

**NCERA221: Turf and the Environment
Iowa State University, Ames, IA, June 10 and 11, 2015**

1. The NCERA221 Meeting took place at the Reiman Gardens, Iowa State University, Ames, IA, on 10 and 11 June 2015. The Meeting followed the agenda provided by Shuizhang Fei (Attachment 1).
2. State Reports (Attachment 2).
3. Growth Potential Model Validation Project Report, Bill Kreuser (NE) (Attachment 3). Bill will develop project protocol and proposal. Contact Bill for additional information and to provide data for meta-analysis and other participation. R. Gaussoin indicated that it will be difficult (impossible?) for this to become a NCERA-funded project.
4. 2015 NTEP Update, Eric Watkins (Attachment 4). A Low-Input Cool-Season Turf Trial is to commence in 2015 with homeowner orientation. There is interest in publishing regional cultivar/species data in *HortTechnology* or *Applied Turf Science* (A. Patton).
5. Regional Roadside Turfgrass Testing Program Report, Eric Watkins (Attachment 5). To participate, matching funding from your state's DOT is required. At present, MI, MN, and WI plan to participate. Contact Eric for additional information and possible participation.
6. GCSAA, A. Patton. Hiring GCSAA Research Director on hold. Likely have \$100,000 in 2015 research funding.
7. The NCERA221 Business Meeting
 - A. The Business Meeting was called to order by Chair Shuizhang Fei at 10:45 AM on 11 June 2015.
 - B. Administrative adviser, Roch Gaussoin, reported that the NCERA221 Project will end in September 2016. By September 2015, the write-up requesting Project extension needs to be initiated. Nick Christens (IA) and Tom Voigt (IL) will take leadership in developing the new project proposal. Assistance will come from Roch Gaussoin (NE) and Chris Hamilton (WI).
 - C. Historian Report, Nick Christens (Attachment 6). The next NCERA 221 Meeting will be hosted by IL (B. Branham, T. Voigt, E. Nangle) in the Chicago area in June 2016. It was determined by vote that the 2017 NCERA221 Meeting would not take place during the ITS Meeting in NJ, but would in fact be held in KS and hosted by J. Fry and J. Hoyle. The 2018 and 2019 Meetings will be hosted by Missouri and Minnesota, respectively. The future of the South Dakota State University and Southern Illinois University Turf Programs is unknown.
 - D. NCERA221 website (<http://ncera221.blogspot.com/?m=1>) has been developed by A. Patton.
 - E. Meeting adjourned at 11:40 AM. Thanks to our ISU Hosts for a great meeting!

Submitted by Tom Voigt – University of Illinois

In attendance (Official Reps): Illinois-Tom Voigt, Indiana-Aaron Patton, Iowa-Nick Christians, Kansas-Jared Hoyle, Michigan- Kevin Frank, Minnesota-Eric Watkins, Missouri-Xi Xiong, Nebraska-Bill Kreuser, North Dakota- Deying Li, Ohio-David Gardner, Wisconsin-Doug Soldat, Roch Gaussoin (Univ. of Nebraska, Administrative Advisor).

All Attendees:

Chicago District Golf Association-Ed Nangle (enangle@cdga.org), Ron townsend (rtownsend@cdga.org);

University of Illinois- Tom Voigt (tvoigt@illinois.edu);

Purdue University-Quincy Lay (qlaw@purdue.edu), Aaron Patton (ajpatton@purdue.edu), Geoffrey Schortgen (gschortg@purdue.edu), Dan Weisenberger (danw@purdue.edu);
Iowa State University-Ryan Adams (rsadams@iastate.edu), Nick Christians (nchris@iastate.edu), Shuizhang Fei (sfei@iastate.edu), Josh Lenz (jel007@iastate.edu); Yang Liu (yliu@iastate.edu), Paul Merrick (pmerrick@iastate.edu), Isaac Mertz (imertz@iastate.edu), Dan Strey (dstrey@iastate.edu);
Kansas State University-Jared Hoyle (jahoye@isu.edu);
Michigan State University –Kevin Frank, (frankk@msu.edu), Aaron Hathaway (hathaw21@msu.edu);
University of Minnesota-Sam Bauer (sjbauer@umn.edu), Eric Watkins (ewatkins@umn.edu);
University of Missouri-Gerald (Lee) Miller (turfpath@missouri.edu), Xi Xiong (xiongxi@missouri.edu);
University of Nebraska-Roch Gaussoin (rgaussoin1@unl.edu), Bill Kreuser (wkreuser2@unl.edu);
North Dakota State University-Deying Li (deying.li@ndsu.edu);
Ohio State University-Arly Drake (drake.271@osu.edu), David Gardner (gardner.254@osu.edu), Dominic Petrella (petrella.21@osu.edu);
University of Wisconsin-Doug Soldat (djsoldat@wisc.edu); and
Bayer Green Solutions Team- Zac Reicher.

Attachments to minutes:

1. 2015 NCERA221 Meeting Agenda
2. 2015 State Reports
3. Growth Potential Model Validation Project (Bill Kreuser)
4. 2015 NTEP Report (Eric Watkins)
5. Regional Roadside Turfgrass Testing Program (Eric Watkins)
6. Historians Report from Nick Christians

Attachment 1. 2015 NCERA221 Meeting Agenda

2015 NCERA 221: Turfgrass and the Environment – Annual Meeting

June 09-11, 2015

Speer Room, Reiman Gardens, Iowa State University, Ames, Iowa and the Horticulture Research Station,
Gilbert, IA

Tuesday, June 09, 2015

- Arrival in Ames, Iowa
- Optional afternoon golf (Otter Creek Golf Course, Ankeny, IA).
- 6:00 pm Optional group dinner at Wallaby's Bar and Grille at 2733 Stange Road, Ames (<http://www.wallabysbarandgrille.com/> on your own).

Wednesday, June 10, 2015

- 7:30 am** Onsite registration
- 7:30 am – 8:15 am** Continental breakfast
- 8:15 am – 8:20am** Welcome and Introduction- Nick Christians and Shui-zhang Fei
- 8:20 am-8:30am** Dr. Joe Colletti, Senior Associate Dean, College of Agriculture and Life Sciences
- 8:30 am-8:40am** Dr. Jeff Iles, Chair, Department of Horticulture
- 8:40am-10:30am** State Report (15 min max)
 - IL-Tom Voigt, Univ of Illinois
 - IL-Ed Nangle, Chicago District Golf Association
 - IN-Aaron Patton, Purdue University
 - IA-Nick Christians, Iowa State University
 - KS-Jared Hoyle, Kansas State University
- 10:30am-11am** Morning break and Garden walk
- 11am-12pm** State Report Continued (15 min max)
 - MI-Kevin Frank, Michigan State University
 - MN-Eric Watkins, University of Minnesota
 - MO-Xi Xiong, University of Missouri
 - NE-Bill Kreuser, University of Nebraska-Lincoln
- 12:00 pm – 1:00 pm** - Lunch catered by The Cafe
- 1:15 pm – 4:30 pm** – Field trip-Horticulture Research station, Gilbert, IA; vans will load in front of Reiman Gardens at 1pm
- 1:30-2:30pm** Tour of the Horticulture Research Station_Nick Howell, Horticulture Research Station superintendent
 - 2:30-4:30pm** Tour of ISU turfgrass research plots
- 5:00 pm –7:00pm** Dinner at Reiman Gardens, catered by Hickory Park

Thursday, June 11, 2015

- 7:30 am – 8:15 am** – Continental breakfast
- 8:15-9:15am** Continued state report
 - ND-Deying Li, North Dakota State University
 - OH-David Gardner, Ohio State University
 - WI-Doug Soldat, University of Wisconsin-Madison
- 9:15-10:30am** Regional research projects
 - Update on ongoing projects and initiation of new projects:
 - Dr. Bill Kreuser_Growth Potential Model Validation project
 - Dr. Eric Watkins_NTEP Update
 - Dr. Eric Watkins, Regional roadside turfgrass testing program
- 10:30am-11am** Morning break
- 11am-12pm** Business meeting
 - Project status/renewal, Dr. Roch Gaussoin, NCERA221 Administrative Advisor
 - Historian report/future meeting site and host, Dr. Nick Christians

12:00 pm - Adjourn and depart for home. Those who depart late are invited to have a buffet lunch at the Mongolian Buffet (Chinese food).

Questions: Direct meeting questions to Shui-zhang Fei, sfei@iastate.edu, (515) 294-5119 or 515-509-9942 (cell)

Attachment 2. 2015 NCERA221 State Reports

State Report for NCERA221

University: University of Illinois
Official NCERA rep: Tom Voigt
Email: tvoigt@illinois.edu
Phone: 217.333.7847

Staffing:

Current team members: Bruce Branham, Tom Voigt
Additions: none
Retirements/vacancies: none

General turf program comments: Due to the cost of attending the U. of I., starting salaries, competing programs, and admissions requirements the number of undergraduate students in the Ornamental Horticulture curriculum has dropped. Given that, the U. of I. is phasing out the Ornamental Horticulture curriculum, including the Turf Program.

In addition, with the lack of national and Illinois state funding for turf research in the mid 2000s, Dr. Branham developed a sustainable foods program and worked in departmental and campus-level administration, while Dr. Voigt established a renewable energy crop research program.

Teaching Program

Current undergraduate enrollment: 1
Trend in undergraduate enrollment over last 3 years: Flat
Placement: Entry-level opportunities are still strong.
Brief comments on teaching: See above. Turf and landscape grass classes are no longer being offered.

Research

Faculty member (complete for each faculty member): Bruce Branham
Current or recently graduated graduate student: 1
MS or PhD: M.S.
Project(s): Nitrogen fertilization.
Graduation date: August 2015
NCERA collaborators on grad project: Tom Voigt

Other notable research projects led by faculty member: 2 USGA studies
Title: A Systems Approach to *Poa annua* control on Putting Greens
Description: See title.
NCERA Collaborators (name, institution): Aaron Patton, Zac Reicher

Title: Do Foliar Fertility Products Enhance Nitrogen Uptake and Turfgrass Performance?
Description: There are performance differences. N¹⁵ work to commence during summer of 2015.
NCERA Collaborators (name, institution): None.

Dr. Branham continues an active herbicide evaluation and weed control program.

Faculty member (complete for each faculty member): Tom Voigt
Current or recently graduated graduate student:
MS or PhD:
Project(s):.
Graduation date:
NCERA collaborators on grad project:

Other notable research projects led by faculty member: Tom Voigt
Title: Evaluation of Non-Native Grasses for Un-Mowed Golf Course Roughs

Description: See title.
NCERA Collaborators (name, institution): none

Dr. Voigt manages U. of I. NTEP trials.

List Publications (*published or in press*) with other NCERA collaborators over the last two years (list):

1. None

Extension Program

State conference dates: January 13 and 14, 2015
Collaborating with other organizations on conference (yes/no): yes
If so who: Illinois Turfgrass Foundation
Attendance figure: 350
Research field day held (yes/no): yes, 2 field days
If so, when: (1.) August 11, 2014, Central Illinois Golf Course Superintendents Association and (2) October 9, 2014 IL Professional Lawn Care Association
Attendance figure: approximately 50 at each
Other Extension activities: Several turf and grassy weed ID workshops, *Lawn Fertilization, Best Management Practice for the Midwest* (Ext. Publication)

Website (yes/no): no
If yes, please list website address(es):
FaceBook/Twitter/social networking (yes/no): no
If yes, please list info:

Brief comments on Extension: Both Branham and Voigt work with individual golf courses and have ongoing on-site research in the Chicago area.

Brief State Report for NCER221

University: Chicago District Golf Association
Official NCERA rep: Ed Nangle
Email: enangle@cdga.org
Phone: 630-423-1925

Staffing:

Current team members: 2
Additions: 0
Retirements/vacancies: 0

General turf program comments: Ron Townsend came in 2015 as research manager and has helped to ramp up work with increase in projects taken on board. Excellent collaboration with courses all over the city and also working with some projects further south in the state.

Teaching Program

Current undergraduate enrollment: N/A
Trend in undergraduate enrollment over last 3 years: N/A
Placement: N/A
Brief comments on teaching: N/A

Research

Faculty member (complete for each faculty member):
Current or recently graduated graduate student: Ron Townsend will begin MS at U Wisconsin Fall 15
MS or PhD: MS
Project(s): Dollar spot control with focus on cultural practices and also oxalic acid production

Graduation date: WI 17
NCERA collaborators on grad projects Doug Soldat / Paul Koch
(Copy and paste as needed)

Other notable research projects led by faculty member:

Title: 1) Greens firmness as affected by wetting agents. 2) Changes in water quality on seasonal basis and impact on green rootzones

Description: 1) Using tru-firm meter to investigate impact on soil firmness post application of various wetting agents as well as other parameters that may have a role in surface firmness. 2) Following water quality through the year on four sites on a monthly basis, analyzing rootzones in each site for changes that follow the buildup in salts (Particularly after winter) and also a four factor gypsum study to see if we can alleviate/prevent a problem building up.

NCERA Collaborators (name, institution): N/A

List Publications (*published or in press*) with other NCERA collaborators over the last two years (list):

1. Nangle, E.J., D.S. Gardner, J.D. Metzger, L. Rodriguez-Saona, T.K. Danneberger, D.P. Petrella, J.L. Cisar. Cool-season turfgrass color and growth habit response to elevated levels of ultraviolet-B radiation. Submitted (HortScience 4-16-15 – Accepted, in edits currently).
2. Nangle E.J., D.S. Gardner, J.D. Metzger, L. Rodriguez-Saona, M.M. Giusti, T.K. Danneberger and D.P. Petrella. (2015). Pigment changes in Cool-season Turfgrasses in Response to Ultraviolet-B Light Irradiance. Agron. J. 107: 41-50.
3. Nangle, E.J., D.S. Gardner, M.A. Bennett, T.K. Danneberger, J.D. Metzger, and L.E. Rodriguez-Saona. (2013). Influence of ultraviolet light on germination rate and speed of Kentucky Bluegrass (*Poa pratensis* L.) Seed Technology Vol. 34, no. 2, 2012 257-262.

Extension Program

State conference dates: ITF January '15

Collaborating with other organizations on conference (yes/no): University of Illinois organizes this

If so who: B Branham / ITF

Attendance figure: 200

Research field day held (yes/no): Yes

If so, when: September 11th 2014

Attendance figure: 65

Other Extension activities: 150-165 course visits, 7 regional presentations on disease management, winter damage issues, turfgrass pigments.

Website (yes/no): yes

If yes, please list website address(es): www.cdgaturf.org

FaceBook/Twitter/social networking (yes/no): Yes

If yes, please list info: twitter @turfresearch

Brief comments on Extension:

With retirement of Ken Diesburg imminent Southern Illinois University may/will be shorn of a turf program – I think this is a big loss for undergraduate education to the state. Cost effective and more accessible for turf students it will be a big loss. Sentiments seem to be rising this year on the golf industry – clubs bringing back initiation fees, memberships starting to show some recovery.

BRIEF State Report for NCERA221

University: Purdue University

Official NCERA rep: Aaron Patton

Email: ajpatton@purdue.edu

Phone: (765) 494-9737

Teaching Program

Current undergraduate enrollment: 28

Trend in undergraduate enrollment over last 5 years:

Placement: All 2014-2015 graduates have been placed.

Research

FACULTY MEMBERS:

1. Cale Bigelow, Department of Agronomy
2. Yiwei Jiang, Department of Agronomy
3. Aaron Patton, Department of Agronomy
4. Rick Latin, Department of Botany and Plant Pathology
5. Doug Richmond, Department of Entomology

Other notable research projects led by group:

A number of experiments continued in 2014/2015 to address practical problems and environmental concerns related to the turfgrass industry. Studies continued to focus on improved understanding of proper cultivar selection, fertility and irrigation programs, plant stress physiology, weed control, pest biology, and disease resistance to minimize management inputs required to achieve management goals and protect the environment.

- 1) Crabgrass control can be increased through proper timing of nitrogen fertilization prior to herbicide application without increasing the amount of herbicide used.
- 2) Initiated research on the influence of hard water on herbicide efficacy with preliminary research discovering economical methods to enhance the efficacy of currently used postemergence herbicides.
- 3) Identified tall fescue and Kentucky bluegrass cultivars requiring less annual mowings and thus fewer fossil fuels to maintain.
- 4) In 2011 a regional N study was initiated at 11 field sites throughout the cool-humid and transition zone regions. The goal of this study was to evaluate the effect of autumn N application timings on turfgrass color response and soil N status.
- 5) Allelic variations in *LpLEA3* gene affect whole-plant response to drought and salinity stress and winter survival of perennial ryegrass population.
- 6) Preliminary results indicate that fungicide inputs on less susceptible cultivars may be reduced to less than 20% of that used for more susceptible cultivars.
- 7) Bioassay results for fungicides used for disease control indicate that residual efficacy is reduced to levels approaching 10% control within 7-10 days after application. Results from the bioassay were reinforced by quantitative analysis of fungicide residues in the verdure.
- 8) We have been exploring the efficacy of experimental microsclerotial formulations of the entomopathogenic fungus *Metarhizium anisopliae*, a potential biological control for Japanese beetle larvae. In the first of several planned trials, one of the two experimental formulations outperformed the commercial product by providing 50% control of Japanese beetle larvae under field conditions.
- 9) An ongoing multi-year field study has been evaluating various commonly planted and alternative golf turf fairway species for their performance and persistence under two mowing heights (1/2" and 3/4") when maintained without supplemental irrigation. To date the feasibility of utilizing fescues and some Kentucky bluegrasses appear promising for seasonally consistent green, dense fairway turf.

Joint refereed publications with other regional collaborators:

1. Reicher, Z.J., M. Sousek, **A.J. Patton**, D.V. Weisenberger, A. Hathaway, and R. Calhoun. 2015. Annual bluegrass control on putting greens from three or more years of season-long applications of herbicide or plant growth regulators. *Crop, Forage & Turfgrass Management*. DOI: 10.2134/cftm2014.0050

2. Sousek, M.D., R.E. Gaussoin, A.J. Patton, D.V. Weisenberger, and Z.J. Reicher. 2014. Weed control and turf safety of single and sequential applications of herbicides over spring seedings. *Appl. Turfgrass Sci.* doi:10.2134/ATS-2013-0046-RS.

Combined listing of refereed publications from faculty (2014-2015)

1. Beck, L.L., A.J. Patton*, Q.D. Law, D.V. Weisenberger, J.T. Brosnan, J.J. Vargas Almodóvar, and G.K. Breeden, and D. Kopsell. 2015. Mesotrione activity on crabgrass (*Digitaria* spp.) as influenced by nitrogen fertilization rate, source, and timing. *Weed Technol.* 29:263-273.
2. Beck, L.L., A.J. Patton*, and D.V. Weisenberger. 2014. Mowing before or after an herbicide application does not influence ground ivy (*Glechoma hederacea*) control. *Appl. Turfgrass Sci.* doi:10.2134/ATS-2013-0017-RS.
3. Beck, L.L., A.J. Patton*, Q.D. Law, D.V. Weisenberger, J.T. Brosnan, J.J. Vargas Almodóvar, and G.K. Breeden. 2015. Mesotrione activity on crabgrass (*Digitaria* spp.) as influenced by nitrogen fertilization rate, source, and timing. *Weed Technol.* In press. Add Kopsell.
4. Harris-Shultz, K.R., S. Milla-Lewis, A.J. Patton, K. Kenworthy, A. Chandra, and F.C. Waltz. 2014. Detection of DNA and ploidy variation within vegetatively propagated zoysiagrass cultivars. *J. Amer. Soc. Horticultural Sci.* 139:547-552
5. Hockemeyer, K. R., and R. Latin. 2015. Spatial and temporal distribution of fungicides applied to creeping bentgrass. *J. Environ. Qual.* 44(3):p. 841-848.
6. Huang, Bingru; DaCosta, Michelle; Jiang, Yiwei. 2014. *Critical Reviews in Plant Sciences.* March-June. 33(2-3): p. 141-189.
7. Sousek, M.D., R.E. Gaussoin, A.J. Patton, D.V. Weisenberger, and Z.J. Reicher. 2014. Weed control and turf safety of single and sequential applications of herbicides over spring seedings. *Appl. Turfgrass Sci.* doi:10.2134/ATS-2013-0046-RS.
8. Zong, J., Y. Gao, J. Chen, H. Guo, Y. Wang, F. Meng, et al. 2015. Growth and enzymatic activity of four warm-season turfgrass species exposed to waterlogging. *J. Am. Soc. Hortic. Sci.* 140(2):p. 151-162.

Extension Program

State conference dates: Indiana Green Expo, January 6-8, 2016

Collaborating with other organizations on conference (yes/no): Yes

If so who: Indiana Professional Landscape Association

Attendance figure: 1,600

Research field day held (yes/no): yes

If so, when: July 14, 2015

Attendance figure: 496 in 2015

Other Extension activities:

- Lawn Care Diagnostic Training
- Turf and Ornamental Seminar
- Turf Herbicide Workshop (same workshop at four locations)

Web (yes/no): turf.purdue.edu

Facebook/Twitter/social networking (yes/no): yes

Twitter:

@BoilermakerTurf

Dr. Cale Bigelow posts information on field observations, useful information, and events to this Twitter account including our Purdue Turf Tips.

@PurdueTurfDoc

Dr. Aaron Patton posts information on field observations, weed identification and control as well as upcoming events to this Twitter account.

@doctorDRich

Dr. Doug Richmond posts information on turf entomology to this Twitter account.

@ricklatin

Dr. Rick Latin posts information on turf pathology to this Twitter account.

@TurfFoundation

The Midwest Regional Turf Foundation posts information important for its members at this Twitter account. All are welcome to follow.

Facebook: Purdue Turf

Blog: <http://purdueturftips.blogspot.com/>

Brief comments on Extension: see below under general comments.

Staffing:

Additions: none.

Retirements/vacancies: Dr. Tim Gibb is reducing his turf entomology extension appointment and Dr. Doug Richmond has added turf entomology extension efforts to his appointment.

General turf program comments

The turf program at Purdue remains stable. Enrollment in the 4-yr Bachelor's degree program has dropped to less than 40 students. Graduation placement remains 100%. Based on new state legislation, all Purdue degree options where a specific number of credit hours is not needed professional accreditation dropped down to 120 hours as the state mandated minimum number of credit hours needed for a bachelor's degree. The Purdue turf science and management degree option required 132 credits previously and now requires only 120 due to this change. This change was effective in 2013.

The program's research efforts continue to be productive and a variety of projects are in progress related to management of both warm and cool-season turfgrasses. Attendance for the Turf program's large outreach events such as the Indiana Green Expo (historically > 1,000 turf of 1,800 total attendees) and summer Turf Field Day (historically > 500) are stable. Research support from cooperators is also declining but efforts to increase our endowment investments have increased thanks to the Midwest Regional Turf Foundation. Seasonal Turf Tips continues to be delivered electronically to over 3,000 individuals.

BRIEF State Report for NCER221

University: Iowa State University

Official NCERA rep: Nick Christians

Email: nchris@iastate.edu

Phone: 515-450-1263

Staffing:

Current team members: Nick Christians, Shuizhang Fei, Ryan Adams

Additions:

Retirements/vacancies: We currently have a vacancy for a tenure track turf extension position.

General turf program comments: We have seen considerable reductions in funding the last 5 years, but we still have positions in teaching, research, and extension, with a good balance between the three.

Teaching Program

Current undergraduate enrollment: 35

Trend in undergraduate enrollment over last 3 years: Decreased from about 60 three years ago.

Placement: 100%

Brief comments on teaching: We have seen a downturn in the golf area, but an increase in sports turf. Increases in tuition are beginning to affect recruitment. There are also 5 two-year programs in the state and many undergrads go to community colleges first to save money.

Research

Faculty member (complete for each faculty member): Nick Christians

Current or recently graduated graduate student: Dan Strey and Kevin Hansen finished MS degrees in 2015. Isaac Mertz will finish his MS in summer 2015.

MS or PhD: Nick currently have 4 MS students. Three of them are in full time jobs and completing their degrees through the Horticulture non-thesis program. Isaac Mertz will begin a Ph.D. program in 2015.
Project(s): We are working with the effects of paint on grass and soil on sports turf areas. There is also a project on rhizomatous tall fescue and some work on biostimulants.
Graduation date: Three MS students will complete their degree in 2015.

Shuizhang Fei

Current or recently graduated graduate student: Jingjie Hao finished her PhD in Dec 2014.

MS or PhD: Shuizhang currently have one MS (Paul Merrick) and one PhD (Yang Liu) student.
Project(s): Rapid gene discovery in creeping bentgrass by high throughput gene silencing (funded by the Consortium for Plant Biotechnology Inc.); herbicide resistant turfgrasses, targeted gene editing in perennial grasses (Funded by the United States Department of Agriculture); biological nitrification inhibition in turfgrass species; develop plant breeding curricula for African universities (funded by the Bill and Malinda Gates Foundation).

List Publications (published or in press) with other NCERA collaborators over the last two years (list):

Jones, M., N.E. Christians, and I. Mertz. 2014. Impact of plant growth biostimulents on creeping bentgrass growth. In press ACTA Horticulturae.
Merrick P and Fei S 2015. Regeneration and genetic transformation in switchgrass Journal of Integrative Agriculture. 14:483-493
Feng Y, Yin Y, Fei S. 2015. Down-regulation of BdBRI1, a putative brassinosteroid receptor gene altered growth and enhanced drought tolerance in *Brachypodium distachyon*. Plant Science 234:163-173
Li Y, Han L, Hao J, Fei S. *Agrobacterium tumefaciens* -mediated transformation of big bluestem (*Andropogon gerardii* Vitman). Journal of Plant Biotechnology.
<http://link.springer.com/article/10.1007%2Fs11240-015-0754-y>
Jingjie Hao, Jiangli Dong, Jinliang Yang, Shuizhang Fei. Transcriptome analysis of a *cbf3* mutant by RNA-seq in *Brachypodium distachyon* XXIII Plant and Animal Genome Meeting, San Diego, CA (Abstract).

Extension Program

State conference dates: January 20-22th 2015

Collaborating with other organizations on conference (yes/no): Yes

If so who: Iowa Turfgrass Institute, Iowa GCSA, ISTMA and IPLCA

Iowa Turf Conference Attendance figure: 816

Research field day held (yes/no): Yes

If so, when: July 23th, 2014

Attendance figure in 2014: 86

Other Extension activities: Extension efforts focus on providing research-based information to Iowa's commercial turfgrass industries (sports turf, golf course, and lawn care). We also have scheduled presentations for Iowa Master Gardeners, Federated Garden Club of Iowa, and local/regional garden shows. Extension efforts are working on creating an Iowa State University-High School Athletic Field Short Course and increasing attendance and tracks for ISU field day. In addition, we will continue to comply and build online videos and tutorials for Iowa pesticide recertification program. One of current activities is revising out of date publications and creating new publications. Some of the new publications topics are an Iowa State University Athletic Field Guide to Safe Playing Fields, Reducing Industry Water Usage, and Guide to Sprayer and Fertilization Calculations, Managing Localized Dry Spot, as well as others.

Web (yes/no): Yes

FaceBook/Twitter/social networking (yes/no): Yes – Twitter, Blog at <http://iaturf.blogspot.com/>, as well as Nick Christians Facebook, Twitter to circulate information.

Joint Extension publications with other regional collaborators in the last two years: No joint extension publications

Extension Publications:

Adams, R.S. 2015. HORT 3021: Fall Tips to Ensure a Healthy Green Yard for Spring. Iowa State Extension Store.

Adams, R.S. 2015. Athletic Field Seeding and Irrigation Tips. Iowa State Extension Store.

Adams, R.S. 2015. Preventing Compaction on Athletic Fields. Iowa State Extension Store.

Adams, R.S. 2015. Organic Turfgrass Fertilization. Iowa State Extension Store.

Adams, R.S. 2015. Tall Fescue: A Low-maintenance Alternative to Kentucky Bluegrass. Iowa State Extension Store.

Adams, R.S., and N.E. Christians. 2015. PM 491: Sod Establishment. Iowa State Extension Store.

Originally prepared by Michael L. Agnew, Extension horticulturist-turf, and Nick E. Christians, professor of horticulture, Iowa State University.

Adams, R.S., and N.E. Christians. 2015. HORT 3023: Selecting a Grass Species for Iowa Lawns. Iowa State Extension Store. Originally prepared by Michael L. Agnew, Extension horticulturist-turf, and Nick E. Christians, professor of horticulture, Iowa State University.

Adams, R.S., and N.E. Christians. 2014. PM 930: Weed Control in Home Lawns. Iowa State Extension Store. Originally prepared by Harlene Hatterman-Valenti, former extension associate, and Michael Agnew, Extension horticulturist-turf, Iowa State University.

Adams, R.S., and N.E. Christians. 2014. PM 1447D: Responsible Phosphorus Management in Home Lawns. Iowa State Extension Store. Originally prepared by Robert J. Mugaas, Hennepin County Extension horticulturist, University of Minnesota; Michael L. Agnew, Extension horticulturist-turf, and Nick E. Christians, professor of horticulture, Iowa State University.

BRIEF State Report for NCER221/WERA011

University: Kansas State University

Official NCERA or WERA rep: Jared A. Hoyle

Email: jahoyle@ksu.edu

Phone: 785-532-1419

Teaching Program

Current undergraduate enrollment: 55

Trend in undergraduate enrollment over last 3 years: Flat for last 3 years, after a downward trend for several years prior to 2011. The department is initiating new efforts to recruit freshmen and transfer students using web site development and social media.

Placement: excellent

Brief comments on teaching: A distance course, *Water Issues in the Lawn and Landscape* (3 cr.) has been quite popular over the last several years, and is available to students outside of KSU through the AgIdea program. Bremer, Fry, Keely, Lavis are contributing instructors.

Research

Faculty members: Jack Fry and Dale Bremer

Current or recently graduated graduate student: Josh Chabon, M.S.

Project(s): (1) Impact of irrigation scheduling and nitrogen fertilizer types and rates on nitrate leaching in tall fescue

(2) Impact of irrigation scheduling and PGRs on mowing requirements in tall fescue

Graduation Date: August 2014

Faculty member: Dale Bremer

Current or recently graduated graduate student: Ross Braun, Ph.D.

Project(s): 1) Effects of irrigation and N management on greenhouse gas fluxes in turfgrass; and 2) Effects of traffic on turfgrasses during prolonged drought (with Hoyle).

Faculty member: Steve Keeley

Current or recently graduated graduate student: Zane Raudenbush, PhD

Project(s): Silvery thread moss biology and management in creeping bentgrass greens

Graduation Date: August 2015

Faculty members: Megan Kennelly and Jack Fry

Current or recently graduated graduate student: Mingying Zhang, PhD (starting summer 2015).

Project(s): Evaluation of new zoysiagrass breeding lines for cold tolerance, quality, and large patch resistance

Collaborators (name, institution): Patton, Purdue; Chandra, Texas A&M

Faculty member: Megan Kennelly

Current or recently graduated graduate student: Ross Braun, M.S.

Project(s): Effect of nitrogen source and timing on large patch in zoysiagrass.

Partner institution: Lee Miller, University of Missouri

Faculty member: Jared Hoyle

Current or recently graduated graduate student: Jake Reeves, M.S.

Project(s): (1) Best Management Practices for the Establishment of Buffalograss Golf Course Rough
(2) Evaluating Herbicide Efficacy Aiding in Removal of Cool-Season Turfgrass and Establishment of Buffalograss to Reduce Green Cover Loss.

(3) Investigation Into Seed Coatings to Improve Seeded Buffalograss Establishment

Current or recently graduated graduate student: Evan Alderman, M.S.

Project(s): (1) Assess Buffalograss Performance When Subjected to Simulated Golf Cart Traffic.

(2) Examine the Effect of Buffalograss Fertility Rate on Divot Recovery.

(3) Effect of Simulated Golf Cart Traffic on Painted Dormant Buffalograss.

Other notable research projects led by faculty member:

Title: *Project(s):* *Evaluating small unmanned aerial systems for detecting turfgrass stress with an emphasis on drought*

Collaborators (name, institution): Bremer, Deon van der Merwe, Fry, Keeley, Hoyle, Kennelly, KSU.

Collaborator: Kevin Price

Title: *Project(s):* Nitrous Oxide Emissions and Carbon Sequestration in Turfgrass: Effects of Irrigation and N Fertilization

Collaborators (name, institution): Bremer, KSU; Fry, KSU

Title: *Project(s):* Developing cold-hardy, large patch-resistant zoysiagrasses.

Collaborators (name, institution): Fry, KSU; Kennelly, KSU; Patton, Purdue; Chandra, Texas A&M.

Title: *Project(s):* Fall and Spring Bermudagrass Control with Glyphosate, Fluazifop and Mesotrione Combinations for Tall Fescue Establishment

Collaborators (name, institution): Hoyle, KSU; Thompson, Cal. Poly; Reeves, KSU

Title: *Project(s):* Turf Paint and Glyphosate Application Timing Effects on Annual Bluegrass and Tall Fescue Control

Collaborators (name, institution): Hoyle, KSU

Title: *Project(s):* Evaluation of Tall Fescue Establishment Influenced by Prodiamine and Dithiopyr Applications

Collaborators (name, institution): Hoyle, KSU; Reeves, KSU

Title: Project(s): Determination of Annual Bluegrass Control Utilizing Hand Held Propane Torch
Collaborators (name, institution): Hoyle, KSU; Brosnan, UT

Title: Project(s): Utilization of Perennial Ryegrass and Buffalograss Swards for Roadside Stabilization
Collaborators (name, institution): Hoyle, KSU; McBee, KSU

Extension Program

State conference dates: Dec 1-3, 2014 in Topeka, KS

Collaborating with other organizations on conference (yes/no): Yes: In 2015, the Kansas Turfgrass Foundation will be inviting the Kansas Nursery and Landscape Association (KNLA) to join the Annual Conference and Trade Show. Inviting KNLA will attempt to increase conference attendance and KTF membership. The addition of KNLA to the conference will also allow a previously separate landscape-training program, NurseryWorks, to be added to the program as a separate educational track.

Attendance figure: about 600-800

Research field day held (yes/no): Yes

If so, when: Always first Thursday in August. Aug. 6, 2015 in Olathe and Aug. 4, 2016, in Manhattan, KS.

Attendance figure: varies by location, average 200-300

Other Extension activities:

- The turfgrass extension specialist (J.A. Hoyle), the nursery production specialist (C. Boyer) and Jay McCurdy (MSU, Extension Turfgrass Specialist) are evaluating non-traditional methods for recording extension activities.
- The Basic Extension Master Gardener Training Curriculum for Turfgrass is currently being updated.
- Advanced Turfgrass Training Modules are being developed with M. Elmore (Texas A&M) to provide a prepackaged, all-inclusive program for educators of all levels.
- The KSU homeowner and professional turfgrass extension publications are currently being reformatted and updated.

Web (yes/no): yes <http://ksu.edu/turf> and <http://www.kansasturfgrassfoundation.com>

FaceBook/Twitter/social networking (yes/no): yes: Facebook, KSUTurf and Kansas Turfgrass Foundation (KTF); Twitter, @KSUTurf ; Blog, blogs.ksu.edu/turf

Brief comments on Extension:

- The KSU Turfgrass website was granted web space on the KSU web servers and migration from the private industry server to the KSU server is complete.
- Along with the new KSU Turfgrass website a new blog has been developed on the KSU server that provides a repository for all past posted information.
- Popularity is rapidly increasing with the blog/facebook/twitter accounts as well as interaction with turfgrass managers through these social media networks. The turfgrass program is still receiving compliments on the reported information. Turfgrass professionals and homeowners are very appreciative of the relative and timely information.
- Recent evaluation of the KSU Turfgrass social media/digital newsletter campaign was complete by Hoyle and Kennelly. The Journal of Extension article (Kennelly and Hoyle, *In press*) explains that majority of the users wait for the weekly email to direct them to new content. Article also reported that content of the blog/newsletter/social media campaign had an overall usefulness of 4.95 and overall quality of 5.02 (1 -6 scale, 6 = best).

- The state of Kansas is starting to offer on-line pesticide recertification credits. Applicators are not allowed to receive all recertification credits online.

Staffing:

Additions: Mark Wilmore, Turfgrass Farm Manager

Responsibilities: Operations and maintenance at the Olathe Turfgrass Research Station.

Retirements/Vacancies: none

General Turf Program Comments:

BRIEF State Report for NCERA211 (formerly 192)

University: Michigan State University

Official NCERA rep: Kevin W. Frank

Email: frankk@msu.edu

Phone: 517-353-0147

Teaching

Current undergraduate enrollment: 60 total [35 (4 yr.), 25 (2 yr.)]

Trend in undergraduate enrollment over last 3 years: flat

Placement: Excellent

Joint teaching activities with other regional collaborators:

Research

Faculty member (complete for each faculty member): **Kevin W. Frank**

Project: Long term nutrient leaching

Description: Nitrogen fate 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. As of 2015, the turfgrass area has now been under continual fertilization practices for 25 years with percolate collection for the last 17 years consecutively. 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 12 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.

Project: Effect of Nitrogen Rate on Runoff Water Quality

Description: A runoff research area was constructed at the Hancock Turfgrass Research Center in the summer of 2013. The turfgrass is Kentucky bluegrass maintained similar to a home lawn with a mowing height of 3 inches and clippings retained on the plots. The research objective is to determine the effect of different rates of polymer coated urea applied either once or twice per year in comparison to standard four application home lawn programs on runoff water quality, in particular nitrogen. Research was initiated in 2014 and continues in 2015.

Project: NTEP Trials

Description: Current trials under evaluation

Kentucky bluegrass ancillary trial – traffic tolerance on athletic fields

Creeping bentgrass green

Creeping bentgrass fairway

Fine leaf fescue lawn height

Fine leaf fescue fairway height with traffic

Faculty member (complete for each faculty member): **Emily Merewitz**

Current or recently graduated graduate student: Kevin Laskowski

MS or PhD: MS

Project: Effects of Drought and Traffic Stresses on Physiological Responses and Water Use Characteristics of Creeping bentgrass (*Agrostis stolonifera*) and Annual bluegrass (*Poa annua*)

Graduation date: August 2015

Description: The objectives of the research are to evaluate physiological responses and water use of creeping bentgrass and *P. annua* to different volumetric soil moisture contents (8, 12, and 16%) and traffic to detect whether there are significant differences in water use characteristics, water use efficiencies, rooting, and hormone production.

Current or recently graduated graduate student: Kevin Laskowski

MS or PhD: pending PhD student

Project: Winterkill research in a low temperature growth chamber

Turfgrass crown survival is the most important factor for turfgrass recovery and regrowth following the winter months. Crowns can be significantly damaged or killed by harsh winter conditions such as extended ice cover. Multiple objectives are being evaluated within this research which will be conducted over the course of several different experiments. The first experiment conducted in the low temperature chamber included treatments that were initiated in the field in summer of 2014 through the fall on creeping bentgrass and poa annua plots. Turf plugs treated with one of the following were taken, subjected to ice cover, placed in the low temperature chamber, and were sampled for survival every 20 days until 100 days. The treatments were 1. Daconil Action 2. Heritage TL 2. Daconil action and Primo Maxx 4. Daconil Action and Heritage TL 5. Heritage TL and Primo Maxx. To date, the sampling for ice survival at low temperatures of turf treated with various plant health protectant products has been completed. Results regarding the impact of these plant protective products on turfgrass survival of ice cover will be analyzed and other experiments related to winterkill issues will continue in 2015.

Project: Polyamines and Abiotic Stress of Turfgrasses

Current or recently graduated graduate student: Yingmei Ma

MS or PhD: PhD

Polyamines (spermidine, spermine, and putrescine) are compounds that are known to accumulate in some plants during stress conditions to promote stress tolerance. If and how these compounds play a role in abiotic stresses of common turfgrass species is not yet known. We have conducted a series of growth chamber studies including one hydroponic and two soil based GC studies with creeping bentgrass 'Penncross' (*Agrostis stolonifera*) and 'Penn-G2' to determine whether exogenous application of PAs may affect plant growth and drought stress tolerance. Application of relatively low concentrations of spermidine (500 or 750 μ M) or spermine (500 μ M) promoted tillering rates under optimal growth conditions in hydroponics. The same levels of polyamine treatments moderated the damages associated with drought stress in the soil based growth chamber studies. The most notable differences in drought response associated with polyamine treatment were increased membrane health. This was observed as greater photochemical health and less membrane damage in polyamine treated plants compared to control plants. The relatively low level of exogenous polyamines used in this study did not have a major effect on plant water relations under drought stress. Canopy temperatures and soil moisture content were not affected by any polyamine treatment; however, on some days during early drought stress relative water content was significantly higher in polyamine treated plants compared to controls. Polyamines could play a major role in protecting photosynthetic and cellular membranes during drought stress of creeping bentgrass. Further research is ongoing related to gene changes due to polyamine treatment under drought and responses of creeping bentgrass to polyamines under salt stress conditions.

Project: Physiological Responses of Creeping Bentgrass to Infection by a Bacterial Pathogen (*Acidovorax avenae* subsp. *avenae*)

Current or recently graduated graduate student: Sha Liu

MS or PhD: MS

Description: A new pathogen *Acidovorax avenae*, known as bacterial etiolation, is a major problem plaguing turfgrasses, particularly creeping bentgrass. The major goals of this research are to evaluate physiological changes in creeping bentgrass in response to the pathogen and while under the influence of abiotic stress. We aim to understand why heat stress may make creeping bentgrass more susceptible to bacterial infection and to better understand the mechanism behind the unique etiolation symptom. We

hypothesize that plants weakened by heat stress and hormone changes caused by the plant-bacteria interaction could contribute to the etiolation symptom and disease susceptibility. This project was multi-objective in nature. The major goals of the project that were accomplished in 2014 are related to determining whether the bacterial pathogen contains genes for phytohormone biosynthesis and determining whether the bacteria produce these hormone products in culture. We have made significant progress in answering the research questions within these objectives. A hormone profile analysis has been conducted on multiple strains of the bacterial pathogen in culture. We have identified a method that is best to utilize for hormone isolation and analysis from the culture media solution. The results indicate the bacteria may be capable of producing gibberellins and others. We are currently obtaining more phytohormone profiles from multiple strains of the bacteria in culture in order to confirm these results. In addition, we have been investigating the best method of achieving disease symptoms under growth chamber environments. The etiolation symptom proves to be an elusive symptom whereas leaf necrosis/chlorosis symptoms we have readily been able to achieve. We have run several tests with using combinations of leaf cut inoculation and root cut inoculation methods in order to get bacterial infection of the plants. After several experiments we seem to have a good method to produce plant symptoms and etiolation responses. Research on this project will continue through 2015 in which we aim to evaluate the following objectives: 1. characterize creeping bentgrass disease symptoms, morphological attributes, and physiological responses to *A. avenae* under optimal and heat stress conditions, 2. Analyze changes in plant hormone production during *A. avenae* disease infection of creeping bentgrass leaves and roots and 3. Determine whether exogenous application of hormones and hormone inhibitors reduce *A. avenae* disease progression in creeping bentgrass.

Project: Cell Viability and Plant Hormone Responses during Salinity Stress in Two Creeping Bentgrass Cultivars Differing in Salt Tolerance

Description: Salinity stress is becoming more prevalent in turfgrass management with the increasing use of recycled water for irrigation. Creeping bentgrass (*Agrostis stolonifera* L.) is a cool-season turfgrass species that contains significant cultivar variation in salt stress tolerance, but the mechanism related to this cultivar variation is not well-understood. Our objectives were to determine whether differential hormone content could play a role in cultivar variation of salt responses and to evaluate whether cell viability assays using dye techniques could differentiate salt stress damage levels in turfgrass species. Therefore, a growth chamber study with potted plants was conducted to evaluate salt ion concentrations, physiological responses, and hormone analysis at 4, 8, and 12 dS m⁻¹ in relatively salt tolerant 'Mariner' compared to salt sensitive 'Pennncross' creeping bentgrass. A hydroponics based growth chamber study was performed for evaluation of whether dead cell stains coupled with image analysis could be a quick method for indicating cell viability variation between cultivars. Greater salt tolerance was evident in 'Mariner' at 12 dS m⁻¹ which showed significantly less membrane damage, higher leaf water content, osmotic potential, and photochemical health compared to 'Pennncross'. A higher K⁺ and lower Na⁺ content was maintained in leaves of 'Mariner' compared to 'Pennncross' while roots of 'Mariner' maintained higher Ca²⁺ content under stressed and non-stressed conditions. Phytohormones levels showed a decline in salt stressed roots compared to non-stressed plants but 'Mariner' roots were able to maintain levels higher than 'Pennncross'. 'Mariner' leaves showed an increased accumulation of abscisic acid (ABA), jasmonic acid (JA), salicylic acid (SA) and zeatin riboside (ZR) while roots maintained higher indole-3-acetic acid (IAA) and SA compared to 'Pennncross'. The results suggest that 'Mariner' was able to mitigate salt stress by better ion regulation and differential regulation of hormones compared to 'Pennncross'. 'Mariner' leaves and roots showed significantly lower dead cells compared to 'Pennncross' under salt stress. The results suggest that the dye method evaluated in this study could be a useful viability dye technique for studying turfgrass stress, response to chemical applications, or other cellular responses.

Faculty member (complete for each faculty member): **Thomas A. Nikolai**

Current or recently graduated graduate student: Nick Binder

MS or PhD: MS

Project(s): Athletic Field Rolling Research

Graduation date: Fall 2015

Description: Routine lightweight rolling has become a very common management practice of golf course greens due to many studies that have taken place over the last couple decades. However, there is currently no published research evaluating this practice on athletic fields. This research looks at routine lightweight rolling at it's effects on athletic field surface and subsurface characteristics.

Other notable research projects led by faculty member:

Title: Management of Naturalized Secondary Roughs

Description: Naturalized secondary roughs have become more common on Michigan golf courses over the last 20 years. Whether designed by the architect, or implemented by existing golf courses, these 'out-of-play' areas now appear on all styles of golf courses. Theoretically, these areas require fewer inputs than finely maintained primary rough. However, we have learned that they do require some inputs in order to look and perform as desired. Research at MSU is exploring ways to most effectively and efficiently maintain these areas with minimal chemical and cultural inputs. The goal is to maintain the ornamental quality (i.e. inflorescence, adequate turf cover) and playability (i.e. thin enough so golf balls can be found and played). The main focus will be weed control, investigating a variety of weed control programs with differing herbicides and timings.

Title: Reducing Mowing Events in Lawns with PGR Application

Description: It has been demonstrated that PGR applications to lawns does reduce growth as expected, but it is not clearly understood whether this practice is worth the cost and effort. This trial seeks to determine whether growth is reduced enough in a lawn in order to skip or delay mowing events. The challenge is that the need to mow is subjective. So, the decision to mow a treated plot will be purely objective: a tool will be used to measure the height of the treated plots and will only be mowed when each plot grows within a certain height range. Quality of these treated plots can also be greatly affected so this will also be evaluated throughout the trial period. Mowing intervals of each plot will be used to determine a necessary mowing interval of each treatment by the end of the growing season.

Title: Annual Bluegrass (ABG) Control

Description: Four trials were established in 2015 to investigate ABG control in three different turfgrass settings – creeping bentgrass (CBG) putting greens, a CBG fairway, and a Kentucky bluegrass (KBG) fairway. Herbicide options and timings are not exhausted in these trials, but the intent is to follow labeled rates, timings, and annual limits to determine efficacy and overall turfgrass quality during trial periods. Nitrogen (urea) was added to herbicide treatments for at least the first application timing in each trial. This addition will help to determine whether supplemental N application will aid in proliferation of the preferred species (CBG or KBG in these cases) during the treatments periods.

Faculty member (complete for each faculty member): **John N. Rogers, III**

Current or recently graduated graduate student: Thomas Green

MS or PhD: MS

Project(s): A Combination of Lightweight Rolling and Sand Topdressing Programs to Decrease Pesticide Inputs and Enhance Fairway Turfgrass Quality

Graduation date: Fall 2015

Description: The objective of this study was to compare turf grown on native soil and sand topdressed areas, and evaluate the effects of season long rolling frequency (one, three, or five times per week) on turf quality and disease severity for a mixed stand fairway of creeping bentgrass (*Agrostis stolonifera* L.) and annual bluegrass (*Poa annua* L.). No fungicide applications were used on these plots that were maintained at 0.5-in height of cut, and vibratory rollers, attached to a John Deere 2500A triplex mower, were used to administer the rolling frequency treatments. This three year investigation was initiated in July 2011. Turfgrass grown on the sand topdressed areas had less dollar spot incidence and rated higher in quality compared to the native soil areas in 2011.

Current or recently graduated graduate student: Eric Chestnut

MS or PhD: MS

Project(s): Establishment Strategies for Creeping Bentgrass Putting Greens

Graduation date: Summer 2016

Description: This study was designed with the idea that new varieties of creeping bentgrass, old greens, and harsh winters, among other factors, are calling for golf course green renovations more now than ever before. Four factors are being used to determine the fastest way to produce a stand of creeping bentgrass (*Agrostis stolonifera* var. Pure Distinction) capable of tolerating putting green traffic: mowing height, nitrogen fertilizer rate, verticutting regimen, and PGR regimen. Initiated in August of 2013, this study is still in the first year of trials and will continue into 2015.

Faculty member: **Joe Vargas, Jr.**

Current or recently graduated graduate student:

MS or PhD: Liu Yan

Project(s): Bacterial Disease of Perennial Ryegrass

Graduation date: Spring 2017

Description: Perennial ryegrass is widely used on golf course fairways and roughs as well as athletic fields. In spite of good management programs, during warm summers, significant turf can be lost that is difficult to explain. We have been able to isolate a bacterium from the infected areas, identified as *Xanthomonas translucens*. It is a known pathogen of *Poa annua* and *Poa trivialis*. However, this is the first known occurrence of the *X. translucens* on perennial ryegrass. *Xanthomonas translucens pv poae* has been identified as the pathogen occurring on the *Poa* species. We are attempting to identify the pathovar attacking perennial ryegrass and to compare it to the *Poa* pathovars to see how similar they are to the one on perennial ryegrass. We also plan on developing probes that can be used by diagnostic laboratories for rapid identification of perennial ryegrass samples with suspected bacterial infection. Since this is a new disease, we are in the process of identifying the temperature range over which infection takes, place as well as the optimum temperatures for symptom development. The initial studies will be conducted in controlled environment growth chambers. It is highly unlikely that we will be able to identify a chemical control for the disease since it is a bacterial disease for which there are no registered products for use on turfgrass. The best approach for controlling the disease could be the use of resistant cultivars. Some of the most commonly available perennial ryegrass cultivars will be tested to determine whether there is any resistance among them that could possibly be used in future breeding programs. Based on the information from the growth chamber studies, field studies will be initiated at the Hancock Turfgrass Research Center. The plots will be inoculated with *X. translucens* to ensure symptom development and various management strategies will be investigated.

Title: Pesticide Application Risk Reduction Technology for Golf Course and Athletic Field Turfgrass Using Treated Sand Topdressing Technology

Description: Research at MSU suggests that it may be possible to combine the sand topdressing and pesticide application into one efficient operation, using a combination sprayer/topdresser machine. This novel technology should reduce the cost, play disruption, and the environmental impact (fuel use, CO₂ emissions) of these maintenance operations by reducing the number of trips over the turf, especially greens and tees. The potential for operator and bystander exposure to spray drift and volatilization should also be reduced, since the sprays will be applied to the sand in a wind-protected environment on the topdresser, prior to expulsion of the sand to the turf. "Proof of concept" research is underway for the control of turfgrass diseases such as dollar spot and anthracnose, and to expand the utility of this technology beyond fungicides, to fertilizers and other sprayable turfgrass maintenance products.

Extension

State conference dates: Jan. 5-7, 2016

Collaborating with other organizations on conference (yes/no): Yes

If so who: Michigan Turfgrass Foundation

Attendance figure: 500 (from 2015 conference)

Research field day held (yes/no): yes

If so, when: Aug. 12, 2015

Attendance figure: 300 (from 2014 field day)

Other Extension activities:

Web (yes/no): www.turf.msu.edu, www.msuturf.blogspot.com

FaceBook/Twitter/social networking (yes/no): yes (Twitter)

Kevin Frank @msuturf

Trey Rogers @msuturfdoc

Joint Extension publications with other regional collaborators:

General turf program comments

'Flagstick' creeping bentgrass, a dollar spot resistant bentgrass, developed by Dr. Joe Vargas and his research group has been released by Seed Research of Oregon/Pickseed USA. Pickseed USA has

produced 4,000 pounds of Flagstick for the 2015 season, with larger quantities expected to be available for distribution in 2016.

Brief State Report for NCER221

University: University of Minnesota

Official NCERA rep: Sam Bauer

Email: sjbauer@umn.edu

Phone: 904-271-0250

Staffing:

Current team members: Sam Bauer (Extension Educator), Dr. Brian Horgan (Professor and Extension Specialist), Dr. Eric Watkins (Associate Professor), Dr. Angela Orshinsky (Assistant Professor), Andrew Hollman (Senior Scientist), Matt Cavanaugh (Research Scientist), Craig Krueger (Field Plot Manager)

Additions: Kurt Hockemeyer (Research Scientist)

Retirements/vacancies:

General turf program comments:

Our undergraduate enrollment continues to be low, which reflects trends in the industry and more stringent admission requirements. Currently we have six graduate students studying turf, three who will graduate this fall. The biggest funding sources for our programs include a USDA Specialty Crops grant for working with fine fescues, and MN Dept. of Transportation support for working with salt-tolerant roadside grasses.

Teaching Program

Current undergraduate enrollment: <10

Trend in undergraduate enrollment over last 3 years: down

Placement: full

Brief comments on teaching: We have not seen any increase in interest for turfgrass at the undergraduate level; most interest in our major is in plant breeding and genetics. Entrance requirements for the University have affected numbers of turfgrass students. Due to low enrollment we have developed a teaching collaboration with UW-Madison that has allowed the delivery of courses even with low enrollments. Eric Watkins has shifted some teaching to non-turf courses such as plant breeding and genetics.

Research

Faculty member: Brian Horgan

Current or recently graduated graduate student: Josh Friell, Ph.D (2014); Maggie Reiter, M.S.; Madeline Leslie, M.S.

Project(s): Salt-tolerant roadside grasses; fine fescues for golf course fairways; developing outreach and extension programs for fine fescue home lawns

Other notable research projects led by faculty member:

Title:

Description:

NCERA Collaborators (name, institution):

Faculty member: Eric Watkins

Current or recently graduated graduate student: Josh Friell, Ph.D (2014); Eric Koeritz Ph.D. (2014); Long Ma, Ph.D.; Maggie Reiter, M.S.; Garrett Heineck, M.S.; Clemon Dabney, M.S.; Ian Lane, M.S.

Project(s): Salt-tolerant roadside grasses; fine fescues for golf course fairways; perennial ryegrass seed production management and breeding; fine fescue breeding; perennial ryegrass breeding; breeding for low-input environments; lawns as a pollinator foraging resource

Other notable research projects led by faculty member:

Title:
Description:
NCERA Collaborators (name, institution):

Faculty member: Angela Orshinsky
Current or recently graduated graduate student: Josh Havill (MS), Lillian Garber (MS)
Project(s): Turf projects include low impact/low cost dollar spot management programs, in-field defense gene upregulation by defense activators, snow scald distribution, biology, taxonomy, epidemiology and management, turfgrass diagnostics, advising on Watkins lab endophyte research.

Other notable research projects led by faculty member: Diseases of hops, Tomato leaf mold on Tomato

Faculty member: Sam Bauer
Current or recently graduated graduate student: N/A
Project(s): Salt tolerant roadside turf; wetting agent influence on surface firmness and winter injury of putting greens; growing-degree days for PGR application; winter injury of turfgrasses; tall fescue and fine fescue planting time

List Publications (published or in press) with other NCERA collaborators over the last two years (list):

1. Watkins, E., D.S. Gardner, J.C. Stier, D.J. Soldat, R.A. St. John, N.E. Christians, A.D. Hathaway, K.L. Diesburg, S.R. Poppe, R.E. Gaussoin. 2014. Cultivar performance of low-input turfgrass species for the North Central United States. Applied Turfgrass Science: doi:10.2134/ATS-2013-0101-RS.

Extension Program

State conference dates: January 13th-15th, 2016
Collaborating with other organizations on conference (yes/no): yes
If so who: Minnesota Turf and Grounds Foundation and Minnesota Nursery and Landscape Association
Attendance figure: 6,000
Research field day held (yes/no): yes, even years (virtual on odd years)
If so, when: August, 2016
Attendance figure: 200
Other Extension activities: online turf school, regional turfgrass workshops
Website (yes/no): yes
If yes, please list website address(es): www.turf.umn.edu, www.extension.umn.edu/turfgrass,
www.sustland.umn.edu
FaceBook/Twitter/social networking (yes/no): yes
If yes, please list info: Twitter @urbanturfmn, @mnturf, @erictwatkins, @microfungirl, @cavanaughturf, @umnyardgarden

Brief comments on Extension:

Our Extension programs continue to evolve. For the past two years we have taken our turf school short course to an online format and added ten instructors from across the Great Lakes Region. We feel that this has been a successful venture and we will continue to improve this class in future years.

BRIEF State Report for NCERA 221

University: University of Missouri
Official NCERA rep: Xi Xiong
Email: xiongxi@missouri.edu
Phone: 573-882-1824

Teaching Program

Current undergraduate enrollment: 8-10.

Trend in undergraduate enrollment over last 3 years: 10-15

Placement: golf courses, sports fields, lawn-care companies, graduate colleges, and others.

Brief comments on teaching: Introductory Turfgrass Management and Advanced Turfgrass Management have been offered every year in fall and spring semester, respectively. An 8-week course on Horticultural Drainage & Irrigation Systems (2 credits) is being offered during spring semester as well.

Research

Faculty member: Xi Xiong

Current or recently graduated graduate student: John Haguewood

MS or PhD: MS

Project(s): *Poa annua* control on creeping bentgrass putting green

Graduation date: May, 2014

Current or recently graduated graduate student: Enzhan (Steve) Song

MS or PhD: PhD

Project(s): Soil hydrophobicity and wetting agent application on turf

Graduation date: May, 2017

Current or recently graduated graduate student: Xiaowei (Natalie) Pan

MS or PhD: PhD

Project(s): Utilizing plant residues to control turfgrass diseases

Graduation date: December, 2016

Current or recently graduated graduate student: Naba Amgain

MS or PhD: PhD

Project(s): TBD

Graduation date: December, 2019

Other notable research projects led by faculty member:

Title: Herbicide options to postemergence control of windmillgrass on warm- and cool-season turf

Description: We carried out greenhouse-base experiments to evaluate herbicide options to control of windmillgrass, which has become an emerging problem in various turf areas in Missouri and surround states.

Collaborators (name, institution): Jim English (University of Missouri), Reid Smeda (University of Missouri), Steve Anderson (University of Missouri), Keith Goyne (University of Missouri), Carl Sams (University of Tennessee), Justin Moss (Oklahoma State University), Nathan Walker (Oklahoma State University), and Mike Richardson (University of Arkansas).

List Publications (*published or in press*) with other NCERA collaborators over the last two years (list):

1. Xiong, X., K. Diesburg, and D. T. Lloyd. 2013. Application of glufosinate on dormant zoysiagrass (*Zoysia japonica*) turf. HortScience. 48: 785-789.

Research

Faculty Member: Lee Miller

Current or recently graduated graduate student: Derek Cottrill

MS or PhD: MS

Project(s): Geographic distribution and management of spring dead spot in Missouri

Graduation date: May 2014

Current or recently graduated graduate student: Maxwell Gilley

MS or PhD: PhD

Project(s): Characterization & management of Pythium root diseases on creeping bentgrass in the Midwest.

Anticipated Graduation date: December 2017

Current or recently graduated graduate student: John Koehler

MS or PhD: MS

Project(s): Evaluation of fertilizer strategies for preventing or recovering from large patch of zoysiagrass

Graduation date: December 2016

Current or recently graduated graduate student: Kyle Robertson

MS or PhD: MS

Project(s): Assessment of hormetic responses in *Sclerotinia homoeocarpa* isolates to sublethal doses of DMI fungicides.

Graduation date: December 2017

Other notable research projects led by faculty member:

Title: 2013-17 National Turfgrass Evaluation Ancillary Trials: Spring Dead Spot on Bermudagrass & Large Patch on Zoysiagrass

NCERA Collaborators (name, institution): Brad Fresenburg, University of Missouri; Mike Richardson, University of Arkansas

NCERA collaborators on grad projects

Project(s): Evaluation of fertilizer strategies for preventing or recovering from large patch of zoysiagrass

Megan Kennelly, Kansas State University, Brad Fresenburg, University of Missouri

Research

Faculty member: Brad Fresenburg

NTEP:

The only research under my watch includes the NTEP trials. We completed the 2010 Perennial Ryegrass trial to hopefully be replaced by a new trial in 2016. We presently have 2012 Tall Fescue, 2014 Fine Fescue, 2014 Creeping Bentgrass – Fairway, 2014 Creeping Bentgrass – Putting Green as standard trials. In cooperation with Dr. Lee Miller, we have two ancillary trials looking at Spring Dead Spot resistance on the 2013 Bermudagrass trial and Large Patch resistance on the 2013 Zoysiagrass trial. We have applied for the 2015 Low Input trial recently sent out.

Extension Program

State conference dates: December 10, 2014

Collaborating with other organizations on conference (yes/no): Yes

If so who: Missouri Turf & Ornamental Council, Mississippi Valley Golf Course Superintendents Association, Gateway Sport Turf Managers Association, Gateway Irrigation Association and Missouri Landscape & Nursery Association. Attendance figure: over 500 with participants, vendors and speakers.

Research field day held (yes/no): Yes

If so, when: July 22, 2014

Attendance figure: 200

Other Extension activities:

Faculty member: Lee Miller

Lawncare Workshop Series

In cooperation with regional extension horticulture specialists, a planned series of lawn care workshops was held in 2013 and 2014 for 50 attendees each in St. Charles, Jackson, and Greene counties. The workshops are targeted towards homeowners and lawn care operations in metropolitan areas and are planned again in 2015. Outreach specifically to homeowners has also been accomplished in association with regional extension specialists through the Master Gardener training program, or in association with the Extension and Agricultural Office in the form of press releases to news media outlets.

Plant Diagnostic Laboratory

The MU Turfgrass Diagnostic Lab merged with the newly reopened MU Plant Diagnostic Clinic in 2014, which had been out of operation for 2 years due to a lack of funding. Patricia Wallace was hired as Director of the Plant Diagnostic Clinic, and Lee Miller serves as faculty supervisor. Over 450 samples were submitted to the Clinic in 2014, with 63 submissions from turfgrass areas.

Missouri Pesticide Applicator Program

The Commercial Pesticide Applicator Program in Missouri is mandated by the USA-EPA with the main educational role provided by University of Missouri Extension and enforcement provided by the Missouri Department of Agriculture. Brad Fresenburg and Lee Miller teach classes for the certification and recertification of pesticide applicators in Category 3: Turfgrasses and Ornamental Pest Control. Recently, an updated version of the training manual for these classes was co-authored by Fresenburg and Miller, and used in 2014 and 2015. In 2013 and 2014, we educated over 2000 commercial turfgrass managers through this program in Springfield, Cape Girardeau, Columbia, St. Louis, and Kansas City.

Website (yes/no): Yes

If yes, please list website address(es): www.turf.missouri.edu, www.turfpath.missouri.edu - Eighty-two online disease reports have been written from March 2011 – May 2015 on a biweekly basis during the season. From March 2011-May 2015, the website has been visited 22,134 times, with 44,883 page views from 5,951 unique visitors. Users in 21 different countries have visited the site (longer than 30 second average visit time), and more than 10 visitors have accessed the site in 46 of the 50 states.

FaceBook/**Twitter**/social networking (yes/no): Yes

If yes, please list info: @muturfpath – 795 followers, 529 messages

Faculty member: Brad Fresenburg

Brad Fresenburg is an Assistant Extension Professor of Turfgrass Sciences and serves as the State Turfgrass Specialist. This is a professional track position with 100% Extension responsibilities with some time dedicated to research, teaching and student recruiting.

Commercial Pesticide Applicator Training:

With the retirement of Wayne Bailey in Entomology, I have been asked to take the lead for the Commercial Pesticide Applicator Training Program beginning this summer. The commercial program is a 4-week traveling road show during the month of January being held in Springfield, Kansas City, Columbia, Cape Girardeau, and St. Louis, MO. Attendance for this program averages over 2000 participants each year. Category 3 Turf & Ornamentals usually averages 33% of the total participants each year.

Missouri Green Industry Conference:

The Missouri Green Industry Conference was held on December 10, 2014 at the St. Charles Convention Center. Tracks (Golf, Sports Turf, Lawn Care & Landscape, Ornamentals, Irrigation, Irrigation Workshop, Equipment Maintenance & Safety, and Pesticide Applicator Re-Certification) were offered in a single day with Pesticide Applicator Re-certification offered as an option on the same day. This joint conference includes the Missouri Turf & Ornamental Council (MoTOC), the Gateway Chapter of STMA, The Gateway Irrigation Association, the Mississippi Valley Golf Course Superintendents Association (MVGCSA), and the Missouri Landscape & Nursery Association (MLNA). Last year's attendance with speakers, vendors and participants was over 500.

Heartland Green Industry/Common Ground Expo:

The Heartland Green Industry/Common Ground Expo was held on December 16th and 17th, 2013 at the Overland Park Convention Center in Overland Park, KS. Tracks (Golf, Lawn Care, Business, and Pesticide Re-certification) were offered over 2 days. This is a joint conference between the Heart Golf Course Superintendents Association and Mid-America Green Industry Council. They are currently lining up tracks, topics, and speakers for December of 2015. Brad usually participates in the Pesticide Re-certification Program of the conference.

Master Gardener Training:

Conducted 12 Master Gardener training session for Home Lawn Care in various locations across Missouri in 2014 and completed 7 in the Spring of 2015.

Website (yes/no): Yes

If yes, please list website address(es): <http://turf.missouri.edu/> <http://pat.missouri.edu>
<http://turf.missouri.edu/stat/>

FaceBook/Twitter/social networking (yes/no): No

If yes, please list info:

Brief comments on Extension: We have had discussions on establishing and implementing a fee based structure for extension. Several of the regional offices have implemented this program where an additional fee is charged per participant to cover any expenses of campus faculty who participate in training in addition to providing an assigned amount to Campus Extension.

BRIEF State Report for NCERA221 and WERA011

University: University of Nebraska Lincoln

Official NCERA rep: Bill Kreuser

Email: wkreuser2@unl.edu

Phone: 402-472-1869

Official WERA rep: Keenan Amundsen

Email: kamundsen2@unl.edu

Phone: 402-472-8390

Teaching Program

Current undergraduate enrollment: 40

Trend in undergraduate enrollment over last 3 years: steady

Placement: 100%

Research

Faculty member (complete for each faculty member): Keenan Amundsen

Current or recently graduated graduate student: Luqi Li

MS or PhD: MS

Project(s): Improving establishment of buffalograss

Graduation date: December 2015

Other notable research projects led by faculty member:

Title: Characterize seed dormancy mechanisms in buffalograss

Description: Conduct studies to test alternative seed treatments to break seed dormancy, profile hormones during germination of treated and untreated seeds. Research is expected to optimize seed treatment to break dormancy and reduce production costs.

Funded by the Native Turf Group. Co-PIs: William Kreuser, UNL; Gautam Sarath, USDA

NCERA Collaborators (name, institution):

Paul Johnson, Utah State University; Shaun Bushman, USDA, Logan, UT; Brandon Horvath, Univ. Tenn.;

List Publications (published or in press) with other NCERA or WERA collaborators over the last two years (list):

1. Amaradasa, B., D. Lakshman, B. Horvath, **K. Amundsen**. 2014. Development of SCAR markers and UP-PCR cross-hybridization method for specific detection of four major subgroups of *Rhizoctonia* from infected turfgrasses. *Mycologia* 106(1):163-172.
2. Donze, T., B.S. Amaradasa, C. Caha, T. Heng-Moss, **K. Amundsen**. 2014. Molecular differentiation of gender in buffalograss. *Crop Science*. doi:10.2135/cropsci2014.07.0478
3. Ramm, C., M. Wachholtz, **K. Amundsen**, T. Donze, T. Heng-Moss, P. Twigg, G. Sarath, and F. Baxendale. 2015. Transcriptional Profiling of Resistant and Susceptible Buffalograsses in

Response to *Blissus occiduus* (Hemiptera: Blissidae) Feeding. Journal of Economic Entomology.
doi: 10.1093/jee/tov067

Faculty member: Roch Gaussoin

Current or recently graduated graduate student: Matt Pederson

MS or PhD: PhD

Project(s): Investigating the potential of select whole grass extracts and their isolated components for protection against mammalian inflammation Graduation date: May 2016

List Publications (published or in press) with other NCERA or WERA collaborators over the last two years (list):

1. Reicher, Z., M. Sousek, and **R. Gaussoin**. 2014. Fall or late winter applications of preemergence herbicides rarely provide season-long control of crabgrass (*Digitaria* spp) in Nebraska. Online. Applied Turfgrass Science doi: 10.2134/ATS-2014-0024-BR.
2. Sousek, M., **R. E. Gaussoin**, A. J. Patton, D. V. Weisenberger, and Z. J. Reicher. 2014. Weed control and turf safety of single and sequential applications of herbicides over spring seedings. Online. Applied Turfgrass Science doi: doi:10.2134/ATS-2013-0046-RS.
3. Watkins, E., D. S. Gardner, J. C. Stier, D. J. Soldat, R. A. St. John, N. E. Christians, **R.E. Gaussoin** et al. 2014. Cultivar performance of low-input turfgrass species for the North Central United States. Appl. Turfgrass Sci. 11(1):p. 1-7. doi: 10.2134/ATS-2013-0101-RS
4. Berndt, W. L., **R. E. Gaussoin**, and J. M. Jr. Vargas. 2014. Cellulase accelerates short-term decay of thatch-mat. Agron. J. 106(3):p. 781-788.
5. Schmid, C.A., **R.E. Gaussoin** and S. A. Gaussoin. 2014. Organic Matter Concentration of Creeping Bentgrass Putting Greens in the Continental U.S. and Resident Management Impact. Applied Turfgrass Science doi:10.2134/ATS-2014-0031-BR
6. Schmid, C.A., **R.E. Gaussoin**, R.C. Shearman, M. Mamo and C.S. Wortmann. 2015. Cultivation Effects on Organic Matter Concentration and Infiltration Rates of Two Creeping Bentgrass (*Agrostis stolonifera* L.) Putting Greens. Applied Turfgrass Science doi:10.2134/ATS-2014-0032-RS

Faculty member: Tiffany Heng-Moss and Fred Baxendale

Current or recently graduated graduate student: Crystal Ramm

MS or PhD: Ph.D.

Project(s): Molecular insights into the defense response of buffalograss to chinch bugs

Graduation date: May 2014

Current or recently graduated graduate student: Kyle Koch (co-advised with Jeff Bradshaw)

MS or PhD: Ph.D.

Project(s): Evaluation of tetraploid switchgrasses for resistance to phloem-feeding insects

Graduation date: December 2016

Current or recently graduated graduate student: Travis Prochaska (co-advised with Gautam Sarath)

MS or PhD: Ph.D.

Project(s): Physiological, biochemical and anatomical insights into aphid-switchgrass interactions

Graduation date: August 2015

List Publications (published or in press) with other NCERA or WERA collaborators over the last two years (list):

None with NCERA collaborators from other institutions.

Faculty member: Bill Kreuser

Current or recently graduated graduate student: Darrell Michael
MS or PhD: MS
Project(s): Winter desiccation prevention and recovery
Graduation date: August 2016

Current or recently graduated graduate student: Glen Obear
MS or PhD: PhD
Project(s): Characterization, remediation, and prevention of iron layer formation in USGA putting greens
Graduation date: December 2018

List Publications (published or in press) with other NCERA or WERA collaborators over the last two years (list):

1. **Kreuser**, W.C., and F. S. Rossi. 2014. Civitas increases clipping yield on a cool-season putting green. *Applied Turfgrass Science*.
2. **Kreuser**, W. C., and F. S. Rossi. 2014. The horticultural spray oil, Civitas™, causes chronic phytotoxicity on cool-season golf turf. *HortScience*. 49:1217-1224. doi:10.2134/ATS-2014-0012-BR.

Faculty member: Zac Reicher

Note: Zac Reicher is included in this report since he was a faculty member for much of the reporting year

List Publications (published or in press) with other NCERA or WERA collaborators over the last two years (list):

1. Sousek, M., R. E. Gaussoin, A. J. Patton, D. V. Weisenberger, and **Z. J. Reicher**. 2014. Weed control and turf safety of single and sequential applications of herbicides over spring seedings. Online. *Applied Turfgrass Science*. doi:10.2134/ATS-2013-0046-RS.
2. **Reicher, Z., M.** Sousek, and R. Gaussoin. 2014. Fall or late winter applications of preemergence herbicides rarely provide season-long control of crabgrass (*Digitaria* spp) in Nebraska. Online. *Applied Turfgrass Science*. doi: 10.2134/ATS-2014-0024-BR.
3. Thompson, C., J. Fry, M. Kennelly, M. Sousek, and **Z. Reicher**. 2014. Seasonal timing of glyphosate application influences control of *Poa trivialis*. Online. *Applied Turfgrass Science*. doi: 10.2134/ATS-2013-0044-BR.
4. Leibhart, L. J., M. D. Sousek, G. Custis and **Z. J. Reicher**. 2014. Speedzone has potential for postemergence goosegrass control in perennial ryegrass and creeping bentgrass. Online. *Applied Turfgrass Science*. doi:10.2134/ATS-2014-0025-BR
5. Proctor, C., Wiesenberger, D. V., **Reicher, Z.** 2015. Kentucky bluegrass and perennial ryegrass mixtures for establishing Midwest lawns. *HortScience* 50(1):1–4. 2015.

Extension

State conference dates: January 5-7, 2015

Collaborating with other organizations on conference (yes/no): No

If so who:

Attendance figure: 548

Research field day held (yes/no): Yes

If so, when: July 23

Attendance figure: 177

Other Extension activities: Backyard Farmer TV, Thursday nights ~20,000 viewers/episode

Web (yes/no): Yes

FaceBook/Twitter/social networking (yes/no): Yes

Joint Extension activities/publications with other regional collaborators over in the last two years: none

Staffing:

Additions:

Matt Sousek, Promoted to Turfgrass Research Farm Manager April, 2015
New faculty position has been approved and will be advertised within 2 months.

Retirements/vacancies:

Lannie Wit, Turfgrass Research Farm Manager Retired March 2015 (with program for 38 years)
Zac Reicher accepted a position with Bayer Crop Science March 2015

Brief State Report for NCER221

University: North Dakota State University
Official NCERA rep: Deying Li
Email: Deying.li@ndsu.edu
Phone: (701)231-8037

Staffing:

Current team members: Alan Zuk, Qi Zhang, and Esther McGinnis.

Additions:

Retirements/vacancies:

General turf program comments:

Student enrollment low at low 20s.

Teaching Program

Current undergraduate enrollment: 23
Trend in undergraduate enrollment over last 3 years: Stable
Placement: 90%
Brief comments on teaching: Class is too small.

Research

Faculty member (complete for each faculty member):

Qi Zhang

Current or recently graduated graduate student:

MS or PhD:

1. Kevin Rue, M.S., Kentucky bluegrass responses to saline, waterlogging, and saline-waterlogging, expected fall, 2016
2. Liqi Yang, M.S. Effects of chloride and sulfate salts on Kentucky bluegrass, expected spring, 2016

No NCERA collaborators on either of the projects

Other notable research projects led by faculty member:

Title: Drought tolerance in creeping bentgrass

Description: Evaluation drought tolerance in commercially available creeping bentgrass cultivars

NCERA Collaborators (name, institution): None

List Publications (*published or in press*) with other NCERA collaborators over the last two years (list):

1. Chandra, A., J. Fry, M. Engelke, A. Genoves, B. Wherley, J. Reinert, S. Metz, **Q. Zhang**, and D. Okevo. 2014. Registration of 'Chisholm' zoysiagrass. J. Plant Register. (Accepted)

Alan Zuk:

Nothing to report

Esther McGinnis:

Nothing to report

Deying Li

Current or recently graduated graduate student:
PhD: Yang Gao.

Project(s): phytoremediation of soils contaminated by oil and gas drilling and production operations using grass species

Graduation date: Graduated January 2015.

NCERA collaborators on grad projects
(Copy and paste as needed): None.

Other notable research projects led by faculty member:

Title: n/a

Description: n/a

NCERA Collaborators (name, institution): n/a

List Publications (*published or in press*) with other NCERA collaborators over the last two years (list):

2. Yuan, L., **D. Li**, Y. Gao, and W. Xiao. 2014. Seed ratios for optimum turf quality of mixtures of Kentucky bluegrass, creeping red fescue, and alkaligrass subjected to deicing salts. HortTechnology 24:712-716.
3. Chang, Z., X. Jin, and **D. Li**. 2014. Phosphorus responses vary among cool-season turfgrasses during establishment from seed. Agron. J. 106:1975-1980. Doi:10.2134/agronj14.0225.
4. Gao, Y., and **D. Li**. 2014. Growth responses of tall fescue (*Festuca arundinacea* Schreb.) to salinity stress. Europ. J. Hort. Sci. 79:123-128.
5. Han L., Y. Gao, and **D. Li**. 2014. Ion uptake in tall fescue as affected by carbonate, chloride, and sulfate salinity. PLoS ONE 9(3): e91908. doi:10.1371/journal.pone.0091908
6. Yin, S., Q. Li, W. Liu, and **D. Li**. 2014. Managing tall fescue (*Festuca arundinacea* L.) and zoysiagrass (*Zoysia japonica* Steud.) mixtures as turfgrass in transition zone. Agron. J. 106:1-6. doi:10.2134/agronj2013.0148.

Extension Program

State conference dates:n/a

Collaborating with other organizations on conference (yes/no):yes

If so who: North Central Turfgrass Association (NCTGA)

Attendance figure: 40

Research field day held (yes/no): no

If so, when:

Attendance figure:

Other Extension activities: Master Gardener

Website (yes/no): no

If yes, please list website address(es):

FaceBook/Twitter/social networking (yes/no):

If yes, please list info:

Brief comments on Extension:

BRIEF State Report for NCER221

University: The Ohio State University

Official NCERA rep: David Gardner

Email: gardner.254@osu.edu

Phone: 614-292-9002

Staffing:

Current team members: Karl Danneberger, David Gardner, Pam Sherratt; Joe Rimelspach (Plant Pathology); Dave Shetlar (Entomology); Ed McCoy (Natural Resources)

Additions: None

Retirements/vacancies: John Street (Horticulture and Crop Science)

Teaching Program

Current undergraduate enrollment: 20-25

Trend in undergraduate enrollment over last 3 years: Down 30

Placement: 92%

Brief comments on teaching: Most classes continue to be offered but with lower enrollments, some upper level classes are being cancelled every other year. PGM students (65 majors currently) take some turf courses. Pam Sherratt and Dave Gardner have assumed more responsibilities in general education and landscape horticulture.

Research

Faculty member: Dave Gardner

Current or recently graduated graduate student: Arly Drake

MS or PhD: MS/PhD

Project(s): MS - Influence of Cultural Practices on Sand-Based Putting Green Firmness (Completed);
PhD – Use of Giberrellin Synthesis-Inhibiting Plant Growth Regulators for the Prevention of *Acidovorax avenae* Infection of Creeping Bentgrass

Graduation date: 2016

Current or recently graduated graduate student: Dominic Petrella

MS or PhD: Ph.D.

Project(s): Methods of Inducing Anthocyanin Production in Plants

Graduation date: 2016

Other notable research projects led by faculty member:

Integrating Microclover with Turfgrass to Develop a More Environmentally Sustainable Ecosystem

Faculty member: Karl Danneberger

Current or recently graduated graduate student: Matt Williams

MS or PhD: M.S.

Project(s): Adaptability of Bermudagrasses in Northern Climates

Graduation date: 2017

Current or recently graduated graduate student: Chenchen Gu

MS or PhD: M.S.

Project(s): The Physiological Effects on Brushing on Bentgrass Putting Greens

Graduation date: 2016

Faculty member: John Street

Current or recently graduated graduate student: Eva Fang

MS or PhD: MS

Project(s): Methiozolin for control of *Poa annua*

Graduation date: 2015

Other notable research projects led by faculty member:

Integrating Microclover with Turfgrass to Develop a More Environmentally Sustainable Ecosystem

List Publications (*published or in press*) with other NCERA collaborators over the last two years

(list):

1. Nangle, E.J., D.S. Gardner, J.D. Metzger, L. Rodriguez-Saona, M. M. Guisti, T. K. Danneberger, and D.P. Petrella. 2015. Pigment Changes in Cool-Season Turfgrasses in Response to Ultraviolet-B Light Irradiance. *Agron J.* 107:41-50.

2. Watkins, E., D.S. Gardner, J.C. Stier, D.J. Soldat, R.A. St. John, N.E. Christians, A.D. Hathaway, K.L. Diesburg, S.R. Poppe, and R. E. Gaussoin. 2014. Cultivar Performance of Low-Input Turfgrass Species for the North Central United States. *Applied Turfgrass Sci.* doi:10.2134/ATS-2013-0101-RS
3. Gardner, D.S., B.P. Horgan and B.J. Horvath. 2013. Spatial Variability of Soil Amino Sugar Nitrogen on Golf Course Fairways. *Int. Turf. Soc. Res. J.* 12: 545-549

Extension Program

State conference dates: December 7-10

Collaborating with other organizations on conference (yes/no): No

If so who:

Attendance figure: 1250

Research field day held (yes/no): Yes

If so, when: August 11, 13

Attendance figure: 325 + 175

Other Extension activities: Spring Tee Off/OSU Sports Turf Short Course in February. Total attendance ~200

Website (yes/no): yes

If yes, please list website address(es): buckeyeturf.osu.edu, hcs.osu.edu/plantscienceonline

FaceBook/Twitter/social networking (yes/no): yes

If yes, please list info:

Facebook: Buckeye Turf, Turfopps

Twitter: @osuturf @grassybrit @globalturf

Brief comments on Extension:

The Ohio Turfgrass Foundation relocated its office staff to the OTF center on the Ohio State campus in 2014. The 2015 OTF conference returns to Columbus after being held at Kalahari Waterpark and Convention Facility in Sandusky Ohio in 2014.

BRIEF State Report for NCER221

University: Wisconsin

Official NCERA rep: Doug Soldat/Paul Koch

Email: djsoldat@wisc.edu

Phone: 608-263-3631

Teaching Program

Current undergraduate enrollment: 6

Trend in undergraduate enrollment over last 3 years: down

Placement: 100%

Brief comments on teaching: Trading online courses with University of Minnesota, working well and open to expanding offerings in the future with other schools.

Research

Faculty member (complete for each faculty member): Soldat

Current or recently graduated graduate student: Sabrina Ruis

MS or PhD: Ph.D.

Project(s): Using DayCent and soil property info to improve nitrogen fertilizer recommendations for turf

Graduation date: 2015

Faculty member (complete for each faculty member): Soldat

Current or recently graduated graduate student: Shannon Plunkett

MS or PhD: MS

Project(s): Improving soil-testing methods for lead-contaminated soils

Graduation date: 2017

Faculty member (complete for each faculty member): Koch
Current or recently graduated graduate student: Lisa Reedich (PhD) - MS or PhD: PhD
Project(s): Impact of temperature on the breakdown and toxicological impact of propiconazole and 2, 4-D.
Graduation date: 2017

Faculty member (complete for each faculty member): Koch
Current or recently graduated graduate student: Ron Townsend
MS or PhD: MS
Project(s): Nitrogen rate and source impact on dollar spot development
Graduation date: 2018

Faculty member (complete for each faculty member): Koch
Current or recently graduated graduate student: Brijesh Karakkat
MS or PhD: Postdoc
Project(s): Rust management on turfgrass
Graduation date: N/A

Faculty member (complete for each faculty member): Koch
Current or recently graduated graduate student: TBD – posted May 2015
MS or PhD: Postdoc
Project(s): Impact of pesticides on landscape phytobiomes
Graduation date: N/A

Publications with other NCERA collaborators over the last two years:

- Watkins, Eric; Gardner, David S.; Stier, John C.; Soldat, Douglas J.; St. John, Rodney A.; Christians, Nick E.; Hathaway, Aaron D.; Diesburg, Kenneth L.; Poppe, Steven R.; Gaussoin, Roch E. 2015. Golf Course Management. February. 83(2): p. 133-138.
- Watkins, Eric; Gardner, David S.; Stier, John C.; Soldat, Douglas J.; St. John, Rodney A.; Christians, Nick E.; Hathaway, Aaron D.; Diesburg, Kenneth L.; Poppe, Steven R.; Gaussoin, Roch E. 2014. Applied Turfgrass Science. 11(1): p. 1-7.
- Bigelow, Cale A.; Soldat, Douglas J. 2013. p. 383-424. In: Stier, John C.; Horgan, Brian P.; Bonos, Stacy A., eds. Turfgrass: Biology, Use, and Management. Madison, Wisconsin: American Society of Agronomy.
- McMillan, M. F.; Kostka, S.; Boerth, T.; Fidanza, M.; Bigelow, C.; Cisar, J.; Soldat, D.; Karas, I.; Williams, K. 2013. International Turfgrass Society Research Journal. 12: p. 815-818.

Extension Program

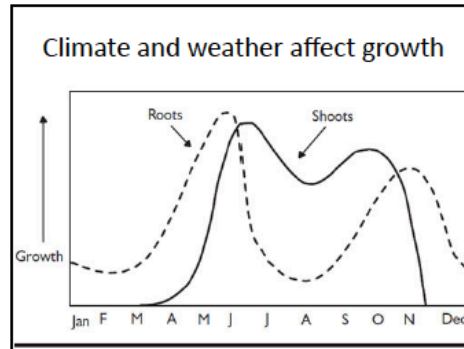
State conference dates: Jan 5, 2016
Collaborating with other organizations on conference (yes/no): No
Attendance figure: 150
Research field day held (yes/no): Yes
If so, when: The last Tuesday in July every year
Attendance figure: 300
Other Extension activities: All three faculty participating in Great Lakes School of Turfgrass Management Web (yes/no): www.turf.wisc.edu, www.tdl.wisc.edu
Twitter: @djsoldat @uwpaul @uwbruce

Staffing:

Additions: January 2014 – hired Paul Koch as extension pathologist: 70% extension, 20% teaching, 10% research
Retirements/vacancies: Vacancy in Hort (expected to be a long term/permanent vacancy)

Cool-Season Growth Potential Model

Bill Kreuser
<http://turf.unl.edu/>

Fertilizing to Match Growth Potential

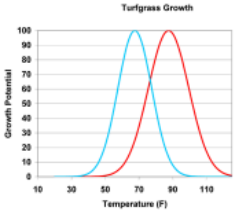
Developed by PACE Turf

Estimates growth potential of turf based on air temperature

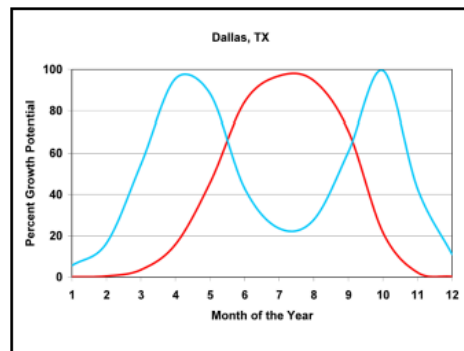
Match N fertilization with growth potential

Equation for calculating growth potential

The optimum temperature for cool season turf is 67.5F, and for warm season turf is 87.5F. The variance is set to 10 for cool season turfgrasses and 12 for warm season turfgrasses.

$$100 \times \left(\frac{\text{average temperature} - \text{optimum growth temperature}}{\text{variance}} \right)^2$$


PACE Turf LLC, 2014



Growth Potential and Fertilization

- Nutrient demand is greatest when plants grow the fastest
- Rational:
 - Fertilize turfgrass at higher nitrogen rates when growth potential is greatest and reduce rates when growth potential is low

Forecasted threat temperature: 75 F or 24 C

Weekly maximum nitrogen for cool season grass:
 0.13 lb N/1000 sq ft
 6.292 kg/ha

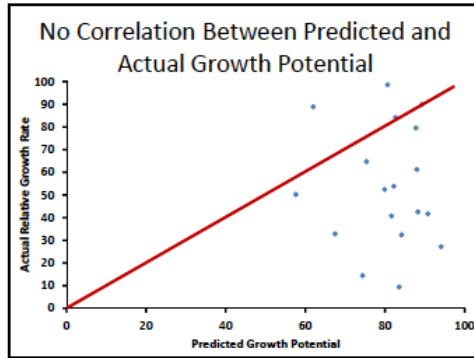
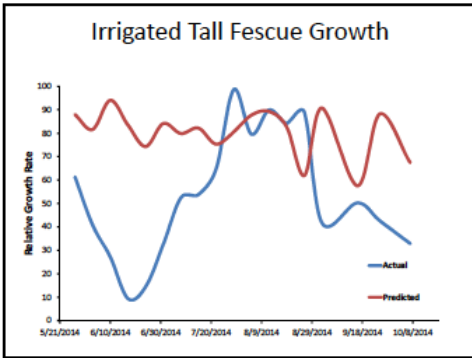
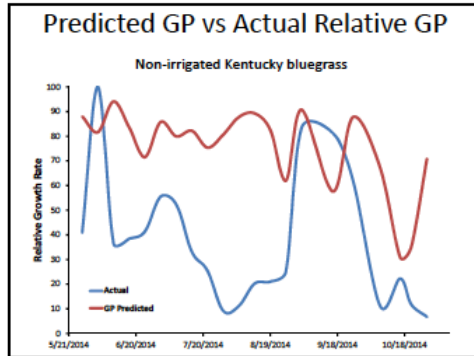
Weekly maximum nitrogen for warm season grass:
 0.09 lb N/1000 sq ft
 4.356 kg/ha

Collaborative Goals

- Measure annual clipping yield from various turfgrass species around the region to refine and improve the accuracy of the growth potential model
- Compile clipping yield and weather data from past experiments around the Great Lakes and Great Plains region to validate the growth potential model

Method 1: Clipping Collection

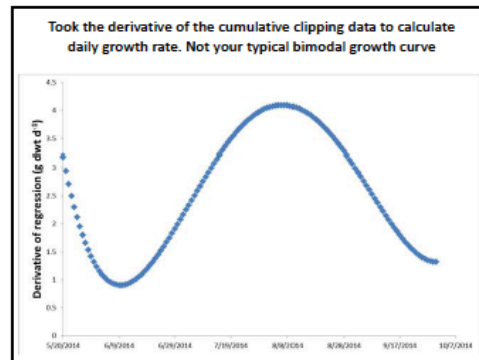
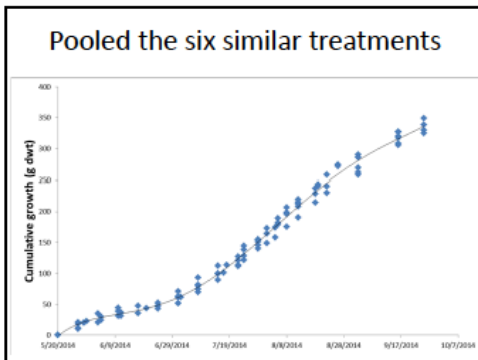
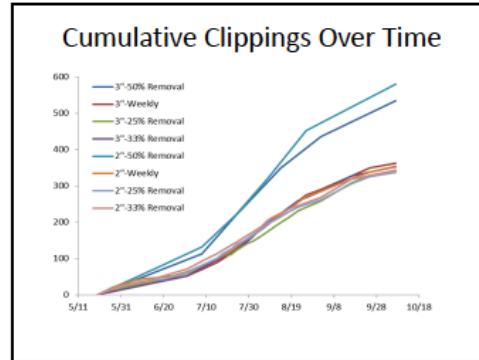
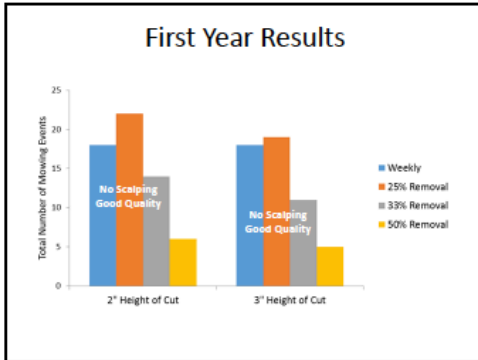
- Collected clippings at each mowing
 - Non-irrigated KBG
 - Irrigated KBG
 - Creeping bentgrass fairway
- Correlated yield with weather and PACE growth potential model



Tall Fescue Mowing Frequency Study

	2"	3"
Weekly	-	-
1/4 Rule	2.66	4
1/3 Rule	3	4.5
1/2 Rule	4	6





Potential for Collaboration

- 1) Data mine existing data sets
- 2) Conduct clipping collection studies
 - Simply collect clippings from a known area over the year

Thoughts?

Attachment 4. 2015 NTEP Report (Eric Watkins)

NTEP Policy Committee

San Antonio TX Feb 27-28 2015

Summary for NCERA-221

Eric Watkins, NTEP Policy Committee representative

1. *Payments for current trial:* The budget is coming around, but still not great. Decisions were made on payments for trials planted in 2013. More money was allocated based on presumed effort (more intense management, treatment application, etc.).
 - a. Bentgrass
 - i. 8K for greens
 - ii. 6K for standard fairway
 - iii. 8K for fairway traffic
 - iv. Results in potential shortfall, likely covered by USGA
 - b. Fine fescue
 - i. 5K for standard
 - ii. 7.5 K for traffic
 - iii. Leaves about 100K "profit" which is important for depleted reserves
2. *Finances:* Revenue streams discussed, including a fee per bag of seed--probably a non-starter with industry, too many hurdles. Grass seed commissions were mentioned as possible partners for advancing NTEPs mission.
3. *New trials:*
 - a. Much discussion was centered on new opportunities for trials. A low-input home lawn trial was approved for fall 2015, this has been viewed very favorably by industry and since the meeting has garnered much interest. This should be an opportunity for NTEP to increase reserves a bit. Advisory panel has been meeting (Bigelow and Watkins from NCR)
 - b. In the near future, a drought trial may occur (separate cool and warm season), with funding support from USGA. This additional funding is necessary due to infrastructure costs associated with rainout shelters of various types. More information forthcoming on this.
4. *Website:* A significant amount of time was spent discussion how data is reported on the NTEP website. There is a need for a better system, but the funds are not there at this point. Winfield Solutions has developed a nice interface using the means from NTEP (demonstrated later via web conference). Longer-term, something should be developed using raw data from NTEP.
5. *Other items:*
 - a. NTEP has been involved with the Grass Roots exhibit.
 - b. Next meeting in San Diego at GIS.

Attachment 5. Regional Roadside Turfgrass Testing Program (Eric Watkins)

The University of Minnesota is taking the lead on a multi-state proposal funded by the participating state Departments of Transportation. This proposal calls for roadside testing of turfgrass cultivars at two sites (one rural, one urban) in each participating state. Currently, the proposal has been approved by the "champion" of the project within MnDOT. The next step is for the project to get approval for funding from Minnesota at which point it will be posted to the pooled fund website (<http://www.fhwa.dot.gov/research/partnership/pooledfund/>). Other states listed on the proposal will then have an opportunity to fund the project. Faculty cooperators in states that agree to provide funding (40,000 total over 2 years) will then become part of the project and receive funding (30,000 total over 2 years). At present, four states are listed as potential participants (Minnesota, Wisconsin, Michigan, and Iowa). Future trials could focus on other aspects of turfgrass management such as soil quality, seed mixtures, turfgrass management.

Attachment 6. Historians Report (Nick Christians)

**NCERA221 Regional Research Committee
HISTORIAN'S REPORT**

Nick Christians
June 9-11, 2015 in Ames, IA

Following is the Historian's Report for the NCERA221 (formerly NCR-10, NCR-192, and NCERA192) Regional Research Committee. Its purpose is to maintain a record of meeting sites and officers of the NCERA211 committee.

Year	Meeting Site	Chairperson	Secretary
<u>PROPOSED SITES</u>			
2019	Minnesota	Eric Watkins	To be announced
2018	Missouri	Xi Xiong	Eric Watkins
2017	Kansas	Hoyle/Fry	Xi Xiong
2016	Illinois	Voigt/Nangle	Hoyle/Fry
<u>HISTORICAL SITES</u>			
2015	Iowa State	Shui-Zhang Fei	Tom Voigt/Nangle
2014	Purdue	Aaron Patton	Shui-Zhang Fei
2013	ASA-CSSA-SSSA	Patton/Bigelow	
2012	Joint meeting with WRC-11 in Corvallis, Oregon	Zac Reicher	Aaron Patton
2011	Joint meeting with WRC-11 in Ft.Collins, CO (Nebraska co-host)	Zac Reicher	Cale Bigelow
2010	Southern Illinois	Ken Diesburg	Cale Bigelow
2009	Michigan State University	Kevin Frank	Ken Diesburg
2008	Ohio State	David Gardner	Kevin Frank
2007	Wisconsin	John Stier	David Gardner
2006	North Dakota	Ron Smith	John Stier
2005	South Dakota	Leo Schleicher	Ron Smith
2004	Nebraska (Joint with WRC 11)	Gerald Horst	Leo Schleicher
2003	Minnesota State University	Brian Horgan	Gerald Horst
2002	Missouri	John Dunn	Brian Horgan
2001	Kansas State University	Jack Fry	Barb Corwin
2000	Glenview, Ill.	Bruce Branham	Jack Fry
1999	Michigan	Jim Baird	Bruce Branham
1998	Iowa State University	Dave Minner	Jim Baird
1997	Purdue University	Clark Throssell	Dave Minner
1996	Colorado State (joint WRC-11)	Clark Throssell	Tom Voigt
1995	University of Wisconsin	Frank Rossi	Clark Throssell
1994	Southern Illinois Univ.	Ken Diesburg	Frank Rossi
1993	Palm Beach Florida	Karl Danneberger	Ken Diesburg
1992	Ohio State University	Karl Danneberger	Ken Diesburg
1991	University of Minnesota	Don White	Karl Danneberger
1990	University of Nebraska/ Joint meeting with WRC 11	Roch Gaussoin	Don White
1989	Kansas State University	Jeff Nus	Roch Gaussoin
1988	University of Illinois	David Wehner	Jeff Nus
1987	University of Missouri	David Minner	David Wehner/Tom Fermanian
1986	Michigan State University	Bruce Branham	David Minner

1985	Iowa State University	Nick Christians	Bruce Branham/Paul Rieke
1984	Purdue University	Bill Daniel	Nick Christians
1983	Beltsville Maryland (Joint NCR-10, WRCC-11, NE-139 meeting)	Bob Carrow	Bill Daniel and Ray Freeborg
1982	Ohio State University	Keith Karnok	Bob Carrow
1981	University of Minnesota	Don White	Keith Karnok
1980	University of Nebraska	Bob Shearman	Don White
1979	University of Illinois	A. J. Turgeon	Bob Shearman
1978	Kansas State University	David Martin	A. J. Turgeon
1977	St. Louis, MO	Ed Kinbacher	David Martin
1976	St. Louis, MO	K. T. Payne	E. J. Kinbacher
1975	Indianapolis, IN	C. Hodges	K. T. Payne
1974	Indianapolis, IN	J. H. Dunn	C. Hodges
1973	St. Louis, MO	P. E. Rieke	J. H. Dunn
1972	Fort Mitchell, KY	R. W. Miller	P. E. Rieke
1971*			
1970	Monticello IL	R. C. Newman	R. W. Miller
1969	Chicago, IL	R. C. Newman	A. E. Dudeck
1968	Chicago, IL	J. B. Beard	R. C. Newman
1967	East Lansing, MI	J. D. Butler	J. B. Beard

* No meeting in 1971; a joint meeting between NCR-10 and the NE group was planned for summer but never took place because of scheduling conflicts.