Project/Activity Number: NCERA221
Project/Activity Title: Turfgrass and the Environment
Period Covered: July 18, 2022 to June 8, 2023
Date of This Report: November 1, 2023
Annual Meeting Date(s): June 7 to June 8, 2023

Participants:
Li, Deying <deying.li@ndsu.edu> – North Dakota State University (https://www.ndsu.edu/agriculture/academics/academic-units/plant-sciences); Gardner, David gardner.254@osu.edu> – The Ohio State University (https://bygl.osu.edu/); Frank, Kevin <frankk@msu.edu>
– Michigan State University (https://www.canr.msu.edu/); Amanda Folck <afolck3@unl.edu> – University of Nebraska-Lincoln (https://turf.unl.edu/); Christian, Nick <nchris@iastate.edu> – Iowa State University (https://www.hort.iastate.edu/); Xiong, Xi <xiongx@missouri.edu> and Smeda, Reid <SmedaR@missouri.edu> – University of Missouri (https://cafnr.missouri.edu/); Derek, Settle <dsettle@cdga.org> – Chicago District Golf Association (CDGA) (https://www.cdga.org/)

Brief summary of minutes of annual meeting:

June 7, 2023, at Dickinson Research and Extension Center.

At 8:00 am local time, Deying Li called the meeting to order. The meeting agenda was motioned by Xi Xiong, seconded by David Gardner, and unanimously approved. State reports were given by those attending and announced for those absent.

At 9:30, the group headed to Medora, ND. Visited Bulley Pulpit Golf Course to observe water conservation, turfgrass stress related research, and general turfgrass management. The group then visited Chateau De Mores for the history of local development. Luch break held at 1:00 pm to 2:00 pm. The group then visited Roosevelt National Park focusing on conservation and biodiversity. Returned to Dickinson at 6:30 and had a social discussion over dinner.

June 8, 2023, at Dickinson Research and Extension Center.

Meeting called to order at 8:00 am.

Nick Christians gave historian report and discussed the meeting site and host for 2024. It was proposed to be hosted at the University of Wisconsin. Dr. Douglas Soldat at the University of Wisconsin has agreed via email communication to host. It was also identified that the Ohio State University should be the host for 2025 meeting.

Current project and presentations were given by David Gardner on organic weed control, by Xi Xiong on hunting bill bug biology on golf course and potential biological control, and by Derk on management research sponsored by CDGA.

New project discussion: attendees discussed group work and funding potential by USDA and agreed to continue the discussion via email and other opportunities for future collaborative projects.

The meeting adjourned at 2:00 pm local time.

Accomplishments:

Our research activities resulted in training 9 graduate students, and several scientific publications and presentations. Outreach activities including presentations and other communication reaches clients with different backgrounds.

Environmental sensing nodes, equipped with multiple sensor types including oxygen and carbon dioxide gas, were deployed at over 60 golf courses worldwide, many in the north central region. Initiated several new projects related to winter stresses of turfgrass in collaboration with NCERA faculty at Minnesota, Wisconsin, Iowa State, Michigan State, Ohio State.

Calcium, when added to an intensively managed turf system, can help creeping bentgrass to cope with dollar spot, especially during cold temperatures. Thus, significantly reduce the needs for fungicide application. A separate research project also developed a novel, mechanical approach to control billbugs, which has become an emerging issue in many north central states.

We discussed publication preparations of a finished research project on crabgrass control. That study found different efficacies occurred at different research sites within our NCERA region (upper Midwest). Researchers investigated alternatives to herbicides and the two chosen were corn gluten meal timed as a pre-emergent and Fe timed as a post-emergent. Dan Gardner, OSU presented a research summary.

Plant Diagnostic Clinic reinstalled at University of Missouri.

The Chicago District Golf Association Turfgrass Program was launched in 1985 with the hiring of Dr. Randy Kane. The foundation of the Turfgrass Program is to provide research-based solutions to 400 member clubs and uses three vehicles to reach turfgrass professionals: education, research, and diagnostics.

When the Association moved into the Midwest Golf House in 2001, numerous programs and services, including the Turfgrass Program, were expanded to benefit the membership. The newly constructed Sunshine Course located at Midwest Golf House was designed to facilitate turfgrass research. This research site allows for collaborative research projects with other industry and academic professionals across the Midwest.

Numerous educational opportunities exist for CDGA member clubs. Research findings are disseminated to member clubs through various in-person and online avenues. In-person opportunities include educational meetings at various events including numerous GCSAA chapter meetings across the Midwest. Additionally, the CDGA hosts educational opportunities each year at the Midwest Golf House. Online education includes the use of weekly scouting reports, research reports, social media, and other digital platforms.

CDGA also hosted the following in the past year:

Turfgrass Seminar. Bob Berry Sunshine Course, Mar 25, 2023. Lemont, Illinois.

PBI-Gordan turfgrass field day-Jul 12, 2022. Bob Berry Sunshine Course, Lemont, Illinois.

Bluecoat Field Day featuring the USGA Green Section and Wadsworth Golf Charities -Sep 12, 2022. Bob Berry Sunshine Course, Lemont, Illinois.

Ohio State University Turfgrass Student Tour – Nov 3, 2022. Bob Berry Sunshine Course, Lemont, Illinois.

Short Term Outcomes:
This spring re-establishment seeding research was conducted at MSU, University of Minnesota, University of Wisconsin, and Iowa State University. On three consecutive weeks in the spring of 2023 four creeping bentgrass cultivars and Two-Putt annual bluegrass were seeded into a bare soil sand-based putting green. The bentgrass cultivars were Penncross, Declaration, Pure Distinction and A4. Previous seed germination research at the University of Minnesota found that some bentgrasses displayed high germination rates at low temperatures while others performed poorly. As a first step in our research, we designed a study to compare bentgrass cultivars and Two-Putt annual bluegrass over three seeding dates in the spring in the field. At MSU we also seeded a trial into a pre-existing annual bluegrass putting green that was killed with glyphosate prior to seeding.

Long-term projects:
Faculty member K. W**. Frank**

Nitrogen leaching research was initially conducted at Michigan State University in 1991. The initial research conducted from 1991 through 1993 indicated that there was minimal risk of nitrate-nitrogen leaching from turfgrass. Subsequent years of research on the same lysimeters indicate the risk of nitrogen leaching changes as the turf ages. Since the summer of 1998 percolate samples have been collected from the same monolith lysimeters and analyzed for nitrate-nitrogen. From July 1998 through 2002, lysimeters were treated annually with urea at a low N rate 2 lb. N/1000 $ft.^2$ and a high N rate 5 lb. N/1000 $ft.^2$. In 2003 the N rate was reduced to 4 lb. N/1000 $ft.^2$ for the high N rate while the low N rate remained at 2 lb. N/1000 $ft.^2$. During the first year (2003) of reducing nitrogen application rates from 5 to 4 lb. N/1000 $ft.^2$ there was no reduction in nitrate-N concentrations in leachate. However, after 15 years of annual 4 lb. N/1000 $ft.^2$ applications there was a significant and sustained reduction in the amount of nitrate-N leaching to the point that the mean leaching concentrations are now approximately equivalent to when the research was initiated in 1998. July 2023 will mark the beginning of the 25th consecutive year of leachate collection and 33 years since turfgrass was established on the lysimeters. It has been 25 years since the high N rate of 5 lb. N/1000 ft.2/yr was initially applied and resulted in high levels of NO_3-N leaching at ten years after turf establishment. Following the N rate reduction, leachate NO_3-N concentrations declined over an approximately 15-year period. The turfgrass growing on the lysimeters is now 33 years old and our objective is to determine if a high N rate of 5 lb. N/1000 ft^{-2}/yr will produce a similar result in NO_3-N leaching as measured at 10 years after turfgrass establishment.

Faculty member **Emily Merewitz-Holm**

Project: Influence of fall mowing height changes on winter survival of annual bluegrass putting greens

Description: In theory for perennial species, the accumulation of sugars from photosynthetic leaf tissues that can go into storage as starches is very important for winter survival and the quantity stored could be influenced by mowing height. The carbohydrates are largely transported from the leaves or root system and stored in crown or other overwintering structure. Theoretically, if annual bluegrass is allowed to develop more leaf surface area for photosynthesis, more carbohydrates could be stored and used for regrowth in the spring; however, annual bluegrass's unique genetics and flowering capacity calls into question whether annual bluegrass will benefit from increased mowing heights and extra storage carbohydrates. Golf course superintendents may be reluctant to raise cutting heights of putting greens due to slower green speeds and the demand to maintain optimal playing conditions as long into the fall as weather permits play. Typically, if superintendents raise cutting heights at all it is when play is declining. Raising the mowing height would be a viable and cost- effective practice to adopt. But first, superintendents need more information on at what level and on approximately what date the mowing height needs to be raised to see any increase in winter survival. Perhaps there is a minimum height that would photosynthetically compensate for the fact that superintendents would prefer to wait very late in the season to raise the mowing height. Thus, the objective of this study is to determine the effect of mowing height on winterkill survival of annual bluegrass putting greens. We hypothesize that raising mowing heights in September from a 0.125 inch standard height to higher levels of cut will reduce winterkill associated with ice cover on annual bluegrass putting greens.

Project: Soil water content and ethylene effects on annual bluegrass winterkill

Description: Winterkill damage to annual bluegrass putting greens and fairways is a significant issue in the turfgrass industry, costing millions of dollars annually in northern temperate areas. Turfgrass managers have expressed a large need for scientifically based management strategies that can reduce winter damage associated with ice and other stresses. Covers and other current management strategies often result in inconsistent protection or are not feasible on large areas. Our research aims to identify chemical management strategies to improve annual bluegrass survival of winter conditions that can be applied broadly and cost effectively. The goals of this study are to better understand annual bluegrass acclimation and overwintering in response to varied levels of soil moisture, plant protective products, and chemicals that regulate the plant hormone ethylene. The methods will include field -based treatments of chemicals and natural acclimation during the fall followed by turfgrass plugs being transferred into controlled environment low temperature growth chambers to evaluate low temperature and ice in a controlled way. This combined research approach has allowed for successful field evaluation in the fall and spring as well as consistent ice and low temperatures during the winter months in previous research.

Project: Characterization of turfgrass plant induced defenses in response to annual bluegrass weevil (ABW) feeding

Description: This study is in collaboration with Dr. Ben McGraw from Penn State. We will assess induced defense mechanisms in turfgrasses in response to insect herbivory by the annual bluegrass weevil (ABW) at various life stages. Plants being immobile organisms are highly vulnerable to abiotic and biotic stressors throughout their life. Our understanding of how plants

protect themselves from insect attack is improving, yet studies in turfgrass are lacking. We will investigate grass hormone and protein responses, which will aid in distinguishing insect defense responses from general mechanical damage. The proposed project would not only improve our knowledge of the turfgrass-insect pest interactions but may identify opportunities for enhancing tolerance within existing turfgrass stands (i.e. priming the stand) or identify desirable plant traits that could be selected for in new cultivars, and thereby reducing the need or amount of insecticide applications and reducing potential insect resistance to pesticides. Currently, turfgrass managers are interseeding CBG into ABW-infestations in hopes of reducing populations over time. This project would provide information as to whether this is a sustainable approach, identify potential resistance/tolerance mechanisms, and cultivars that would be the most effective candidates for defense against ABW. Additionally, the findings of the project would inform management of other turfgrass insect pests with a similar feeding habit or life cycle.

Faculty member **Thomas A. Nikolai**
Project: Lightweight rolling, PGR, green speed and collar research
Description: Research at Michigan State University has made lightweight rolling of the putting green a common mechanical practice. Benefits on lightweight rolling discovered at MSU include decreased turfgrass disease, localized dry spot, and broadleaf weeds while increasing putting green smoothness (green speed). However, some golf courses experience thinning of collars from frequent lightweight rolling. This research will focus upon interactions between PGR's, lightweight rolling, and mowing height on the thinning of turfgrass collars along with the effect on putting green speed.

Project: Lightweight rolling establishment studies
Description: In a study performed at MSU in 2005 it was apparent that lightweight rolling increased the density on newly seeded putting surfaces, however, no data, except digital images, was collected. This study will incorporate timing and frequency of rolling following seeding to collect data regarding percentage turfgrass cover over time. Obviously, the quicker the establishment the faster areas can be open for play which has an economic impact. Lightweight rolling establishment studies will take place on the putting green and on fairways.

Project: Fairway rolling research and customer satisfaction
Description: As mentioned earlier MSU has made lightweight rolling of putting greens a common mechanical practice due to the numerous benefits of the practice. Research performed on fairways has had mixed results and it has become apparent to MSU turfgrass researchers that heavier rollers are required on fairways to see reductions in disease and localized dry spot (please don't start this practice without having a conversation with me). This summer we will attempt to quantify the difference in ball roll length between fairways that are rolled to those that are not rolled. Additionally, we will be performing an establishment study with fairway rolling as well.
Faculty member **John N. Rogers, III**
Project(s): Sod on plastic establishment practices for cool-season grasses
Description:
Sod grown on plastic, commonly called Sod on Plastic (SOP), isa method of sod production on a thin layer of growing medium on top of a plastic sheet. Benefits of growing SOP: Complete

control over the growing medium, preventing soil layering issues; Ability to harvest the whole rootzone without damaging the roots, avoiding transplant shock during sod installation; Smooth playing surface after sod installation; Faster establishment rate, reducing production time from 18 months to 4 months; Being able to produce sod on non-arable lands (e.g., concrete).
Faculty member: **Joe Vargas, Jr.**
We propose to examine the impact of creeping bentgrass cultivar (CBG) including a susceptible cultivar, Penncross, an intermediate cultivar, Shark, and highly resistant cultivar, Coho, in combination with dew removal and a biocontrol on the development of dollar spot. Techniques to control dollar spot, the costliest disease on golf courses from a management perspective, have been studied at length, but there are still many questions which need to be addressed in order to develop more consistent, economical management strategies.

The study will be set up with three replications of each treatment. The study site has been seeded to large plots of Coho, Shark and Penncross creeping bentgrass. Dew will be removed on a frequent, consistent basis in the plots. Biocontrol treatment applications will be made at 48 GPA or 96 GPA using a CO2-powered backpack sprayer. Fertility will be applied as needed. The study site will be inoculated with a sand-cornmeal mixture infested with the disease pathogen. Treatment applications will be made according to label standards. Plots will be rated visually for percent plot area blighted by disease and for turfgrass quality. Photos will be taken periodically during the trial.

Publications:

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