2nd and 3rd Quarter 2020

TEXAS TURFGRASS ASSOCIATION

Texas Turfgrass Association 2020

Back to the Basis of Education and Networking

Mission Statement:

To Promote, Support, & Inspire the Turfgrass Industry in the State of Texas through Education, Research, & Fellowship.

Vision Statement:

"Our Vision is to create action through programs, education, and research that promote the Turfgrass Industry & Turfgrass Professionals in the State of Texas. We strive to provide a local opportunity for growth and a positive impact on our Members through professional, social, and educational interaction, while encouraging inclusion from all of the key segments of the Texas Turfgrass Industry. We believe the future of the Texas Turfgrass Industry is stronger when we work, share, teach, and learn together."

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President's Message

Howdy Family,

What. A. Year. With COVID-19 on first, political turmoil hanging on second, and the drought bringing it home into 2021, just wow. TTA has remained a solid association through this challenging year, staying true to the mission of bringing education and research to the Texas turfgrass industry.

Gratitude goes to our Sponsors, Board, and Advisors for the dedication they've demonstrated while trying to bring you options on earning CEUs this year. As most of you know, the virtual summer conference was to say the least entertaining and very educational! We had an astounding 114 attendees! I've never seen someone with as much drive as our Katie to get things done, bring together everyone as ONE team, and accomplish great things.

As you may imagine, we spent a great deal of time at the summer Board of Directors meeting discussing options for the 2020 Winter Conference. The Board provided a survey to all constituents to help provide a voice to all on whether an in person conference or virtual conference would be best. You spoke, we listened! After much discussion, we decided we could do this. On the forefront is safety precautions while we are in Frisco, and the committees have been working diligently in tandem with the City and hotel to ensure all safety measures are in place, while informing you of the same. We hope to see you there, but if we do not, we know we will see you again soon!

While the logistics of the winter conference were the main topic at the Board Meeting, we did discuss all committees and where we see TTA going in the near future. We are eager to begin working with the youth, through the FFA and 4-H clubs. Turfgrass is always the low hanging fruit, the last of the agriculture topics to be covered, if at all, in these youth programs. We will begin making an effort to better inform organizations of the beauty of sod, the multiple platforms one could assess when thinking about coming into our industry, and the happiness we are all ultimately able to bring the end user of our services.

In closing, thank you for allowing me to be your president in 2020. We will continue to send updates, as needed, to provide TTA protocol and answer your questions on operations in the coming days.

Take things one day at a time, focus on what you can control, do the best you can, and we will get through this together.

With Best Regards,
Whitney Milberger

Howdy TTA !

For our Association, 2020 began like normal, very routine, and full of goals for the New Year!

The worldwide pandemic that we are still experiencing has personally effected every person, association, job, family, and industry. I was personally very apprehensive when we made the decision to cancel our Summer Meeting in -person and divert to a digital platform that so many of us have become local experts now.

I am please beyond words at how well the TTA, our members, our board of directors, and our committees came together to keep education in Turf as the foremost importance to this industry. The Summer Platform was the highlight of our education for the summer and was a true testament of what you can do when given lemons; you make that Lemonade. Thank you again to every person and speaker who enhanced, and "Set the bar', for a digital platform. And to all members who enjoyed the Two-Day Zoom- we thank you!

As of now, for 2021, Texas Turfgrass Association has plans to keep the next Summer Conference at Horseshoe Bay. We are optimistic and will keep all members and exhibitors informed as planning unfolds.

This year, I felt strong that TTA was driven to form committees and get back to the very basics of what makes our association special. Very smart, driven and tenacious board members revisited the topics of, "What is our Vision? What is our Mission Statement? " We may have changed through the years and had to re-focus on how to drive member and professional engagement in a state of competing associations, but we saw industry members come together and support what this association is about. And for that- we thank you!

My desire is that you wish to keep this association a presence in your life and I vow to keep working hard for TTA as your Executive Director. I am excited to see how this Winter Conference ends and thank you all for coming if you were able!
Thanks again for letting us end 2020 off with a bang!

Your Executive Director,
Katie Flowers

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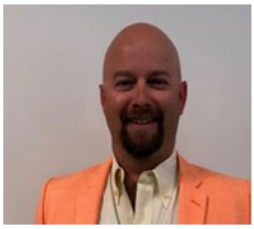

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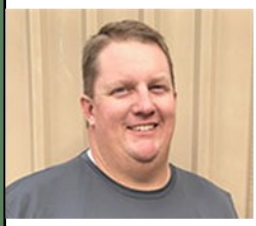

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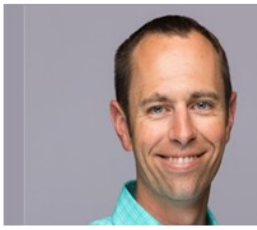

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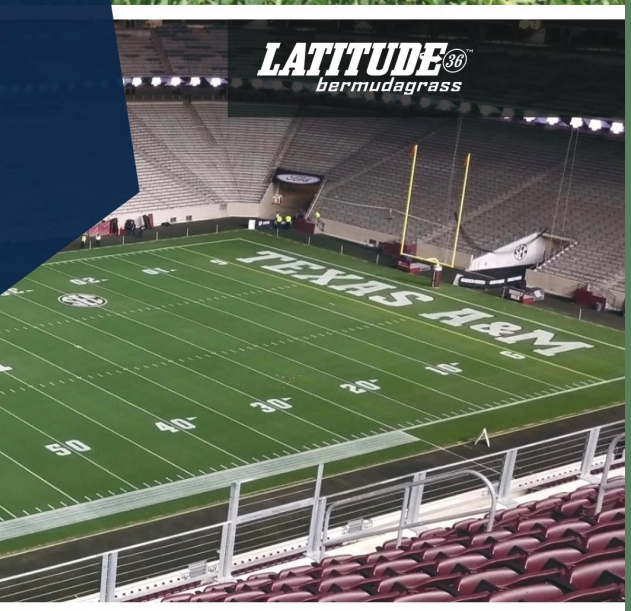

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Summer Virtual Conference Recap

The 2020 Summer Virtual Conference was the first time that TTA ventured into a digital platform and needless to say this event was a HUGE success!

Two days of Virtual education was provided for the members and the turn out was far better than we anticipated! Dr. Becky Grubbs, Dr. Chrissie Segars, Dr. Chase Straw, Dr. McCurdy , Maddie Reiter, Dr. Wherley, Kai Umeda, Janet Hurley and much more, allowed our TTA members to get their TDA credit during this world wide pandemic.

The biggest treat and surprise find was our Virtual DJ – David Osbourne who set the "Zoom Bar" high with entertainment and allowed our Sponsors to showcase their products. It was the first time you danced during a Zoom webinar and I hope we get to show case him again for our Members.

Thank you to our Sponsors, Members, Speakers, and DJ who helped bridge the education gap this summer with a Fun filled Zoom that set the bar in Virtual Education!


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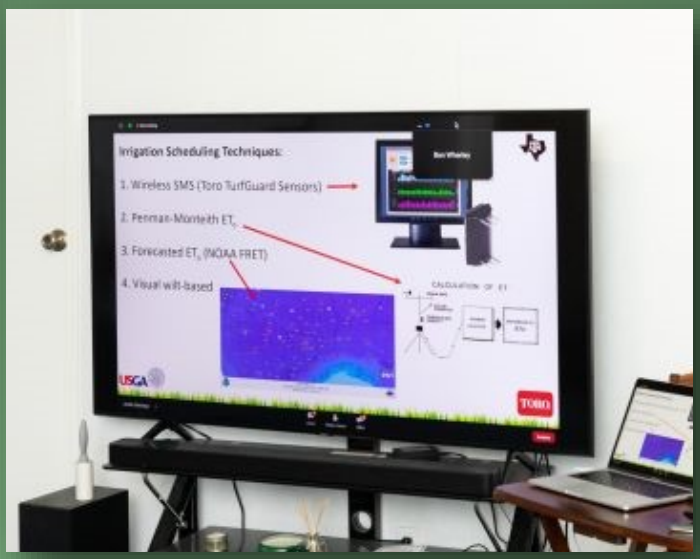
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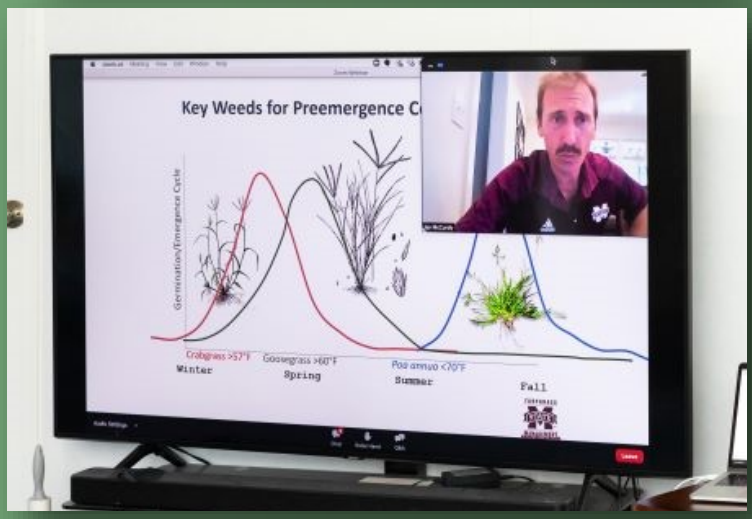
Key Weeds for Preemergence C
Germination/Emergence Cycle
Crabgrass >57°F
Goosegrass >60°F
Poa annuo <70°F
Winter
Spring
Summer
Fall


Herbicide injury to zoysia sod

Using seedling emergence patterns to guide more effective annual bluegrass (*Poa annua* L.) control

By: Andrew Osburn,
Dr. Becky Bowling, and
Dr. Muthu Bagavathiannan

Annual bluegrass (Poa annua L.) is a troublesome winter annual weed found in many turfgrass systems throughout Texas. With the intermittent cool weather over the past several weeks, we have already begun to see annual bluegrass emergence in the College Station area. This means that appropriate fall pest management programs need to be chosen and implemented in a timely fashion to reduce the aesthetic and economic damage caused by this challenging weed. One critical aspect of effective pest management programs is understanding the biology of the pest in question, and for annual bluegrass specifically, understanding seedling emergence patterns can inform appropriate herbicide application timing. So, when does annual bluegrass germinate and for how long does that germination window last?

Texas A&M is leading a nationwide study to investigate many aspects of annual bluegrass: its biology, resistance distribution and mechanisms, various control methods both conventional and alternative, and socioeconomic drivers of management decisions. As part of this large study, seedling emergence patterns of annual bluegrass are being monitored at seven locations across the country in multiple USDA hardiness zones1. In Texas, we are monitoring seedling emergence patterns in zones 8b (Location 1: College Station, on a Zack fine sandy loam soil with 2-5% slope) and 9a (Location 2: Brenham, on a Latium clay soil with 3-5% slope) (Figure 1). The study, which is in its second of two years, captures the emergence pattern of annual bluegrass from fall, when seedlings first emerge, through late spring until no further seedling emergence is observed. Weather stations at each location are simultaneously recording soil temperature and soil moisture data. This data will allow the team to develop comprehensive emergence forecast models that will give turfgrass managers another tool in their arsenal for fine-tuning weed control programs from year to year. The first year of data collection is already complete and the preliminary results are discussed here.

In the first year of this study, seedling emergence was monitored from mid-October 2019 to mid-March 2020 in both College Station and Brenham. Emergence patterns relative to soil temperature and soil moisture are shown in Figures 2 (College Station) and 3 (Brenham). Annual bluegrass emergence was first observed around mid-November in 2019 in both locations. This is in stark contrast to 2020 observations in which initial annual bluegrass emergence was recorded in mid-September in College Station. This variability across years demonstrates the importance of monitoring local weather conditions including soil temperatures and moisture in order to predict the germination of annual bluegrass rather than solely relying on a calendar. At peak emergence in 2019, soil temperatures were averaging 58° F and in College Station and 59° F in Brenham. However, the climate conditions leading up to these emergence events should be considered more important for promoting seedling emergence as soil temperatures and moisture content for the previous 10-14 days can be used as predictors for emergence flushes. The average temperature in College Station for the first 14 days in November was 55°F with a low of 40°F while Brenham had an average of 57°F with a low of 45°F. Traditionally, it is recommended that turfgrass managers make their first preemergence herbicide application in the fall when temperatures in the upper inch of soil drop to 70°F or below for 4 or 5 consecutive days.

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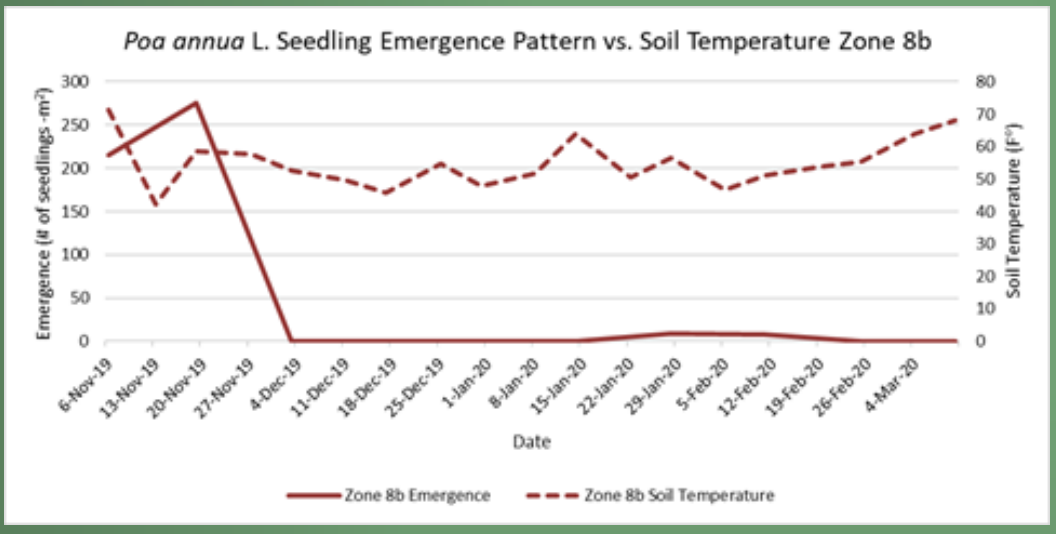
Fig. 1.

Experimental plots recording annual bluegrass seedling emergence patterns in Brenham, Texas

(USDA hardiness zone 9a)



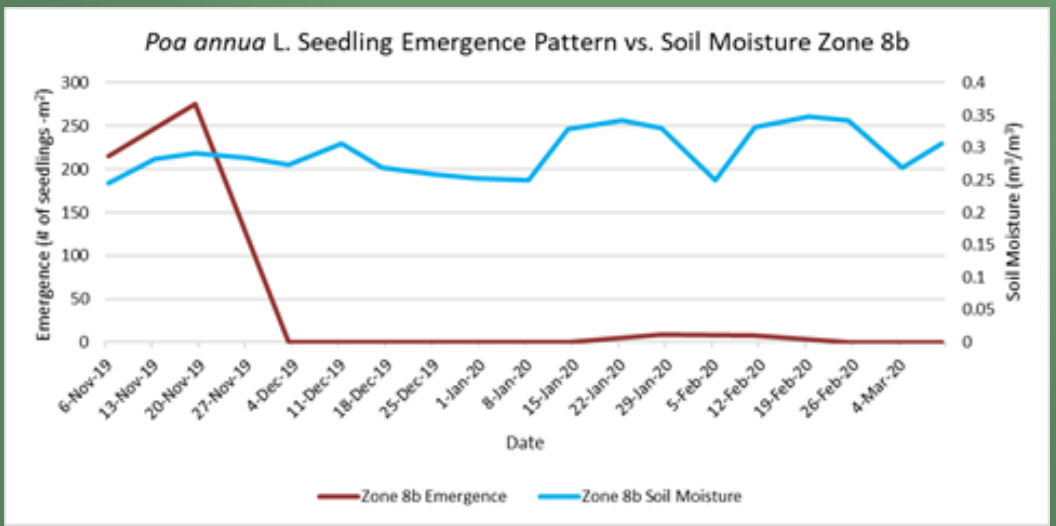


Fig. 2

The emergence pattern of *Poa annua* from November 2019 to March 2020 in College Station, Texas (zone 8b).

Seedling emergence (# of seedlings/m^2) is plotted against average soil temperatures (°F) (left) and average soil moisture content (m^3/m^3) (right).

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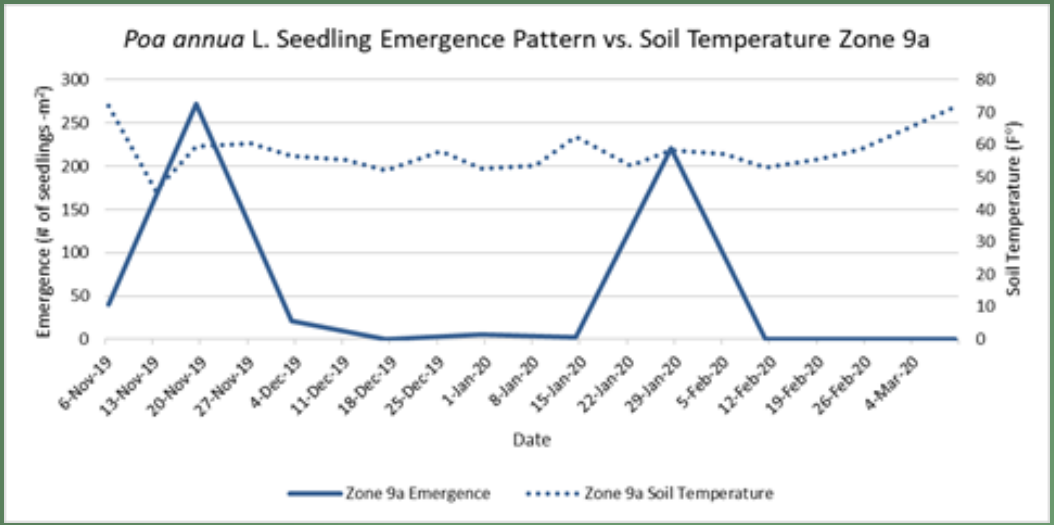

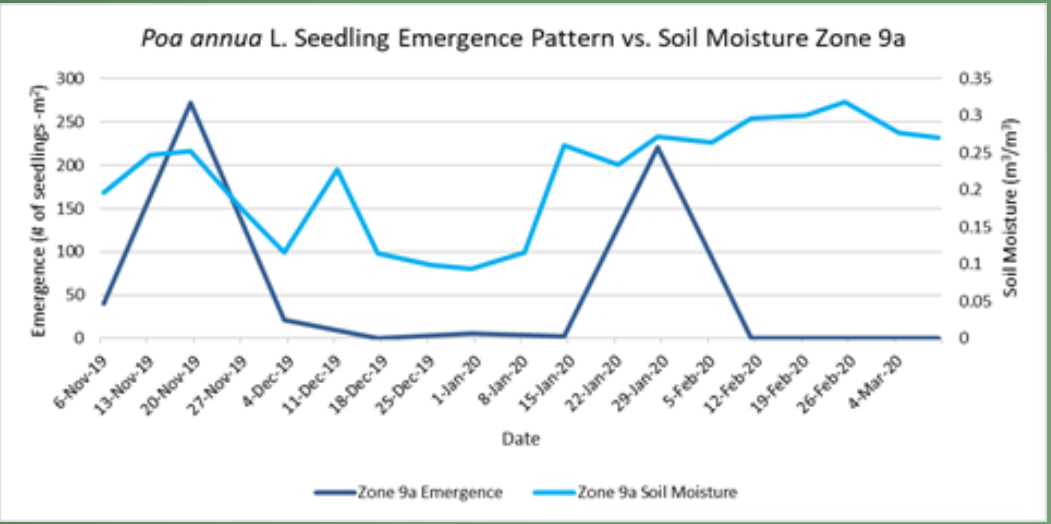

Fig. 3

The emergence pattern of *Poa annua* from November 2019 to March 2020 in Brenham, Texas (9a)

Seedling emergence (# of seedlings/m2) is plotted along with average soil temperatures (°F) (left) and average soil moisture content (m3/m3) (right).

Continued from page 10

Seedling emergence slowed from mid-November to the beginning of December at both locations. While germination remained minimal in College Station (8b) for the rest of the season, a second significant flush of seedling emergence was observed in Brenham (9a) in late January, approximately 10 weeks after the initial flush of emergence. The average soil temperature during this flush was 58°F, while soil temperatures averaged 55°F 14 days before with germination event with a low of 49°F. After this second flush, annual bluegrass emergence declined quickly over the course of a few short weeks until no more seedling emergence was observed in either location. This indicates a bimodal seedling emergence pattern in Brenham for 2019, with two unique, significant seedling emergence events spanned months apart.

Our observations over the course of this study so far suggest that emergence patterns for annual bluegrass are highly weather-dependent. However, the observation of two significant emergence events at Brenham in 2019 indicates that when winter weather is milder, as is often observed in more southern geographic regions, a singular preemergence herbicide application in the early fall may not always be sufficient to protect turfgrass areas from an annual bluegrass germination and emergence throughout the winter season. If a milder winter weather is expected, turfgrass managers may consider a split- or sequential preemergence herbicide program to broaden their window of coverage should a second late-season flush occur. This would consist of making a first application in the early fall (typically when soil temperatures reach around 70 F for four to five consecutive days), followed by a second application at a rate and interval specified by the product label. Alternatively, using preemergence herbicides with long soil residual activity, such as indaziflam, could be beneficial in limiting any additional flushes of germination later in the season.

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Turfgrass managers should also be diligent about monitoring soil temperature and moisture in order to better predict emergence patterns. Findings from this study at completion should go a long way toward better understanding the role of environmental variables in stimulating annual bluegrass emergence.

Adopting strong preventative control measures is critical as dense populations of established annual bluegrass can lead to difficult and costly postemergence control programs, such as multiple postemergence herbicide application or diligent and intensive hand weeding. If preemergence herbicide applications are timed properly, annual bluegrass pressure could be greatly reduced, preserving aesthetic value and reducing the need for restorative measures in the spring. Additionally, appropriate selection and utilization of preemergence herbicide applications could be an effective method for depleting a robust annual bluegrass seedbank, reducing further seedbank inputs, and future seedling emergence.

When selecting and using herbicide products of any kind, be sure to **rotate the sites of action** and **always follow the label** in order to prevent herbicide resistance and get the most out of your herbicide program. It is important to remember that strong integrated weed management programs that encompass diverse management tactics, including a focus on enhancing turfgrass competitiveness, are vital for sustainable management of annual bluegrass while reducing the risk of resistance development.

Funding - This project was funded by the USDA-NIFA Specialty Crops Research Initiative (SCRI) program (award #: 2018-51181-28436).

About the Authors - *Andrew Osburn is a PhD student in the Department of Crop and Soil Sciences at Texas A&M University in College Station. Dr. Becky Bowling is an Assistant Professor and Extension Specialist with Texas A&M AgriLife in Dallas, and Dr. Muthu Bagavathiannan is an Associate Professor of Weed Science and Agronomy in the Dept. of Soil and Crop Sciences at Texas A&M in College Station.*

2021 Conferences

Details Coming Soon! Save the Dates!

Summer Conference

HORSESHOE BAY RESORT.
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July 18 - 21, 2021

Winter Conference

TBD

Date and Location TBD Soon!

Mapping Sports Field Surface Properties

Dr. Chase Straw
Texas A&M University

Performance testing of sports fields is becoming more common to quantify surface properties, such as surface hardness. Many testing devices now incorporate a Global Positioning System (GPS) and Bluetooth capability to georeference sampling locations and send the data to a computer, tablet, or phone. Maps can be created from collected data using Geographic Information Systems (GIS) to visualize the variability (i.e. differences) of a certain property across a field. Maps are gaining increasing attention in the sports turf industry, with several private testing companies incorporating them in their consultation with sports turf managers. However, for the sports turf manager, little is known about how they are created and what their practical uses are.

Map Creation

Maps are typically made from point data, where each point represents a specific latitudinal and longitudinal location on a field. Determining the latitude and longitude of a given point is called georeferencing and is done using a GPS. Data that is collected at that location for a specific surface property is stored within the point in a GIS software (this is why they are called point data). Figure 1 depicts maps for five surface properties on a high school football field: volumetric water content (i.e. soil moisture), penetration resistance (i.e. soil compaction), normalized difference vegetative index (NDVI; i.e. turfgrass health), surface hardness, and turfgrass shear strength. The Google Earth images on the left show the points where data were collected and stored for each measured property. The soil moisture, soil compaction, and turfgrass health data were collected using a mobile multi-sensor sampling device, the Toro Precision Sense 6000. The surface hardness and shear strength data were collected using a handheld Clegg Impact Tester and Shear Strength Tester, respectively. All point data were georeferenced using a GPS device. Many commercially available soil moisture meters, as well as newer versions of the Clegg, are capable of georeferencing their data with either an internal or external GPS.

Once point data are collected, there are multiple methods to create maps using GIS software, all of which use some form of spatial interpolation. Spatial interpolation uses a mathematical formula that estimates values at locations that were not measured, based on the surrounding values at locations that were measured.

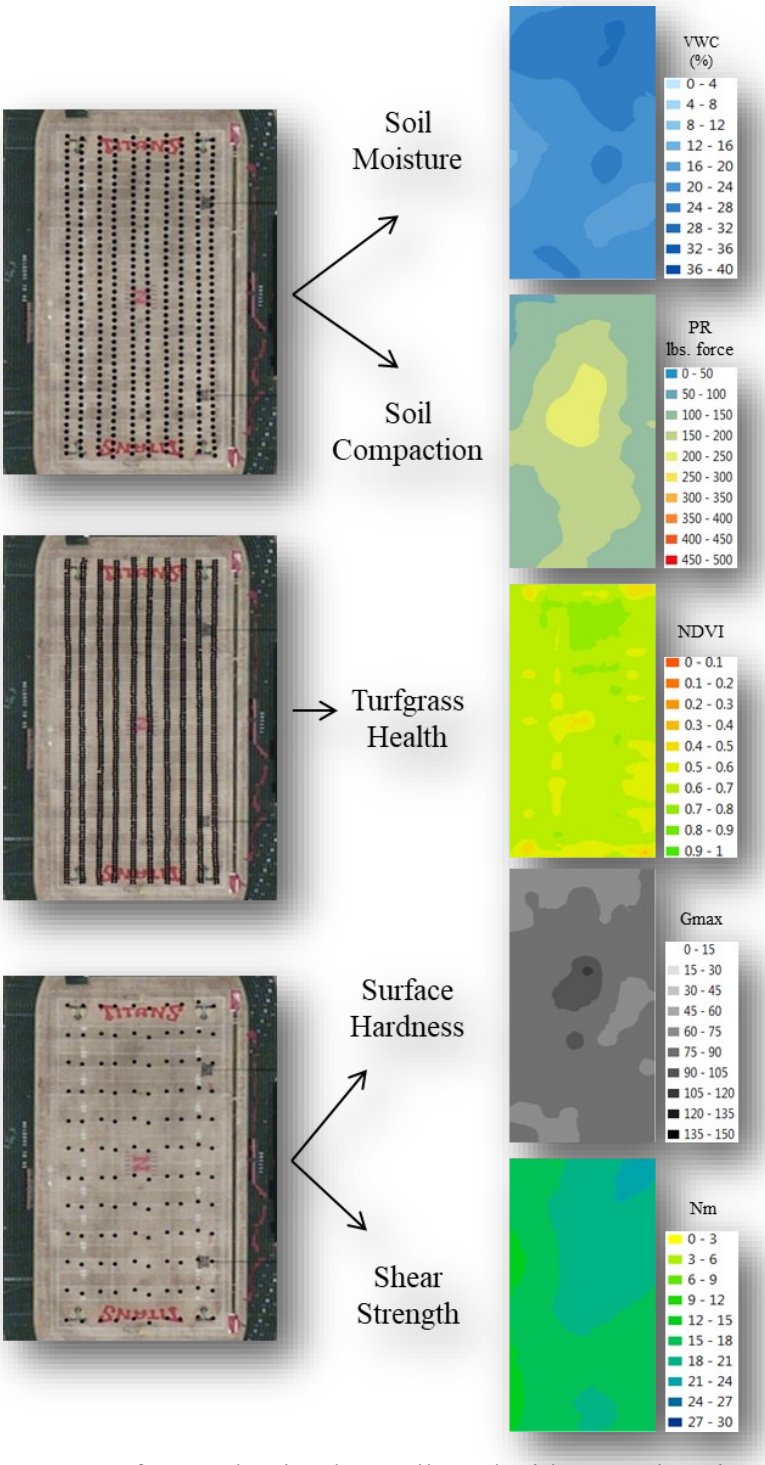

Figure 1. Georeferenced point data collected with several testing devices (left) and their respective maps created from the data (right).

The result is a continuous surface that shows the variability of a given property across the field, or in other words, a map (right side of Figure 1). Maps are not limited to these five properties. Any quantifiable measurement can be made into a spatially interpolated map.

Using Maps

Site-specific management is perhaps the most suggested use for maps in sports field management. Site-specific management simply involves the application of inputs (such as water, aerification, and fertilization) only where, when, and in the amount needed. This fosters more precise and efficient application of inputs. Current management practices are often based on recommendations designed to provide good results under average conditions over large areas. Sports turf managers frequently use high amounts of resources in order to achieve a safe, predictable outcome. However, this type of management does not take into account the variability of certain measured quantities (e.g. soil moisture, soil compaction, etc.) that may exist within or between fields. Site-specific management focuses on managing sports fields at a smaller scale than current practices in order to target only "troubled" areas (high or low values in the data). Focusing efforts on smaller areas may reduce management inputs, improve field consistency (above- and below-ground), increase the efficiency of management tactics, and enhance turfgrass longevity/stress tolerance. There are many site-specific management applications for sports fields using maps: a.) soil moisture maps can detect deficiencies in irrigation systems down to a single head; b.) soil compaction maps can be used to create a site-specific cultivation plan; c.) turfgrass health maps can identify wear/stress patterns that alert managers to rotate field use; and d.) overlaying maps of different variables may highlight imperfections in current management practices or underlying agronomic issues.

Another example of how maps can be used at sports facilities is to demonstrate sustainability. Terms like "going green" and "eco-friendly" will soon become common lingo among sports turf managers. Public concern over the use of pesticides and synthetic fertilizers on sports fields and recreational areas has intensified over the past decade. As societal pressure increases for the conservation of energy and natural resources, attempts to implement site-specific management and reduce inputs may become key to increasing the credibility of sports facilities attempting to become "sustainable." Improving field playability and athlete safety through the implementation of site-specific management would further exhibit social sustainability of sports fields by improving player satisfaction. Maps can play a critical role when trying to communicate sports field efforts of sustainability to the public.

A third use of maps in sports field management could be to help explain field closures. Sports field management often involves more than just taking care of the field. Interacting with coaches, players, and administration may be common and at times difficult. Questions often arise when fields need to be closed for inclement weather or maintenance practices. Sometimes telling them that the field is "too wet" is just not enough. Numbers and data can be confusing for some, but maps are somewhat easy to understand. For example, the bright red color depicting stressed turf on a turfgrass health map is an easy way to highlight areas that need special attention or justify closing/rotating field use.

The last example of how maps could be used in sports turf management is to propose new equipment or renovations. Maps can easily highlight deficient areas within a field or across multiple fields within a sports complex. Sports turf managers may be cognizant of these areas, while their administrators are often unaware. Maps can be employed to justify the purchase of new equipment or utilized to rationalize the need for future renovations.

Sports Field Mapping Protocol

Unfortunately, adoption and use of maps among sports turf managers has been slow. This is likely due to several reasons, but primarily related to lack of knowledge about the required technologies, shortage of time and labor for data collection, and cost of testing devices (as well as their accompanying software subscriptions). With all of this in mind, the University of Minnesota developed a free sports field mapping protocol that outlines step-by-step instructions to collect and analyze sports field surface property data for map creation. The detailed protocol outlines step-by-step instructions to collect data, which can then be used to create maps of surface properties with free mapping software that can be downloaded via the internet (Figure 2). One of the reasons the protocol was created was to help sports turf managers get their foot in the door with mapping sports field surface properties for site-specific management. The only thing required is a sampling device (or multiple sampling devices) and effort. There are several positive outcomes anticipated from this initiative, such as management resource conservation, increased field uniformity and athlete safety, and increased familiarity with new technologies amongst sports turf managers. The protocol is available for free through the University of Minnesota's Office for Technology Commercialization. It can be found by searching online for "sports field mapping protocol" or by the provided link in the "Useful Links" section of aggieturf.tamu.edu.

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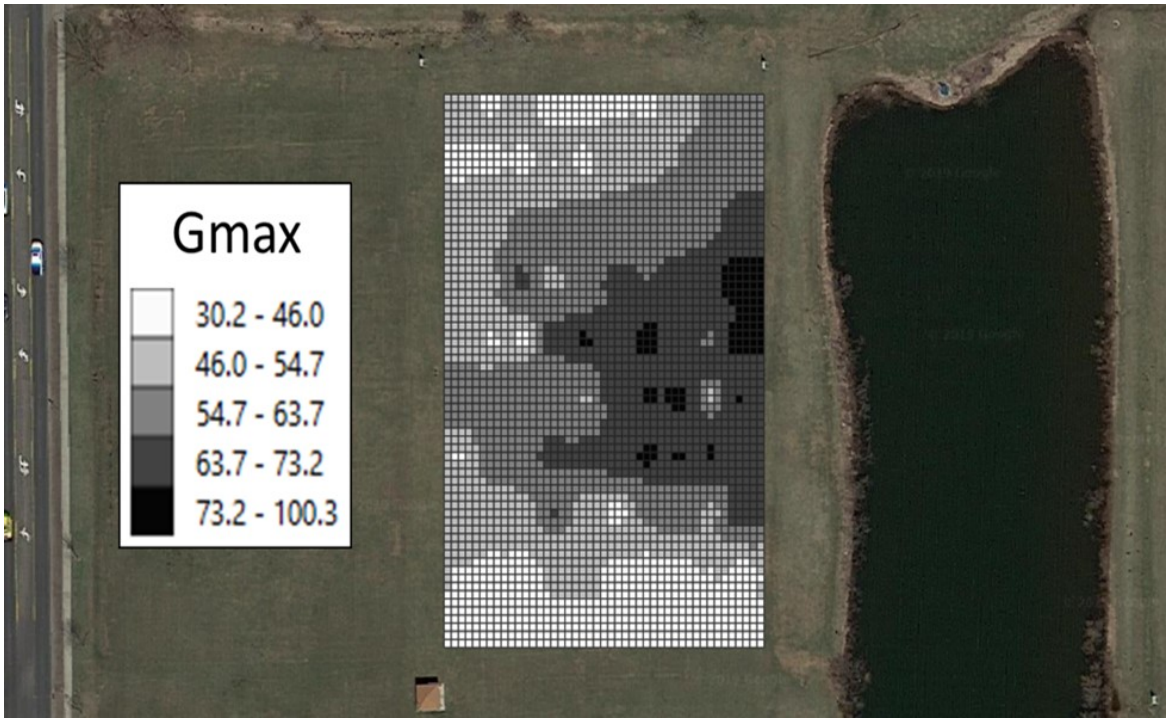
Figure 2.

An example map created from the free sports field mapping protocol. Any type of sampling device can be used (GPS is necessary) and any measurable surface property can be mapped.



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C. Straw and G. Henry. 2016. Mapping to improve athletic field management. SportsTurf, March 2016:16-

December 1 - 2, 2020

Winter Conference and Trade Show

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TDA Session for Non Licensed Attendees

TDA Lectures

8:00 a.m. - 5 p.m.—CANCELED

Due to restriction of Travel to our Extension Agents, this class was canceled at the time of publishing.

<u>All other sessions remain on schedule 12/1 and 12/2</u>

If you wish to contact Dr. Matocha to see other options for this class in the near future, please do so by utilizing his contact below.

Dr. Mark Matocha - Texas A&M AgriLife Extension
mmatocha@ag.tamu.edu

TEXAS DEPARTMENT OF AGRICULTURE LICENSE EXAMS (PESTICIDE APPLICATORS)

Tuesday, December 1st

Full Day Exhibitors Trade Show Schedule

11:00 a.m. - 1:00 p.m.
GRAND OPENING OF EXHIBITS
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Tuesday, December 1st
Morning Concurrent Sessions

Golf Session Frisco 3

8:00 a.m.

Goosegrass and the Next Annual Bluegrass

Dr. Eric Reasror
Southeast Research Scientist
PBI – Gordon Corporation

9:00 a.m.

Integrating Nutritional Advancements with Existing Programs

Steve Trotter
Midwest Turf Services

10:00 a.m.

Reducing Water Consumption in Golf Course Fairways with Precision Irrigation

Dr. Chase Straw
Assistant Professor, Turfgrass Management and Physiology
Texas A&M University

Sports Turf Session Frisco 4

8:00 a.m.

Maintaining Sports Field Uniformity to Increase Player Safety and Performance

Dr. Chase Straw
Assistant Professor, Turfgrass Management and Physiology
Texas A&M University

9:00 a.m.

MoneyGram Soccer Park's Field Renovation Learning Curve

Troy Crawford
Director of Grounds
MoneyGram Soccer Park

10:00 a.m.

Wicked Witch of the Pest
1 General-Pest Features (AG); 1 Pest Control (SPCS)

Dr. Chrissie Segars
Extension Turfgrass Specialist Texas A&M AgriLife Extension

Commercial Session Frisco 5

8:00 a.m.

Carbon Sequestration and Microbial Populations in Turfgrass Landscapes

Dr. Joey Young
Associate Professor of Turf Science
Dept. of Plant and Soil Science
Texas Tech University

9:00 a.m.

POA Annua Research
1 General Pesticide Factors (AG); 1 Weed (SPCS)

Andrew Osborn, MS
Graduate Research Assistant
Department of Soil and Crop Sciences - Texas A&M University

10:00 a.m.

Water x Weeds: The Impact of Watering Practices on Weed Pressure and the Efficiency of Weed Control Programs
1– IPM (AG); 1 Weed (SPCS)

Dr. Becky Bowling
Assistant Professor & Extension Specialist for Urban Water - Dallas Center. Texas A & M University

Tuesday, December 1st

Annual Awards and Education

1:00 p.m.
Annual Meeting and Awards!

General Sessions Frisco 1-2

2:00 p.m.

So you want to be a Meteorologist??
Weather Hazards and Your Venue
Dr. Kevin Kloesel
Emergency Manager and University Meteorologist
University of Oklahoma

3:00 p.m.

Creating a Water Quality Management Plan Worth its Salt
Dr. Becky Bowling
Assistant Professor & Extension Specialist for Urban Water
Department of Soil and Crop Sciences,
The Dallas Center, Texas A & M University

CONTINUING EDUCATION UNITS
TDA Ag: 1 Laws & Regs, 2 IPM, 5 General
TDA SPCS: 2 Weed, 1 L&O, 1 Pest, 1 General L&R

GCSAA Approved Points:
TDA Lecture 0.70; 12/1/20: 0.50; 12/2/20: 0.30;
TCEQ Session 0.70

GCSAA
Golf Course Superintendents Association of America

Wednesday, December 2nd

Morning and Afternoon Sessions

BRUNCH WITH THE EXHIBITORS
9 a.m. - 11:30 a.m.

SILENT AUCTION CLOSES & PRIZE DRAWING AT 11am

Complimentary Head-shots will be offered courtesy of *Photography by JT*

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THOMAS TURFGRASS Grass & Installation

12:00 p.m.

TEXAS STMA
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Location : Bush and Erudia Room

System Hydraulics & Design Trouble shooting

8:00 a.m.— 5:00 p.m.

(CEU'S approved)

David Torres: L10003537; WETS Instructor

Location: Bass Room

At a time in Texas when our water supplies are being depleted faster than they can be replenished, it is the responsibility of the stakeholders to be more efficient with this valuable resource. This course covers & helps troubleshoot designs with emphasis on hydraulics & pressure losses to make sure the irrigation plan is most efficient.

Wednesday, December 2nd

Afternoon Concurrent Sessions

Golf Session
Frisco 3

1:15 p.m.

Equipment Calibration for Successful Pesticide Application 1 Gen-Equipment Characteristics (AG); 1L&O (SPCS)

Dr. Chrissie Segars
Extension Turfgrass Specialist
Texas A&M AgriLife

2:15 p.m.

Optimizing Turfgrass Performance Using Advanced Monitoring Technology and Practical Analysis Methods

Carmon Magro
Vice President - Stevens Water Monitoring Systems - POGO TurfPro

3:15 p.m.

Turf Colorants: Myths, Realties, and the Latest Research on Their Use
1 Gen-Pesticide Factors

Dr. Benjamin Wherley
Associate Professor Turfgrass Science & Ecology Dept.

Sports Turf Session
Frisco 4

1:15 p.m.

USA Softball in OKC the Softball Capital of World

Jeff Salmond, CSFM
Vice President
United Turf and Track

2:15 p.m.

Baseball/Softball Field Maintenance: What Almost 30 Years Has Taught Us

Craig Sampsell
Andrew Batts
Sports Field Solutions

3:15 p.m.

Athletic Field Paint and Turfgrass Health
1 IPM (AG)

Dr. Chrissie Segars
Extension Turfgrass Specialist
Texas A&M AgriLife Extension

Commercial Session
Frisco 5

1:15 p.m.

Goosegrass and the Next Annual Bluegrass

Dr. Eric Reasror
Southeast Research Scientist
PBI – Gordon Corporation

2:15 p.m.

A Review of TDA Pesticide Laws and Regulations
1 Laws &Regs (AG); 1 Gen Standards (SPSC)

Hendry Krusekopf
Assistant Regional Director
Pesticides Region 2 – Dallas

3:15 p.m.

Warm Seasons Turfgrass Disease and Nematode Management
1 General– Pest Features (AG)

Dr. Young -Ki Jo
Professor & Extension Specialist
Dept. of Plant Pathology

Texas Turfgrass Association

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Dr. Chase Straw
Assistant Professor - Turfgrass Management and Physiology
Texas A&M University

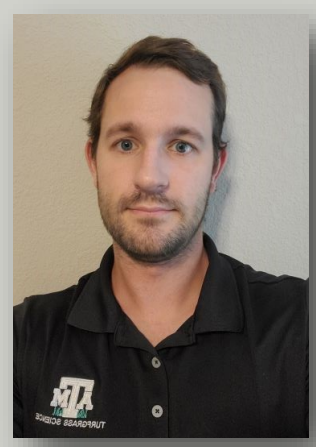
Dr. Chrissie Segars
Extension Turfgrass Specialist
Texas A&M AgriLife Extension

Dr. Joey Young
Associate Professor of Turf Science
Department of Plant and Soil Science
Texas Tech University

Dr. Benjamin Wherley
Associate Professor
Turfgrass Science & Ecology Dept.
Soil and Crop Science
Texas A&M University

Dr. Becky Bowling
Assistant Professor &
Extension Specialist for
Urban Water; Dept. of Soil and Crop Sciences, Dallas Center.
Texas A & M University

Keeping Texas Green since 1947



Andrew Osborn, MS
Graduate Research Assistant
Texas A&M University

Carmen Magro, CGCS
Vice President
Stevens Water Monitoring Systems
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Dr. Kevin Kloesel
Emergency Manager and University Meteorologist, University of Oklahoma

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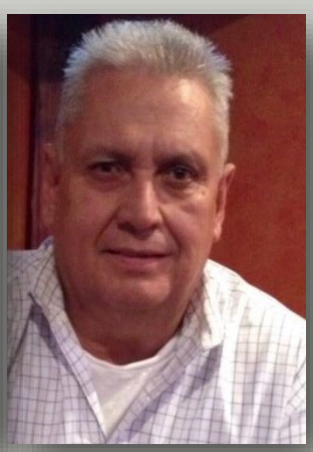
Hendry Krusekopf
Texas Department of Agriculture



David Torres
Instructor
Water Educational Training Services

Steve Trotter
Midwest Turf Services

Andrew Batts
Sports Field Solutions

Craig Sampsell
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Sports Field Solutions

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RESEARCH

Benjamin Wherley, Ph.D.

Baoxin Chang, M.S.

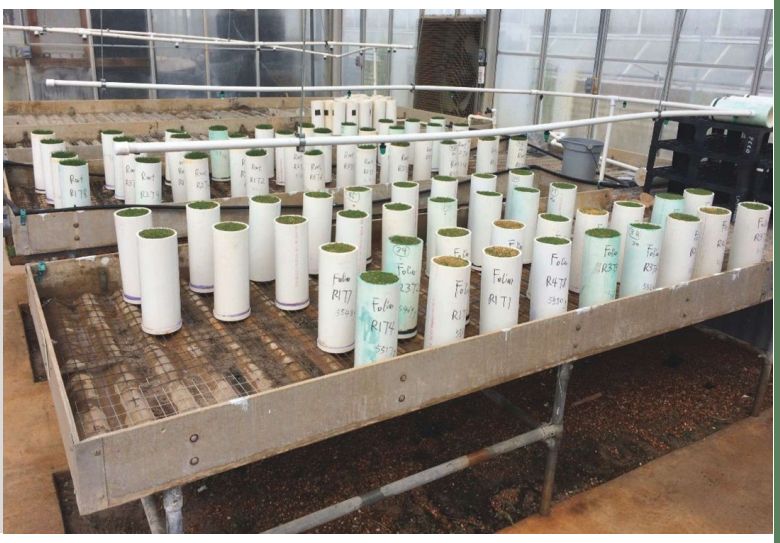
Jacqueline Aitkenhead-Peterson, Ph.D.

Jason West, Ph.D.

This research was funded in part by a grant to GCSAA from the Environmental Institute for Golf.

Effects of irrigation chemistry on Tifway bermudagrass performance and nitrogen uptake

Tifway bermudagrass maintained acceptable quality and efficient uptake of fertilizer nitrogen at irrigation salinity levels up to 5 dS/m.



A study of the effects of irrigation water chemistry and nitrogen source uptake on Tifway bermudagrass was conducted in a greenhouse at Texas A&M University, College Station, Texas. Photo by Baoxin Chang

As availability of potable water for irrigation of turfgrass systems declines, golf course superintendents must increasingly manage turfgrass using lower-quality water sources. Currently, more than one-third of golf courses in the southern United States use recycled water for turf irrigation (5). While often a cheaper alternative to potable water, recycled or effluent water usually contains elevated levels of salinity.

CHEMISTRY OF IRRIGATION WATER

Irrigation water is generally considered to pose low salinity hazard at EC (electrical con- ductivity) < 0.75 dS/m (decisiemens/meter), medium hazard at EC = 0.75 to 1.5 dS/m, high hazard at EC = 1.5 to 3 dS/m, and very high hazard at EC > 3 dS/m (2). If not managed through leaching, soil EC can rapidly accumulate to levels exceeding that of irriga- tion water, especially during periods of high evaporative demand and low precipitation. Previous research (2) summarized an extensive amount of turf salinity literature and reported an overall average ECe (saturated soil paste extract) threshold for hybrid bermudagrass of 3.7 dS/m, although reported ECe values have ranged from 0 to 10 dS/m, depending on the study and cultivar used (2).

Irrigation chemistry can directly impact turfgrass growth, water use rates and soil phys- ical properties (3), but there has been limited research aimed at impacts of irrigation and/ or tank-mix water chemistry on foliar or root uptake of various nitrogen sources. Research published in 2013 (4) showed that 31% to 56% of foliar nitrogen uptake in creeping bentgrass putting green turf occurred within eight hours of application and that foliar absorption effi- ciency could be affect- ed by nitrogen source used (4). When common bermudagrass was fertilized using ammonium nitrate at rates up to 1.5 pounds nitrogen/1,000 square feet/ month under increasing salinity levels up to 6.0 dS/m (1), the authors reported nitrate leaching remained low for all treatments, with leachate nitrate concentrations averaging 0.3 milligram nitrogen/liter — less than 1% of the applied nitrogen.

As golf course superintendents become more reli- ant on low-quality water sources, knowledge of the impacts of water chemistry and salinity on availability and uptake of nitrogen becomes an important consideration, both for superintendents

Chemical parameters associated with irrigation water treatments

	Sodium hazard	Salinity hazard	EC (dS/m)	pH	Bicarbs (ppm)	SAR
Reverse osmosis	low	low	0	5.9	0	0.1
Sodic potable	high	low	<1	8.4	509	33.7
2.5 dS/m saline	high	medium	2.5	6.3	0	58.9
5 dS/m saline	high	medium	5	6.3	0	117.9
10 dS/m saline	high	high	10	6.2	0	294.8

Abbreviations: EC = electrical conductivity, Bicarbs = bicarbonates, SAR = sodium adsorption ratio

Table 1. Chemical parameters associated with irrigation water treatments used in the nitrogen uptake study.

and fertilizer manufacturers. This is true from a tank-mix/foliar application perspective and also from a root-zone/soil chemical standpoint. Various soluble inorganic nitrogen sources are available for use in turf fertilization programs. Knowledge of potential interactions of water chemistry on foliar or root uptake of various inorganic nitrogen sources could aid superintendents in optimizing plant health and in minimizing environmental losses of nitrogen. Such information could also help to define thresholds at which increasing root- zone salinity begins to impair bermudagrass nitrogen-uptake efficiency. This information could ultimately contribute to development of improved best nutrient management practices for the golf course superintendent.

The objectives of this study were to evaluate the effects of five irrigation water sources - reverse osmosis (RO), sodic potable (SP), and saline (SA) at 2.5, 5 and 10 dS/m — and two soluble fertilizer nitrogen sources — 15N- labeled sources of ammonium sulfate and urea - on Tifway bermudagrass quality, growth and nitrogen-uptake efficiency.

APPROACH

This study was conducted in a greenhouse at Texas A&M University, College Station, Texas. The study was arranged as a completely randomized block design with four replicates. A golf cup cutter was used to remove Tifway bermudagrass (Cynodon dactylon × C. transvaalensis Burtt-Davy) sod plugs, 4 inches (10 centimeters) in diameter, from established fairway research plots at the Texas A&M Turfgrass Research Field Laboratory. Sod plugs were washed free of soil and, following USGA recommendations, were established into medium-coarse sand [90:10 (v:v) sand: peat moss] in PVC columns (4 inches in diameter × 11 inches deep; 10 × 28 centimeters).

Following a two-week establishment period with reverse osmosis irrigation, turf was irrigated over eight weeks using five irrigation sources: sodic potable, reverse osmosis, or saline water with EC of 2.5, 5 or 10 dS/m. Sodic potable water was from a local municipal potable water source and represented a sodium hazard, but no salinity hazard based on United States Salinity Laboratory classification (6). Reverse osmosis water was produced from an onsite reverse osmosis unit, and sa- line water was produced by mixing sodium chloride (NaCl) with reverse osmosis water to achieve desired EC levels (Table 1). At the initiation of the study period, lysimeters were irrigated to saturation using the respective irrigation sources. Twice weekly during the study period, lysimeters were weighed and hand- watered back to their respective saturation weights using the respective water sources. In this way, lysimeters were managed using a slight leaching fraction, minimizing the potential for salts to accumulate beyond the electrical conductivity of the irrigation water.

Turf was clipped weekly at 0.5-inch (1.27-centimeter) height of cut and fertil- ized at a rate of 0.2 pound nitrogen/1,000 square feet (0.98 gram/square meter) weekly, using a nitrogen-depleted nutrient solution with nitrogen source added from either urea (NH_2CONH_2) or ammonium sulfate [$(NH_4)_2SO_4$]. During the 10-week study, clipping dry weights, evapotranspiration rates, lightbox images for determination of percent green cover and turf quality ratings were also determined on a weekly basis.

At the end of the 10-week study, ^{15}N- labeled fertilizer solutions were individually prepared for urea and ammonium sulfate nitrogen treatments using each water source (reverse osmosis, sodic potable, and saline 2.5, 5 and 10 dS/m). Thus, treatments were consistent with the same treatments under which turf had been managed for the initial 10 weeks, but now including labeled ^{15}N for subsequent tracing into plant tissues. These solutions were prepared to a final ^{15}N enrichment of 10 atom percent and applied at a rate of 1 pound nitrogen/1,000 square feet (5 grams/square meter), delivered directly into the upper soil surface via syringe in a volume of 1 fluid ounce (30 milliliters).

After a 48-hour uptake period, root-zone EC was measured at the 1-inch (2.5-centi- meter) soil depth. Above-ground shoot tissues and below-ground root tissues were thoroughly rinsed using distilled water to remove any extracellular nitrogen. Above-ground plant tissues (shoot and verdure fractions) were oven-dried, ground and milled to a fine powder before submitting for determination of total nitrogen and percent ^{15}N via mass spectrometry analysis at Texas A&M Univer- sity. This information provided data on the relative uptake differences among the treatments and insight into water quality × nitrogen source interactions on bermudagrass up- take efficiency.

Findings

Turf performance

Irrigation chemistry significantly affected turf quality during both years of our study (Figure 1). With the exception of the 10 dS/m salinity treatment, turf quality in all treat- ments remained above 7 (on a scale of 1-9, where 1 is dead turf, 6 is minimum acceptable turf quality, and 9 is the highest-quality turf) throughout the study period. The 10 dS/m sa- linity treatment noticeably declined over the eight-week period and eventually fell to below acceptable turf quality ratings by the eighth week. Turf quality was highest in reverse osmosis, sodic potable and 2.5 dS/m saline, which all generally maintained turf quality ratings between 8 and 8.5. Quality of the 5 dS/m saline treatment was intermediate to these and to the 10 dS/m saline treatment, generally scoring between 7.5 and 8 across the rating dates.

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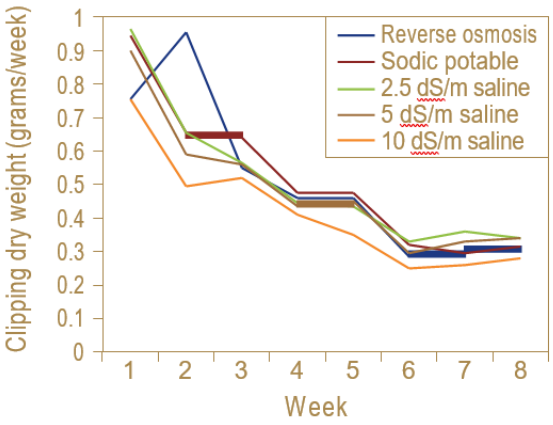

Figure 1.

The influence of irrigation water chemistry on Tifway bermudagrass turf quality throughout the eight-week study period.

Turf quality was rated on a scale of 1-9, where 1 is dead turf, 6 is minimum acceptable turf quality, and 9 is the highest-quality turf.

Data are averaged over both years.

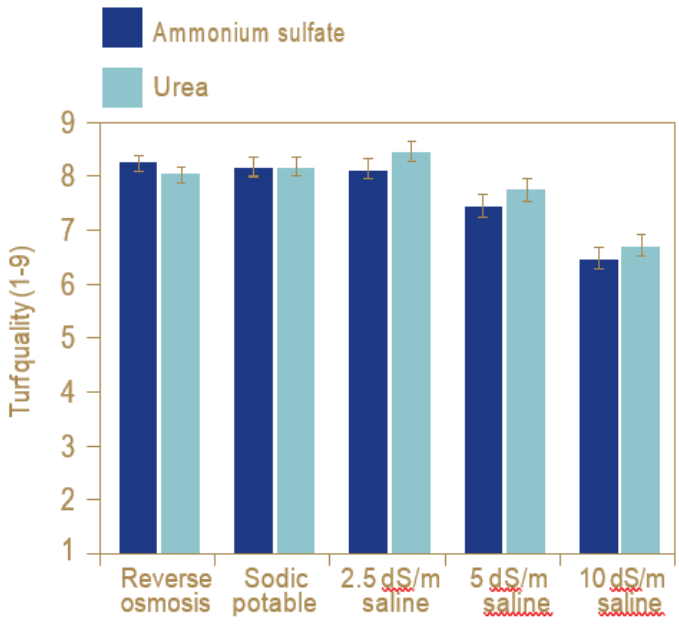

Figure 2.

The effect of nitrogen source on Tifway bermudagrass turf quality.

Turf quality was rated on a scale of 1-9, where 1 is dead turf, 6 is minimum acceptable turf quality, and 9 is the highest-quality turf.

Data are averaged over rating dates and years. Error bars denote standard error.

Continued from previous page

Irrigation chemistry significantly affected turf quality during both years of our study (Figure 1). With the exception of the 10 dS/m salinity treatment, turf quality in all treat- ments remained above 7 (on a scale of 1-9, where 1 is dead turf, 6 is minimum acceptable turf quality, and 9 is the highest-quality turf) throughout the study period.

The 10 dS/m salinity treatment noticeably declined over the eight-week period and eventually fell to below - acceptable turf quality ratings by the eighth week. Turf quality was highest in reverse osmosis, sodic potable and 2.5 dS/m saline, which all generally maintained turf quality ratings between 8 and 8.5. Quality of the 5 dS/m saline treatment was intermediate to these and to the 10 dS/m saline treatment, generally scoring between 7.5 and 8 across the rating dates.

There was also an interaction between irrigation chemistry and nitrogen source (Figure 2). Turf quality declined with increasing salinity from 2.5 to 10 dS/m. Although not the case in reverse osmosis and sodic potable treatments, urea resulted in slightly elevated turf quality relative to ammonium sulfate within the 2.5, 5 and 10 dS/m saline treat- ments. Percent green cover data followed similar trends as the previously described turf quality responses (data not shown).

Clipping dry weights

Irrigation chemistry led to differences in clipping dry weights among the treatments, although nitrogen source did not (Figure 3). Clipping dry weights, which decreased over the course of the study period from ~0.9 to 0.3 gram/week across all treatments, were noticeably lower within the 10 dS/m saline compared to all other treatments. Little detectable difference in clipping dry weights could be detected among all other treatments, although during the final two collection dates, a trend toward greater clippings was noted in 2.5 and 5 dS/m saline treatments.

Fertilizer nitrogen uptake

Of the 1 pound nitrogen/1,000 square feet rate applied, total uptake over the 48-hour period ranged from 25% to 60% of applied (Figure 4). Also, under all water sources, nitrogen uptake was 10% to 30% higher when ammonium sulfate was used instead of urea. Interestingly, nitrogen uptake increased for both nitrogen sources with increasing salinity, peaking at 5 dS/m. However, at 10 dS/m, up- take declined, suggesting impairment of up- take because of excessive salinity stress.

Soil electrical conductivity

Soil EC, measured at the 1-inch depth at the end of the 15N uptake period just before flushing, increased with increasing irrigation salinity (data not shown). In year one, the 1-inch depth soil EC ranged from ~1 to 3 dS/m (reverse osmosis and 10 dS/m saline, respectively). However, in year two, soil EC was increased relative to 2016 for all treatments, ranging from ~1 to 5 dS/m (reverse osmosis and 10 dS/m saline, respectively). An interaction between irrigation and nitrogen source also occurred for soil EC in year two, with ammonium sulfate fertilization leading to slightly higher soil EC compared to urea under reverse osmosis and 2.5 dS/m saline, but not at 5 or 10 dS/m saline levels.

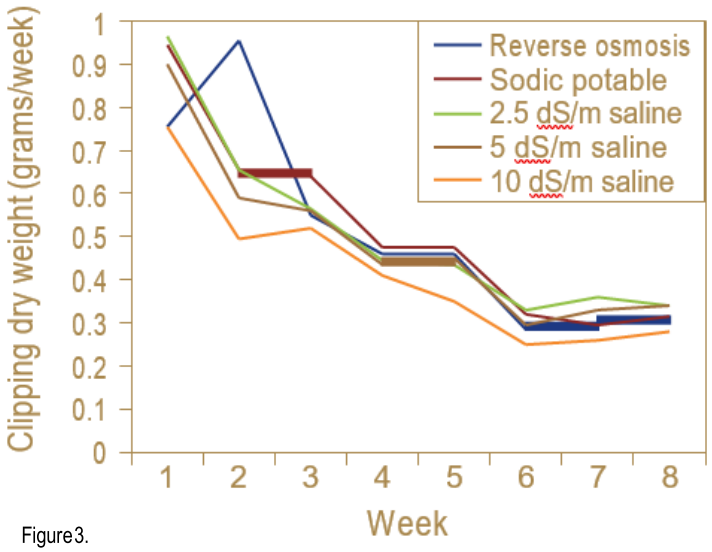

Figure 3.

The effects of irrigation water chemistry on Tifway bermudagrass clipping production during the study period. Data are averaged over both years.

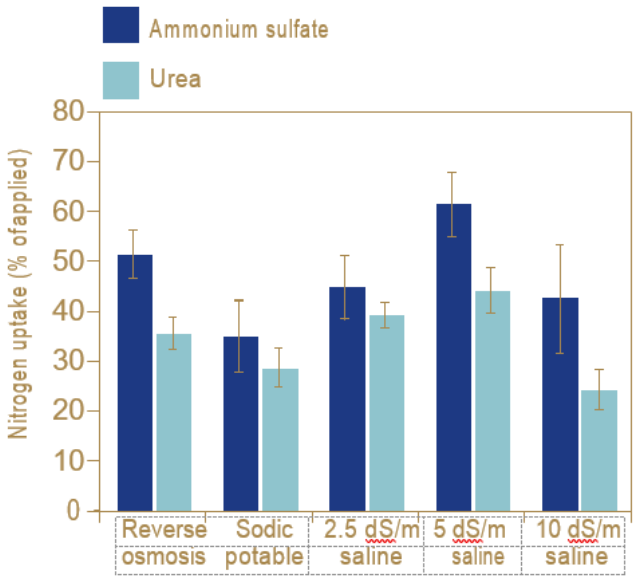

Figure 4.

The effect of irrigation water chemistry on uptake of two nitrogen sources by Tifway bermudagrass. Data are averaged over both years. Error bars denote standard error.

Summary

With increasing use of recycled water on golf courses, salinity stress is likely to become a more common issue for turf managers. The findings from our work showed that Tifway bermudagrass is capable of maintaining acceptable quality and efficiently taking up fertilizer nitrogen at irrigation salinity levels up to 5 dS/m, which in our study corresponded to final soil EC levels (at a 1-inch depth) of ~2.5 dS/m. However, at 10 dS/m irrigation salinity, which corresponded to soil EC levels of ~3 to 5 dS/m, turf quality noticeably declined to below acceptable levels, with corresponding reductions in nitrogen uptake. Our findings are consistent with those of previous researchers (1), who reported no increase in nitrogen leaching from common bermudagrass with increasing irrigation salinity up to 6 dS/m.

Across all irrigation sources, nitrogen uptake was 10% to 30% higher with ammonium sulfate than with urea. However, with saline irrigation treatments, urea resulted in superior turf quality. Collectively, the results suggest that reductions in hybrid bermudagrass nitrogen fertilization rates should not be necessary until irrigation EC levels begin to exceed 5 dS/m.

Funding - This research was made possible through a grant to the Golf Course Superintendents Association of America by the Environmental Institute for Golf.

Acknowledgments - This research was originally published as "Irrigation salinity effects on Tifway bermudagrass growth and nitrogen uptake" by B. Chang, B.G. Wherley, J. Aitkenhead-Peter- son and J.B. West. Crop Science 59:1-9 (2019) (doi:10.2135/cropsci2019.01.0065). Originally Published in ***Golf Course Management.***

The RESEARCH SAYS

- Tifway bermudagrass maintained acceptable quality and efficient uptake of fertilizer nitrogen at irrigation salinity levels up to 5 dS/m.
- At 10 dS/m irrigation salinity, turf quality declined below acceptable levels, with corresponding reductions in nitrogen uptake.
- Across all irrigation sources, nitrogen uptake was 10% to 30% higher with ammonium sulfate than with urea.
- Reductions in hybrid bermudagrass nitrogen fertilization rates should not be necessary until irrigation EC levels begin to exceed 5 dS/m.

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Authors

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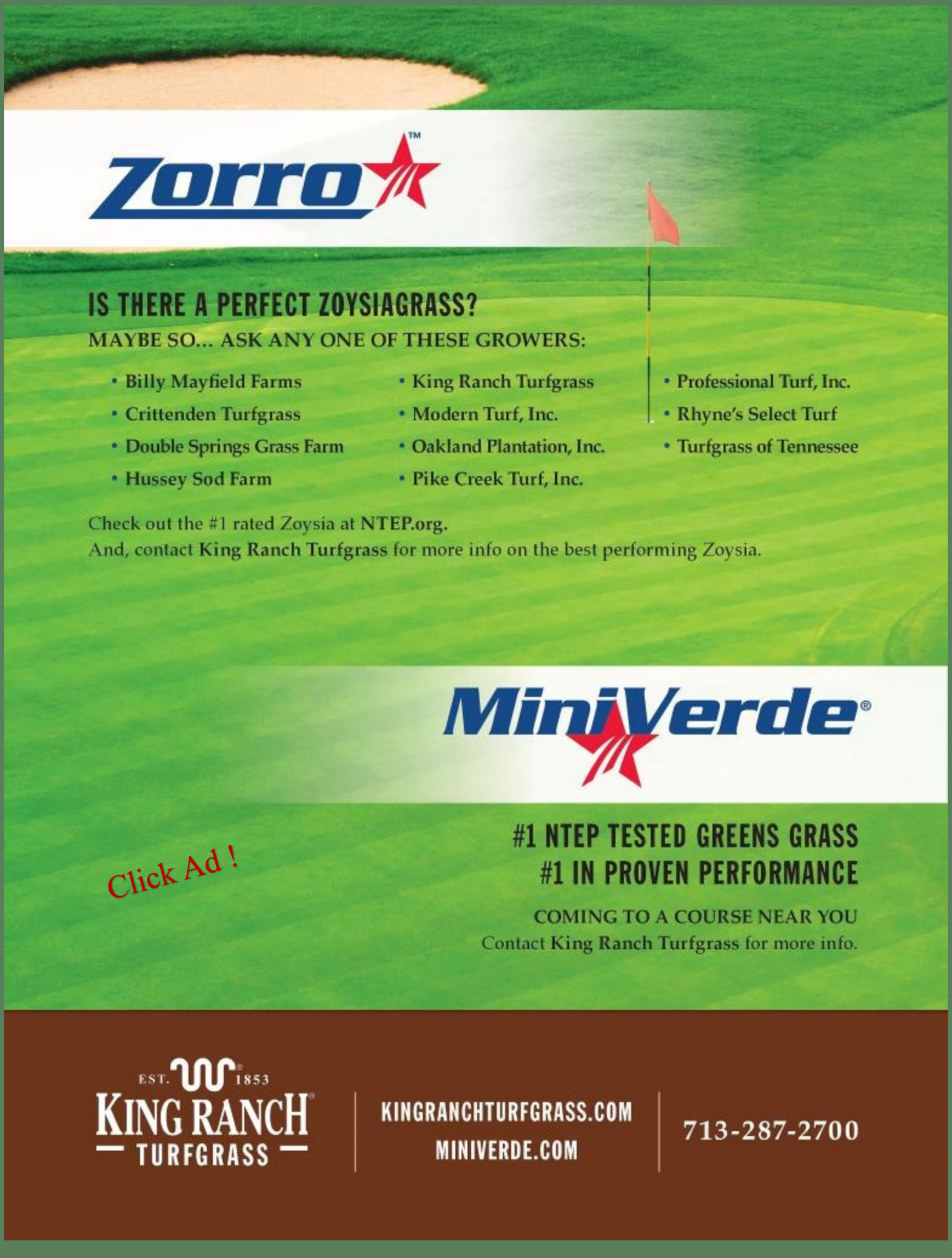
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