Shaffer, a longtime superintendent, is the owner of Minimalistic Agronomic Techniques (M.A.T.) He was previously the superintendent at The Country Club in Cleveland and is director of golf course operations emeritus at Merion GC, Ardmore, Pa., where he hosted the 2013 U.S. Open. Reach him at matthewgshaffer@gmail.com.

Hosted by Mike Kenna, Ph.D. | *mpkenna@gmail.com*

Super Science

// **RISE OF THE MACHINES**

A BETTER WAY TO OPTIMIZE NITROGEN APPLICATIONS ON BENTGRASS GREENS

By Mike Kenna, Ph.D.

Doug Soldat, Ph.D., and his doctoral graduate student Qiyu Zhou suggest that relying on temperature alone — in models such as the PACE Turf Growth Potential (GP) model — to estimate turfgrass growth rate is inaccurate.

Using several machine-learning random forest (ML-RF) models — based on factors including weather data, management practices and soil — the duo says it predicted turfgrass clipping removal more accurately than the PACE model.

The objectives of their research were to:

❶ Investigate the combined effect of management practices, weather and soil characteristics on creeping bentgrass response;

❷ Develop a machine learning growth model for creeping bentgrass that can accurately estimate a short-term turfgrass growth rate; and

❸ Test the feasibility of using the developed ML-RF prediction model to improve nitrogen management.

They conducted a two-year experiment on creeping bentgrass growth response and corresponding N fertilizer usage to the ML-RF model-based N-fertilization plan and other commonly used N-fertilization strategies.

Soldat and Zhou found that temperature, relative humidity and evapotranspiration were the key weather factors for estimating bentgrass growth. Foot traffic, nitrogen rate and soil moisture were weakly correlated with bentgrass growth, although the ML-RF model's accuracy substantially increased with those variables included.

A study using the ML-RF model over two years on two different root zones found the model resulted in acceptable turfgrass performance with about 50 percent less N fertilizer usage than the method that recommended the most N fertilizer and about 30 percent less fertilizer than the traditional way that superintendents schedule N applications.

The model is, however, only effective for its original testing location, suggesting that individual golf courses must develop customized growth prediction models to manage nitrogen accurately. To do this, a superintendent can collect and record clipping volume for at least one year. G

For more information

Soldat, D., and Q. Zhou. 2021. Building a better growth model to optimize nitrogen applications to bentgrass putting greens. USGA Turfgrass Environ. Res. Summ. p. 82-87.

This project was funded in part by the USGA Green Section.

NEWS UPDATES

NUFARM HIRES NEW US GOLF SEGMENT LEAD

Nufarm added Jeff Eldridge, CGCS, as its new U.S. golf segment lead. Eldridge is a former director of agronomy at The Clubs of Cordillera Ranch, golf course and grounds manager at Lake Quivira Country Club and superintendent for The Nicklaus Club at Lions Gate.

"Jeff's experience in the golf industry and business background will bring fresh ideas and enthusiasm to our golf segment as we enter into a busy period of new product launches at Nufarm over the next few years," said Blaine Pinkerton, vice president of turf and ornamental sales in the U.S. for Nufarm.

Jeff Eldridge

Eldridge will help launch several solutions, including Anuew EZ plant growth regulator, Tourney EZ fungicide and Allstar herbicide.

"With a current innovative portfolio of solutions and pipeline for new technologies coupled with Nufarm's global relationships for developing technologies, I will be well positioned to support superintendents across the country to meet and exceed the expectations of their members," said Eldridge.

"SOLVITA SOIL TESTS SHOULD BE ABLE TO ESTIMATE THE MINERALIZATION POTENTIAL OF TURFGRASS SOILS."

Karl Guillard, Ph.D., Brendan Noons, M.S., and John Inguagiato, Ph.D.

(see story on page 22)

//WHAT'S GROWING ON

New soil tests examine fairway responsiveness to nitrogen fertilization

By Karl Guillard, Ph.D., Brendan Noons, M.S., and John Inguagiato, Ph.D.

The ability to predict the nitrogen (N) mineralization potential of any turfgrass site and its expected response to N fertilization would be a valuable tool in nutrient management. Turfgrass soils often accumulate organic matter over time, increasing their mineralization potential. However, assessing this potential is not routine due to the lack of mineralization tests offered by many labs, the cost of the tests and the long-term requirements (weeks to months) of these tests for reliable results.

USGA Davis
Research provided and funded by USGA.

Solvita and Woods End Laboratories offer two tests recently developed to rapidly measure the biologically-active carbon (C) and N fractions in soil organic matter: the soil CO_2-burst (CO2B) and soil labile amino nitrogen (SLAN) test kits.

These tests measure labile C and N fractions correlated to soil microbial activity. Therefore, the Solvita soil tests should be able to estimate the mineralization potential of turfgrass soils. An estimate of the mineralization potential should help guide N fertilization.

The objectives of this research were:

TABLE 1

Mean Solvita soil test concentrations and bentgrass quality and growth responses, with analysis of variance *P* values (2021 results).

	SLAN	CO2B	NDVI	Visual Quality	Visual Color	Visual Density	DIA† Cover	DIA DGCI	Sum Clipping yield
Traffic	mg kg^{-1}	mg kg^{-1}		1-9; 9 best			Percent green		g m^{-2}
No	247.3	119.7	0.677	6.3	6.7	6.5	89.5	0.495	43.4
Yes	243.3	121.2	0.667	5.9	6.1	6.0	82.3	0.471	30.5
Treatment									
0	216.7*	99.9	0.638*	4.5*	4.7*	4.7*	73.0*	0.447*	25.0*
0.25	230.8	107.8	0.645*	4.6*	5.1*	4.8*	77.1*	0.454*	28.6*
0.50	232.9	111.4	0.657*	5.4*	5.6*	5.6*	82.8*	0.468*	30.6
0.75	237.9	119.9*	0.667	5.9	6.3	6.2	87.7	0.486	34.6
1.00	245.9	120.7*	0.673	6.1	6.4	6.1	84.2	0.479	29.6*
1.25	245.9	124.2*	0.673	6.4	6.6	6.5	87.8	0.489	39.4
1.50	253.6*	131.3*	0.684*	6.6	7.0	6.9	90.2	0.499	42.2
1.75	258.8*	129.6*	0.686*	6.9	7.0	6.9	91.1	0.499	41.0
2.00	265.1*	134.2*	0.693*	7.3*	7.4*	7.3*	90.6	0.501	44.1
2.25	272.2*	140.1*	0.703*	7.4*	7.5*	7.2*	92.6	0.508*	52.2*
Standard	238.6	106.2	0.670	6.3	6.7	6.5	88.2	0.486	38.9
AOV p-values									
Traffic	0.2258	0.3939	0.0230	0.0017	0.0287	0.0078	0.0463	0.0266	0.0178
Treatment	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
T × T	<.0001	0.0072	0.4647	0.3234	0.7027	0.4346	0.2400	0.7615	0.0449

* Significantly different from the Standard treatment ($P < 0.05$)
† DIA, Digital Image Analysis
‡ Compost and organic fertilizer rates of available N (lbs. per 1,000 ft²); Standard treatment is liquid urea at 0.2 lbs. N per 1,000 ft² every 21 days.

TABLE 2

Correlation coefficients (*r*) and *P* values for no-traffic and traffic plot responses in relation to SLAN and CO2B concentrations, and *P* values for the difference between traffic treatment r values for each variable. 2021 results.

SLAN	No-Traffic		Traffic		
Variable	*r* value	*P* value for *r*=0	*r* value	*P* value for *r*=0	*P* value for difference between traffic treatments *r* values
NDVI	0.892	<.0001	0.894	<.0001	0.9744
DGCI	0.787	<.0001	0.838	<.0001	0.5595
Quality	0.833	<.0001	0.897	<.0001	0.3144
Color	0.791	<.0001	0.904	<.0001	0.1039
Density	0.794	<.0001	0.877	<.0001	0.2773
Cover	0.754	<.0001	0.809	<.0001	0.5849
Yield	0.755	<.0001	0.727	<.0001	0.8043
CO2B	**No-Traffic**		**Traffic**		
Variable	*r* value	*P* value for *r*=0	*r* value	*P* value for *r*=0	*P* value for difference between traffic treatments *r* values
NDVI	0.838	<.0001	0.876	<.0001	0.5788
DGCI	0.708	<.0001	0.859	<.0001	0.1148
Quality	0.730	<.0001	0.880	<.0001	0.0835
Color	0.704	<.0001	0.873	<.0001	0.0680
Density	0.687	<.0001	0.914	<.0001	0.0059
Cover	0.697	<.0001	0.811	<.0001	0.2979
Yield	0.620	0.0001	0.750	<.0001	0.3366

1) determine if there is a correlation between CO2B and SLAN tests and fairway creeping bentgrass quality and growth responses, and 2) if test results correlate to bentgrass fairway turf responses, then categorize the responsiveness to N fertilization as a function of Solvita soil test results with standard fertilizer treatment.

METHODS

In August 2017, we initiated the study site located in Storrs, Conn. We designed the experiment as a split-block design with traffic (yes or no) as the horizontal factor and compost (10 rates, in 0.25-lb. increments from 0 to 2.25 lbs. N per 1,000 ft^2) as the vertical factor with three replicates.

We incorporated compost into the 0 to 4-inch soil profile by rototilling before seeding. After compost incorporation, we seeded creeping bentgrass ('13M') into the study site and managed it as a fairway. During the bentgrass grow-in period during the late fall of 2017, we applied an organic fertilizer (Sustâne All Natural 5-2-4) to the plots at the same N rates as the initial incorporated compost rates.

In addition to the organic treatments, we applied a standard fertilizer regime treatment with 0.2 to 0.25 pounds N per 1,000 ft^{-2} approximately every 21 days as liquid urea. The fall of 2017 was an establishment period. The treatments and data collection implementation commenced in 2018 and continued in 2019, 2020, and 2021 with fall applications of Sustâne organic fertilizer.

In 2021, we used a cart-traffic simulator to replicate traffic three times a week during the growing season. We collected bentgrass response measurements (NDVI, percent green cover, dark green color index [DGCI], visual quality, visual color and visual density) and soil samples monthly from May through November from each plot. We also collected clipping yield monthly from June through November for each plot. Using the Solvita CO2B and SLAN tests, we analyzed soil samples.

We statistically analyzed data using analysis of variance to determine treatment effects (fertilizer rates, traffic and the fertilizer rate multiplied by traffic interaction) on the mean bentgrass quality and growth responses and soil CO2B and SLAN concentrations. We correlated mean fairway bentgrass responses to mean SLAN and CO2B concentrations within and across traffic treatments. We applied binary logistic regression to determine the probability of bentgrass fairway responses from the compost-organic fertilizer plots that would equal or exceed the responses from the

Continued on page 24

TABLE 3

Concentrations of Solvita soil labile amino-nitrogen (SLAN) and soil CO_2-burst (CO2B) concentrations of equaling or exceeding the response of the standard fertilizer treatment at a selected probability of *P* = 0.67. 2021 results.

P = 0.67	SLAN, mg kg^{-1}	
Variable	**No-Traffic**	**Traffic**
NDVI	255	254
DGCI	267	258
Visual Quality	248	243
Visual Color	252	249
Visual Density	255	242
Percent Green Cover	267	266
Clipping Yields	279	252
Mean	**260**	**252**
P = 0.67	CO2B, mg L^{-1}	
Variable	**No-Traffic**	**Traffic**
NDVI	127	137
DGCI	134	154
Visual Quality	123	123
Visual Color	125	127
Visual Density	129	121
Percent Green Cover	146	153
Clipping Yields	137	130
Mean	**131**	**133**

Continued from page 23

standard N fertilization plots across the Solvita soil test values for each of the traffic treatments.

2021 RESULTS

Traffic effects were significant for NDVI, visual quality, color and density, percent green cover, DGCI and clipping yields (Table 1). Across these variables, the no-traffic treatment yield was significantly greater than trafficked plots. Fertilizer treatment effects were highly significant for all variables (Table 1). Averaged across traffic treatments, all responses were linear and significant in relation to fertilizer N rate ($P < 0.001$, data not shown).

Compared with the standard treatment, concentrations of SLAN were significantly lower at the non-fertilized 0 pounds N per 1,000 ft^2 rate but significantly greater once the N rate reached ≥ 1.5 lbs. N per 1,000 ft^2 from compost-organic fertilizer (Table 1).

Concentrations of CO2B were not significantly different from the standard at the non-fertilized 0 to 0.5 lbs. N per 1,000 ft^2 compost-organic fertilizer rates but significantly greater than the standard treatment once the compost-organic fertilizer N rates reached ≥ 0.75 lbs. N per 1,000 ft^2 (Table 1).

NDVI was significantly less than the standard treatment at 0 and 0.5 lbs. N per 1,000 ft^2 compost-organic fertilizer rates but were significantly greater than the standard treatment once the compost-organic fertilizer N rates reached ≥ 1.5 lbs. N per 1,000 ft^2. Response of DGCI from the standard treatment was greater than 0 and 0.5 lbs. N per 1,000 ft^2 compost-organic fertilizer treatments but was significantly lower than the highest compost-organic fertilizer rate of 2.25 lbs. N per 1,000 ft^2 (Table 1)

Visual quality, color and density ratings were significantly lower than the standard treatments from compost-organic fertilizer rates of 0 to 0.5 lbs. N per 1,000 ft^2 but were significantly higher at the highest compost-organic fertilizer rates of 2 and 2.25 lbs. N per 1,000 ft^2 (Table 1).

The percent green cover of the standard treatment was significantly greater than the 0 to 0.5 lbs. N per 1,000 ft^2 compost-organic fertilizer treatments but not different from compost-organic fertilizer rates ≥ 0.75 lbs. N per 1,000 ft^2. The 0, 0.25, and 1 lb. N per 1,000 ft^2 compost-organic fertilizer rates were significantly lower than the standard treatment for clippings yield. In contrast, the compost-organic fertilizer 2.25 lbs. N per 1,000 ft^2 rate produced significantly greater clipping yields than the standard treatment (Table 1).

Correlations between fairway bentgrass compost-organic fertilizer responses in relation to SLAN and CO2B concentrations were highly significant with high r values across the traffic treatments (SLAN $r = 0.727$ to 0.904; CO2B $r = 0.620$ to 0.914) (Table 2). There was no significant difference in r values between traffic and non-traffic treatments for SLAN concentrations and from all but one variable (visual density) for CO2B (Table 2).

Since there were strong correlations between Solvita soil test concentrations and fairway creeping bentgrass responses, binary logistic regression was applied to determine the probability

of compost-organic fertilizer plot responses that were equal to or greater than the response of the standard fertilizer treatment with respect to the SLAN and CO2B concentrations. We show probability curves in Figures 1 and 2 for traffic and no-traffic plots.

The probability curve of SLAN concentrations for all variables in both no-traffic and traffic treatments was modeled relatively well. When we combined all variables, there would be a ≥ 67 percent chance that fairway bentgrass responses would equal or exceed the responses of the standard fertilizer treatment when SLAN concentrations were ≥ 260 and ≥ 252 mg kg^{-1} for non-trafficked and trafficked plots, respectively (Table 3).

The probability curves for CO2B concentrations for all variables in both no-traffic and traffic treatments were modeled relatively well. When we combined all variables, there would be a ≥ 67 percent chance that fairway bentgrass responses would equal or exceed the responses of the standard fertilizer treatment when SLAN concentrations were ≥ 131 and ≥ 133 mg kg^{-1} for non-trafficked and trafficked plots, respectively (Table 3).

FUTURE EXPECTATIONS

With each year of treatment imposition, we observe better correlations and model fits of the data. We attribute this to more mineralization of the compost and organic fertilizer additions. The data suggest the production of reliable tables of SLAN and CO2B concentrations and associated probabilities of responses equal to or exceeding the response of the standard fertilizer treatment of 0.2 to 0.25 lbs. N 1,000 ft-2 applied approximately every 21 days for our soils and climate conditions. This could assist the superintendent in guiding fertilization based on their risk tolerance (See example in Tables 4 and 5 and Figure 3).

The goal of using the Solvita tests to guide N fertilization for turfgrasses would be to recommend a specific amount of N needed for the optimum response for any specific SLAN or CO2B concentration. Following the concepts presented in Tables 4 and 5 and Figure 3, we could suggest fairway creeping bentgrass soils with:

- SLAN or CO2B concentrations that fall below the $P = 0.33$ cutoff receive the full recommended N rate,
- SLAN or CO2B concentrations that fall between the $P = 0.33$ and the $P = 0.67$ cutoffs receive ⅔ to ½ of the

Continued on page 26

TABLE 4

Recommended N rate based on SLAN concentrations and the probability of those concentrations equaling or exceeding the response of the standard N treatment across both traffic treatments for all variables combined using logistic regression output for 2021.

Apply (1 – P) × Standard rate of N Example: Standard N rate = 0.2 pounds N/1,000 ft² approx. every 21 days		
SLAN, mg kg^{-1} soil	Probability	Suggested rate of N to apply
≤ 50	0.000	0.20
100	0.000	0.20
150	0.005	0.20
200	0.082	0.18
250	0.594	0.08
300	0.960	0.01
≥ 350	0.997	0.00

TABLE 5

Recommended N rate based on CO2B concentrations and the probability of those concentrations equaling or exceeding the response of the standard N treatment across both traffic treatments for all variables combined using logistic regression output for 2021.

Apply (1 – P) × Standard rate of N Example: Standard N rate = 0.2 pounds N/1,000 ft² approx. every 21 days		
CO2B, mg L^{-1}	Probability	Suggested rate of N to apply
≤ 50	0.015	0.20
75	0.063	0.19
100	0.232	0.15
125	0.573	0.09
150	0.857	0.03
175	0.964	0.01
200	0.992	0.00
225	0.998	0.00
≥ 250	1.000	0.00

Continued from page 25

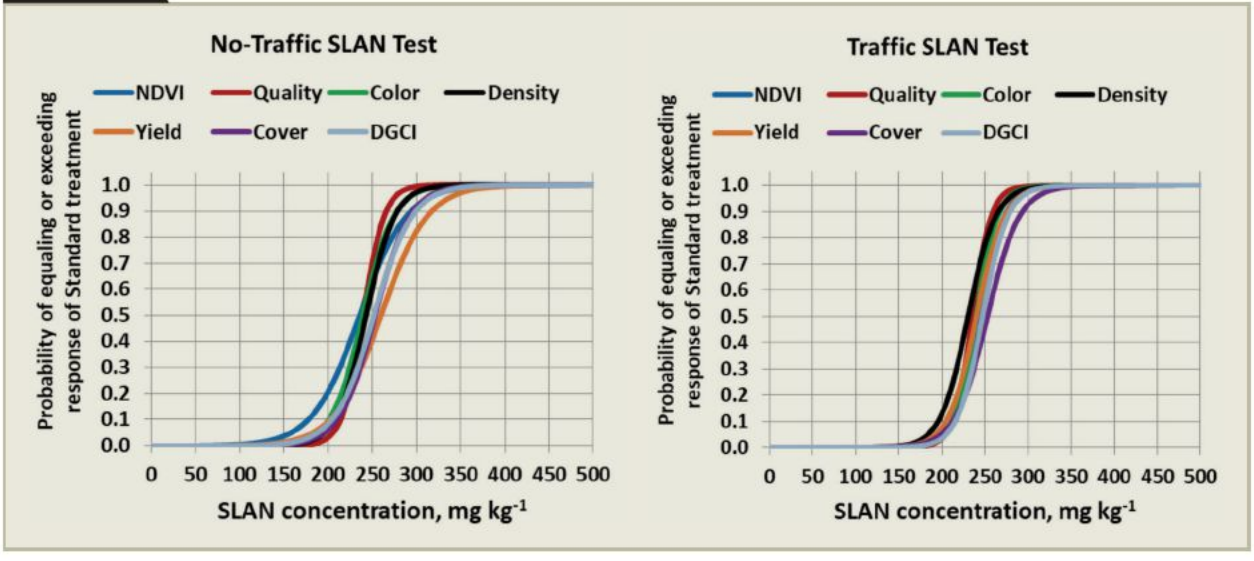
recommended N rate,

- SLAN or CO2B concentrations that fall between the $P = 0.67$ and the $P = 0.90$ cutoffs receive ½ to ⅓ of the recommended N rate, and
- SLAN or CO2B concentrations above the $P = 0.90$ cutoff receive little to no additional N fertilization.

The example above would assume that optimum conditions for mineralization would be present across the growing season. Another approach to using the P values to guide N fertilization is for superintendents to apply $(1 - P) \times$ the full rate of N fertilization, where P is the probability of equaling or exceeding the standard fertilizer treatment response based on the SLAN or CO2B concentration (See example presented in Tables 4 and 5).

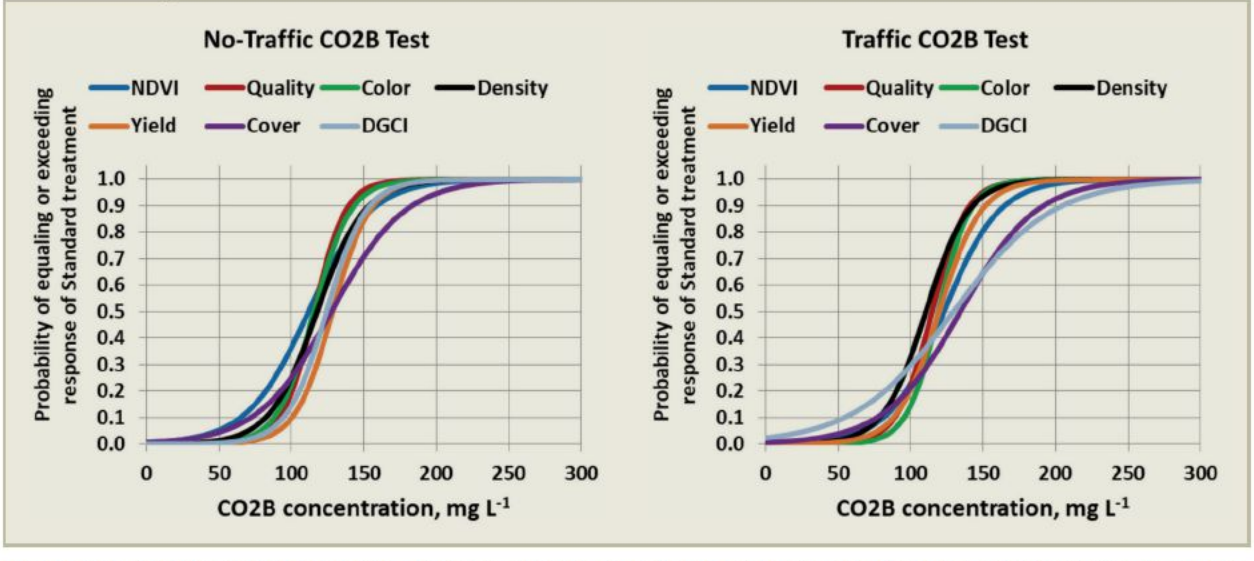
The results from 2021 suggest that the Solvita soil test results correlate well to fairway creeping bentgrass

FIGURE 1



Compost-organic fertilizer probability curves of equaling or exceeding the NDVI, DGCI, visual color, visual color, visual density, percent green cover, and clippings yield response of the standard fertilizer treatment (approximately 0.2 lbs N per 1,000 ft² every 21 days) relative to the Solvita SLAN concentrations for the no-traffic and traffic plots (2021 results pooled across all sampling dates).

FIGURE 2



Compost-organic fertilizer probability curves of equaling or exceeding the NDVI, DGCI, visual color, visual color, visual density, percent green cover, and clippings yield response of the standard fertilizer treatment (approximately 0.2 lbs N per 1,000 ft² every 21 days) in relation to the Solvita CO2B concentrations for the no-traffic and traffic plots (2021 results pooled across all sampling dates).

Research Takeaways

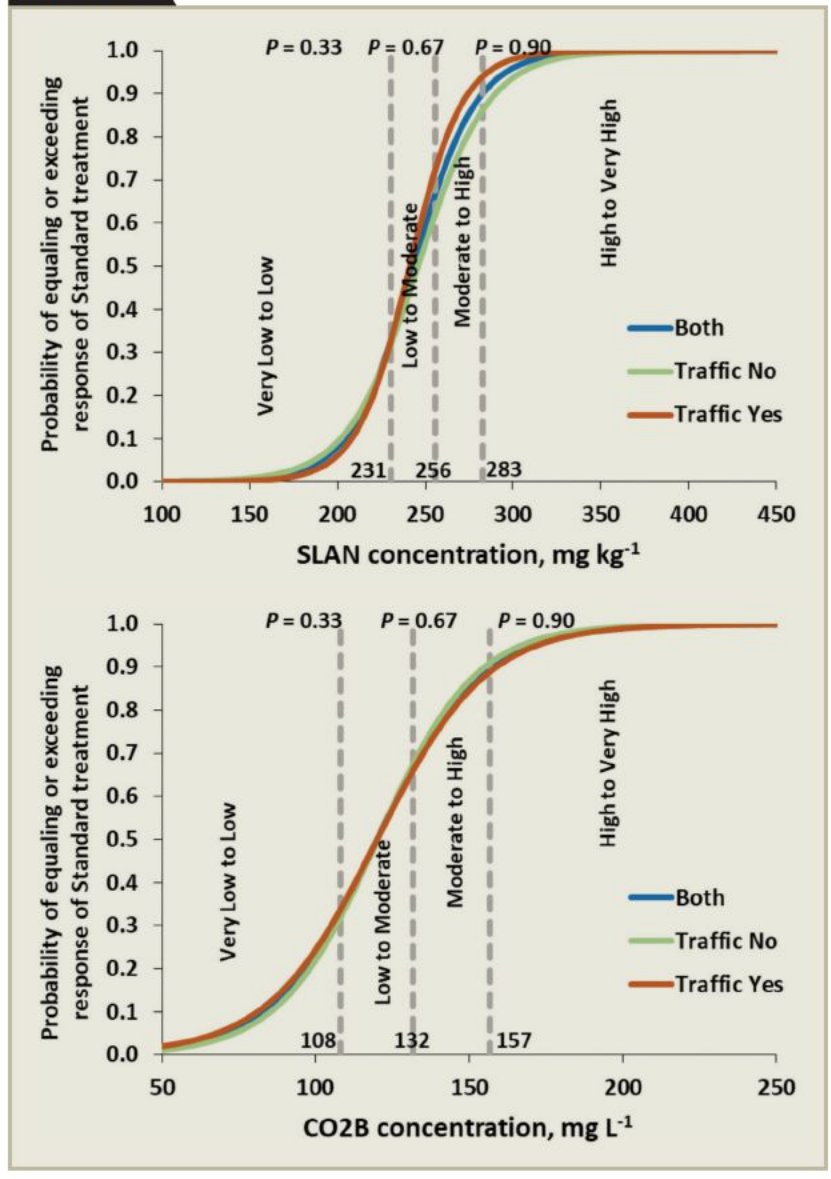
- Compost and organic fertilizer rates have produced a wide range of the soil CO_2-burst (CO2B) and soil labile amino nitrogen (SLAN) test concentrations in fairway creeping bentgrass plots.
- SLAN and CO2B test concentrations respond linearly to compost and organic fertilizer rates.
- Fairway creeping bentgrass growth and quality responses strongly correlate to SLAN and CO2B test concentrations.
- For most variables, trend responses across compost and organic fertilizer rates were generally similar between trafficked and non-trafficked plots.
- Binary logistic regression generated curves to estimate the probability that compost and organic fertilizer rate responses would equal or exceed that of the standard fertilizer treatment.
- The CO2B test produced better binary logistic regression model fits than the SLAN test.
- The CO2B and SLAN tests show potential for estimating the mineralization potential of fairway creeping bentgrass soils.
- The 2021 results suggest the potential categorization of fairway creeping bentgrass soils with Solvita tests as to their probability of equaling or exceeding the response of a standard N treatment.
- The Solvita SLAN and CO2B tests have the potential to guide N fertilization of creeping bentgrass fairways.

responses. We have had three years of consistently strong data to show the potential of these new tests in predicting fairway mineralization and use in guiding N fertilization.

Suppose this holds across different years, soils, and climates. In that case, golf course superintendents will have new tools to easily and quickly assess the mineralization potential of any fairway on their course. These tests will be site-specific and give the superintendent objective guidance for N fertilization.

The value of using the Solvita soil tests also would be seen in fairway areas where mineralization potential is low, and where they could benefit from an optimal N fertilizer rate. An additional advantage of the Solvita soil tests is that they could be conducted on-site by the superintendent with a full test kit, if desired, without the need to send samples to a laboratory.

FIGURE 3



Compost-organic fertilizer probability curve representing all variables combined for both traffic treatments and categories of fairway creeping bentgrass responses that would be equal to or greater than the responses obtained from the standard fertilizer treatment in relation to Solvita SLAN and CO2B concentrations. The gray vertical lines indicate *P* values of 0.33, 0.67, and 0.90 obtained from the equations used for values in Tables 4 and 5 (2021 results).

Author Karl Guillard, Ph.D., is a professor emeritus of agronomy and teaching fellow at the University of Connecticut; Brendan Noons is a former graduate student of the University of Connecticut; and John Inguagiato is an associate professor of turfgrass pathology at the University of Connecticut For additional information, contact Guillard at karl.guillard@uconn.edu.

Acknowledgments

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Additional reading

Guillard, Karl; Inguagiato, John C.; Noon, Brendan G. 2022. New soil tests to guide nitrogen fertilization. *USGA Green Section Record*. May 6. 60(8): p. [1-12].

There's a thin line between an acceptable amount of thatch and a potentially damaging amount, according to experts.

Why thatch control is critical to turfgrass health

Experts discuss the impact of thatch control on fairways and greens

By Chris Lewis

Although a marginal amount of thatch is acceptable on fairways — and even beneficial at times — experts say if superintendents notice more than half an inch of organic matter, it may present serious issues in the future. If fairways have excess thatch growth, most of the turfgrass' root system may be in the thatch itself, rather than in the soil.

"This results in stress on the turfgrass, which can lead to susceptibility to environmental stress, and nutritional imbalances," says Nick Christians, Ph.D., professor in the department of horticulture at Iowa State University.

Nick Christians

Christians says aside from potential environmental stress and nutritional imbalances, excess thatch on fairways can also trigger turfgrass disease, resulting in long-term damage.

"There's no question about it," he says. "By reducing excess thatch build-up — or even preventing it, preferably — superintendents will notice many short- and long-term positive effects concerning their fairways' plant health."

In addition to fairways, superintendents must also focus on greens, as they're especially prone to thatch development. Christians says he's seen virtually every impact thatch can have on turfgrass through his decades-long career. But, as an example of its influence on greens, some of the worst cases of *Pythium* blight he encounters are on greens that have an inch or more of thatch.

To help reduce the likelihood of thatch overgrowth, superintendents must implement adequate green management practices, including a program that prevents thatch accumulation.

"Avoid excess nitrogen and irrigation," he says. "After all, thatch is generally the result of overmanagement, leading to an environment that's ideal for overgrowth."

Christians says reel mowers with a poor quality of cut can negatively impact fairways with excess thatch, especially those with creeping bentgrass and bermudagrass.

"Reel mowers can bounce and dig into the turf during mowing, causing a condition known as washboarding in areas with excess thatch layers," he says. "Up-to-date mowers with sharp blades can help minimize this condition, but, above all else, superintendents must diminish their excess thatch layers."

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Dryject

JOHN PADDOCK
Owner and president

Superintendents' inputs highly influence the rate at which thatch accumulates. They should only apply enough fertility and water to produce a uniform, healthy playing surface, as excessive inputs will magnify thatch accumulation. Superintendents can manipulate thatch levels by encouraging healthy biological activity (decay) while incorporating the native soil back into the thatch's top portion via core aeration and dragging. Topdressing or injection with a blended soil/sand mix — or with sand alone — are other options superintendents should consider. By incorporating these materials, superintendents can create a "hybrid thatch" or mat, which firms it up and encourages robust microbial activity and decay. By regularly incorporating a desirable soil medium, superintendents will also provide a necessary dilution to this organic matter.

Redexim North America

PAUL HOLLIS
Executive vice president

Excess thatch is due to beneficial microbial activity's absence, along with improper fertilizer and topdressing applications or watering. If the layer of organic material isn't controlled, it can affect the water and nutrient absorption into the soil profile while also impacting a fairway's firmness and playability. Thatch control via mechanical means, such as aeration or verticutting, will help manage excess thatch. By performing these practices, superintendents will control organic matter, relieve soil compaction, stimulate root growth and improve drainage. Verticutting helps remove thatch buildup, enabling turf to effectively absorb fertilizers and nutrients. Verticutting positively impacts putting surfaces' smoothness as it thins any tufted growth. If superintendents apply fertilizers and topdressing in a controlled manner, they'll further increase their greens' smoothness.

John Deere

JONATHAN GLADIS
System solution specialist

By maintaining a healthy layer of thatch, superintendents will notice various benefits on fairways and greens, including a decline in insect and disease pressure. Whenever there is excess thatch between the soil and the plant, pests will have an environment where they can thrive. The next benefit they'll see is easier and more reliable moisture management. Turf plants' roots will not only grow into the soil but also work their way into the thatch layer, which has less water available. Since thatch is hydrophobic, it can be difficult for water sources to traverse through the turf canopy and thatch prior to entering the soil. The playability of fairways and greens will increase as they'll have more consistency, firmness and smoothness.

STEC Equipment

CLIFF STEWART
Dealer development manager

Superintendents can alleviate excess thatch by establishing a consistent cultural practice regime of core aerification at least twice a year, followed by vertical mowing and a topdressing program. Not all clubs or budgets enable topdressing programs on fairways, so core aeration and vertical mowing are vital to minimize thatch. Turfgrass roots will become stronger, providing more consistent turf coverage. Firm and fast are the new norm for fairways, and golfers will benefit from these turf conditions.
By applying the same practices to putting greens, superintendents will further improve golfers' satisfaction. For greens, utilize additional light and frequent vertical mowing, followed by biweekly topdressing throughout the growing season. Greens' surfaces will have firm, fast conditions, resulting in enhanced turfgrass health.

"Given that I constructed the green in a minimalistic fashion, I focused on killing the creeping bentgrass and reseeding. I tackled the renovation with considerably less enthusiasm and patience than when I first installed the green."

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

Learning from my mistakes in a backyard turf renovation

When we built our home, I installed a putting green along the corner of the property. The design and construction of the green followed a minimalist rendition: simply seeding creeping bentgrass into recently spread topsoil encompassing the root zone construction. Through a repetitive practice of mowing, watering, fertilizing and sand topdressing, the 800-square-foot green came to life. That green became the signature trademark of the neighborhood.

As our kids grew up, the putting green became the meet-up place for the neighborhood kids and parents. Little kids with putters and golf balls in their hands without parental supervision could be considered some sort of neglect. A practical benefit of having that putting green in our backyard was we always received our packages early from FedEx and UPS, given the drivers often took their breaks to hit a few putts.

Over the years, that putting green was an integral part of family gatherings, my sons' middle and high school golfing activities and neighborhood social events.

GOODBYE GREEN

As time and my family moved on, the putting green became more of a relic. The time commitment to manage it had lost most of its appeal. It took less time to mow than to actually start the greensmower, transport it, remove the wheels and then reverse the process to take it back.

I made the decision about 10 years ago to remove the putting green and reestablish the area to a mix of Kentucky bluegrass and perennial ryegrass. Given that I constructed the green in a minimalistic fashion, I focused on killing the creeping bentgrass and reseeding. I tackled the renovation with considerably less enthusiasm and patience than when I first installed the green.

KNOCK 'EM DOWN

The process consisted of spraying the bentgrass area with glyphosate, waiting 10 days and spot-treating any places I thought required a second treatment.

Initially, the ryegrass predominated the area, but blended well with the existing lawn. In the 10 years since, creeping bentgrass has slowly reemerged alongside the outline of the putting green.

It's easy to point to the number, or lack of, glyphosate sprays I initially made when speculating on the failure to remove creeping bentgrass.

In creeping bentgrass fairway renovation, superintendents traditionally apply two glyphosate sprays before seeding with a new cultivar or blend of creeping bentgrass cultivars. The purpose of the two sprays is to kill as much existing plant material as possible. Unfortunately, if it is not completely killed, new shoots can emerge from nodes along the stolons and surviving crowns.

Effective control of established creeping bentgrass should lean toward practices used for bermudagrass fairway renovation. In bermudagrass renovation, superintendents apply an initial nonselective herbicide or herbicides. Prior to the second application, superintendents promote turf recovery by watering and fertilizing to promote new and existing growth. Superintendents make the second application and repeat the turf recovery phase prior to a third application. Often the intervals between sprays may run up to 30 days.

For creeping bentgrass, superintendents do not promote an active regrowth phase because the spray intervals may range from 7 to 10 days. Given the seasonal limitations of renovating creeping bentgrass in the late summer through fall, 30-day intervals may not seem practical. Yet promoting turf recovery after an initial nonselective herbicide spray effectively increases the kill potential of a second spray. Lastly, if superintendents increase the number of nonselective sprays to three or more, the success rate should be greater.

Creeping bentgrass is fascinating. Given its growth habit, including stolons and nodes, you could, in theory, establish a putting green or fairway from one creeping bentgrass plant. Unfortunately, to kill creeping bentgrass, you need to get all the individuals.

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

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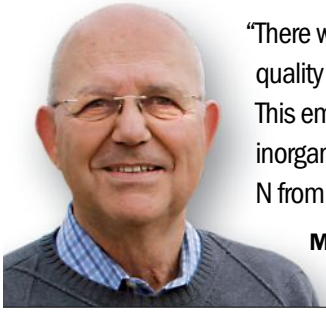

"There was no significant difference in the visual quality throughout the 20 years of the MSU study. This emphasizes the need to find a way to balance inorganic N with available N. Too much readily available N from water-soluble sources is a potential problem."

MIKE KENNA, PH.D., *Research Editor*

Inside golf's battle with nitrogen leaching

In my first undergraduate soil course, the professor described nitrogen (N) as the 'gas pedal' for plant growth. Indeed, in the 1970s, inorganic N fertilizer was relatively inexpensive, and most sports turfgrass recommendations were much higher than they are today.

During that time, there was little concern about N leaching through a turfgrass root zone. It was the growth and color response that most managers had an interest in obtaining.

By the late 1980s, golf courses were under attack for polluting groundwater with increased nitrate levels. While nitrate results from an EPA study of Cape Cod golf courses were encouraging for the industry, some golf courses did increase nitrate concentrations in groundwater at several locations.

In 1986, the Cape Cod course using the highest proportion of slow-release N fertilizers had the lowest concentration of nitrate-N in groundwater. The golf course with the greatest nitrate-N groundwater concentrations applied more water-soluble N.

In 1987, reducing nitrogen applications significantly reduced groundwater concentrations of nitrate-N at the same Cape Cod courses.

TIME FOR TESTING

The USGA started to evaluate the fate of pesticides and fertilizers in 1990. Most studies were on relatively young turfgrass, and N leaching was insignificant. For example, in a 1991 lysimeter study at Michigan State University (MSU), Eric Miltner, a doctoral graduate student under Bruce Branham, Ph.D., used the labeled '15N' to track the fate of N for two years.

Miltner and Branham found about half of the applied urea-N was in leaf tissue and removed by mowing. The other half was organic N, with 21 percent in the thatch, 21 to 31 percent in the soil and less than half a percent in leachate.

From 1994 through the spring of 1998, the lysimeter area at MSU received 3 lbs. N per 1,000 ft^2, but no sampling for N analysis occurred.

From 1998-2002, the high N rate (5 lbs. per 1,000 ft^2 annually) saw a dramatic increase in nitrate-N leaching from 5 ppm in 1998 to 25 ppm in 2002. During the same time frame, there was a modest increase in nitrate-N leaching for the low N rate (2 lbs. per 1,000 ft^2) from 3 ppm in 1998 to 5 ppm in 2002.

RETURN TO FORM

In 2003, Kevin Frank, Ph.D., changed the high annual N rate to 4 lbs. N per 1,000 ft^2, and the low N rate remained the same. The concentration of nitrate-N leaching from the high N rate treatment started to decline by 2004.

Over the next 14 years, the nitrate-N concentration in leachate from the high N rate decreased dramatically to the point that the concentrations in leachate in 2007 were similar to those initially measured in 1998.

There was no significant difference in the visual quality throughout the 20 years of the MSU study. This emphasizes the need to find a way to balance inorganic N (immobilized) with available N (mineralized). Too much readily available N from water-soluble sources is a potential problem.

A 1980 study by Cornell University of 125 golf courses ranging in age from 1 to 125 years old suggests soil organic matter accumulation is rapid in the first 10 years after establishment and slowly builds to an equilibrium at 25 years when no further N immobilization occurs. This trend is similar to the long-term carbon sequestration research conducted around the country.

So, the bottom line is that it is valuable to have an easy method that accurately estimates N mineralization rates in older turfgrass soils. This soil test would reduce the potential environmental impact of golf courses and save on fertilizer costs. G

For more information

See Frank, Kevin W. 2018. Twenty years of measuring N leaching from turfgrass. *Golfdom*. October. 74(10): p. 56-58.

Mike Kenna, Ph.D., retired director of research, USGA Green Section. Contact him at mpkenna@gmail.com.

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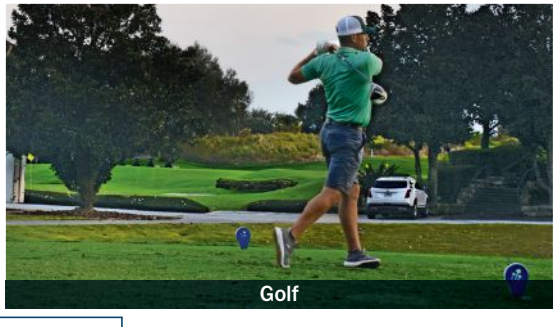
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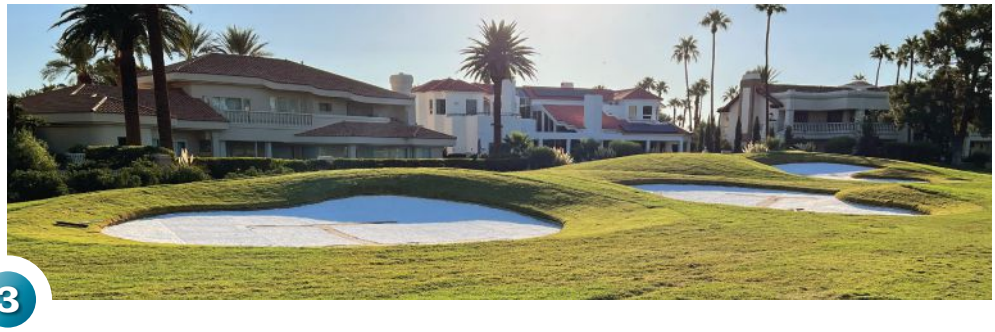

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Deere.com

2 | Ceora

Ceora, an autonomous mowing solution from **HUSQVARNA**, offers cost-efficient care of fairways and roughs. Ceora is virtually silent and features Husqvarna's EPOS (Exact Positioning Operating System) satellite-based technology for operation on up to 18 acres of turf. Ceora is managed through a phone or computer and offers superintendents the opportunity to save on labor and equipment costs.

Husqvarna.com

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ZLineProducts.com

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KubotaUSA.com

6 PondHawk

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PondHawk.com

The 19th Hole

Curtis Schriever

GREENKEEPER // Wichita (Kan.) CC

Curtis, what can I get you? I'll have a Yuengling since that just became available in Kansas. We put a tap in at the clubhouse.

Tell me about Wichita CC. It was founded in 1900; it's been at this location since 1950. We're going to embark on a big renovation soon with Tripp Davis & Associates. Greens, tees, irrigation upgrades and a few bunkers — the bunkers here are still pretty new. It's going to be an exciting time.

//BEST ADVICE

"MATT SHAFFER ALWAYS TOLD ME, 'FORGET ABOUT THE MONEY. GET HOME.' EACH JOB I TOOK GOT ME A LITTLE CLOSER TO HOME. I THINK THAT ADVICE ULTIMATELY LED ME TO THE GREAT JOB I HAVE NOW."

How did you get into the business? I discovered golf late in life, probably during my sophomore year of high school. I started playing on sand greens. After high school, I got a job at Lowe's and started playing at Carey Park in Hutchinson (Kan.). They had grass on their greens, so to me, that was the crème de la crème. To keep playing golf, I took a job at Willowbrook, a nine-hole private golf community. The superintendent was Charlie Thompson. He could drive his golf car to work and play whenever he wanted. I asked him halfway through that first summer, 'How do I get your job?' He said, 'I went to (Kansas State University) for golf course management.' It was a done deal after that; I enrolled at K-State for golf course management.

Tell me about your family. My wife Hannah and I met at the Golf Industry Show in San Diego. She also went to K-State, but I (already) knew of her … she was the beer cart girl at my course. I finally went up and talked to her in San Diego, and the rest is history. We have two kids; our daughter Juniper is seven, and our son Charleston will be two in May.

And your wife is a pastry chef. What's her specialty? Yes, it's definitely not good for my waistline! On my birthday, she'll make me Guinness brownies that are out of this world.

OK … how does your dog know Kid Rock? I was working at The Patriot GC in Owasso, Okla., for a Folds of Honor event called the Patriot Cup, which was a celebrity tournament. It's after the tournament, and I'm around the cottages picking up signage. It's early morning, so I'm trying to be quiet, and I lost track of my dog, Jovie. I start running around the cottages, kind of whisper-yelling for her. I come around one of the cottages, and there she is, just sitting with Kid Rock, waiting for treats. I was about to apologize, but he just sort of waved at me like, 'Hey, she's OK; she's just hanging out with me.'

We're both Chiefs fans. What was your Super Bowl experience? I was on a Disney property during the Super Bowl. We watched the first quarter on the bus back to the hotel. My family quickly fell asleep after we got back to the hotel. I was standing in front of the hotel TV, trying not to yell, so they could sleep while I watched the game! That was my Super Bowl experience, but I wouldn't change it for the world. My kids had a great day, and they all woke up to a Chiefs win.

As interviewed by Seth Jones, Feb. 16, 2023.

PHOTOS BY: *GOLFDOM* STAFF (CURTIS), CURTIS STRIEVER (JOVIE THE DOG), S_BUKLEY / SHUTTERSTOCK (KID ROCK), YUENGLING (YUENGLING), EUROBANKS / ISTOCK-GETTY IMAGES PLUS / GETTY IMAGES (BROWNIES)

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*Jonathan L. Larson, Carl T. Redmond and Daniel A. Potter, SCI. September 2011.

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