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2021 G2F Maize GxE Project Workshop

NAPPN CONFERENCE

February 16th, 2021

www.Genomes2Fields.org

- Agenda:

8:30 – 8:50AM - Welcome and G2F maize GXE project update

8:50 – 10:00 – Presentations

9:50 – 10:00AM - Break

10:00 – 11:50AM – Presentations

11:50AM - Adjourn

2020 Academic & Federal Institutions

Arkansas (AR)
Beth Hood

Colorado (CO)
John McKay

Delaware (DE)
Randy Wisser

Georgia (GA)
Joe Knoll
Jason Wallace

Illinois (IL)
Martin Bohn

Indiana (IN)
Mitch Tunistra

Iowa (IA)
Jode Edwards
Patrick Schnable

Kansas (KS)
Sanzhen Liu

Michigan (MI)
Maninder Singh
Addie Thompson

Minnesota (MN)
Candice Hirsch
Nathan Springer

Missouri (MO)
Sherry Flint-Garcia

Nebraska (NE)
James Schnable

New York (NY)
Ed Buckler
Michael Gore
Rebecca Nelson

North Carolina (NC)
Jim Holland

Ohio (OH)
Richard Minyo
Peter Thomison

South Carolina (SC)
Rajan Sekhon

Texas (TX)
Seth Murray
Wenwei Xu

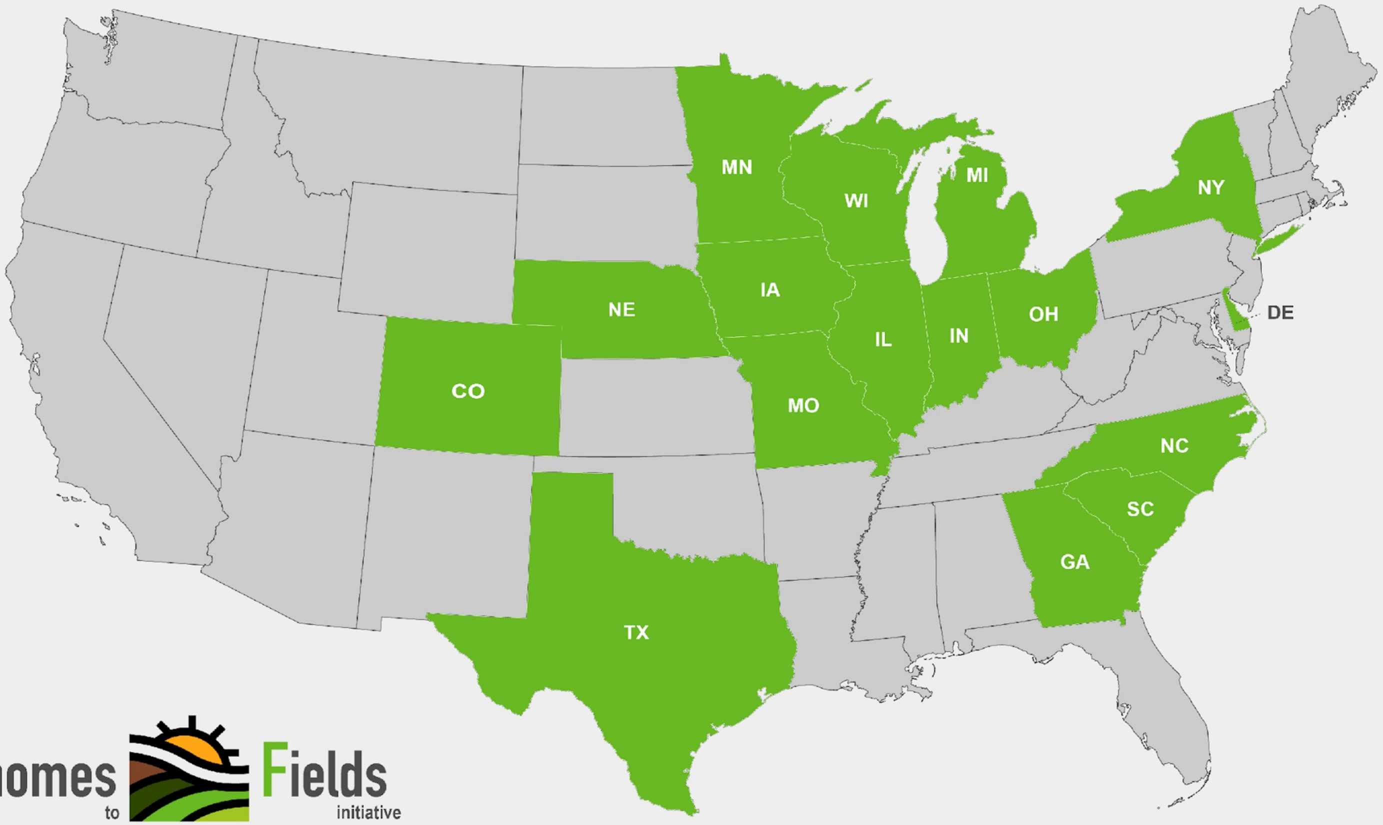
Wisconsin (WI)
Natalia de Leon
Shawn Kaeppler

Other Investigators
(Not shown on map)
Tim Beissinger (Germany)

2020 Academic & Federal Institutions

Clemson University
Colorado State University
Cornell University
Iowa State University
Michigan State University
North Carolina State University
Ohio State University
Purdue University
Texas A&M University
University of Delaware
University of Georgia
University of Illinois
University of Minnesota
University of Missouri
University of Nebraska
University of Wisconsin
USDA-ARS
Georg-August-Universität Göttingen
(Not shown on map)

30 Locations
21 institutions
28 PI



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Overview of Maize GXE Project:

- G2F has been able to successfully evaluate a diverse set of hybrids across multiple locations and years to maximize interaction between representative set of material and multiple environments

- Living infrastructure of researchers across disciplines and a network of field phenotyping sites

Year	2014	2015	2016	2017	2018	2019	2020
No. of trials	23	28	40	43	42	47	42
No. of unique locations	19	24	34	38	31	35	30
No. of states/provinces	13	16	19	23	22	18	17
No. of principal investigators	19	25	29	32	28	29	28
No. of plots	12,678	13,650	19,360	21,186	27,298	22,572	21,108
No of unique inbreds:	380	553	313	295	295	375	364

Since 2014:

- 212 unique environments

2020 Field Design

- Plots per location
  - Each location grows between 500 – 1,500 of various hybrids
  - Incomplete blocks per location, overall balanced
  - 2 row plots
- Populations and testers change every two years
  - PHZ51 (Lancaster - late tester for south)
  - PHK76 (Lancaster - intermediate tester)
  - PHP02 (Iodent - early tester for north)
- Yellow Stripe (YS) Hybrids
  - Common set of 25 hybrids replicated in each location
  - Serve as checks across multiple locations and years
  - Used for specific research projects

Yellow Stripes
2369/LH123HT
B14A/H95
B14A/MO17
B14A/OH43
B37/H95
B37/MO17
B37/OH43
B73/MO17
B73/PHM49
B73/PHN82
CG119/CG108
CG44/CGR01
F42/H95
F42/MO17
F42/OH43
LH74/PHN82
PHG39/PHN82
PHW52/PHM49
PHW52/PHN82
PHB47/PHN82
TX714/TX779
TX777/LH195
TX779/LH195
B73/TX779
Red Ear/LH195

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Data Collection

- **Phenotypic**
  - Plot-level notes of stand count, lodging, flowering, yield, etc. *(n= 15)*

Agronomic Characteristics

Yield Components

Flowering/Silking Dates

Plant/Ear Height

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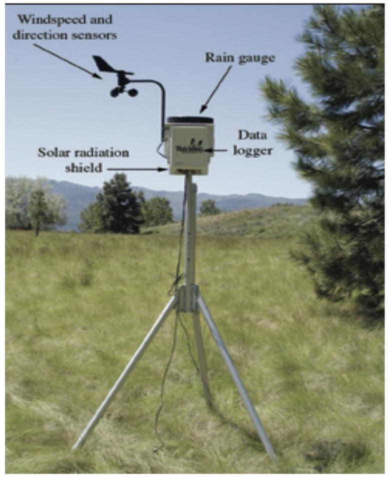
Data Collection

Weather Data:

- Field-level from weather stations temperature, relative humidity, rainfall, wind, PAR, soil temp, photoperiod, etc. *(n=14)*

MicroStation

Main Weather Station

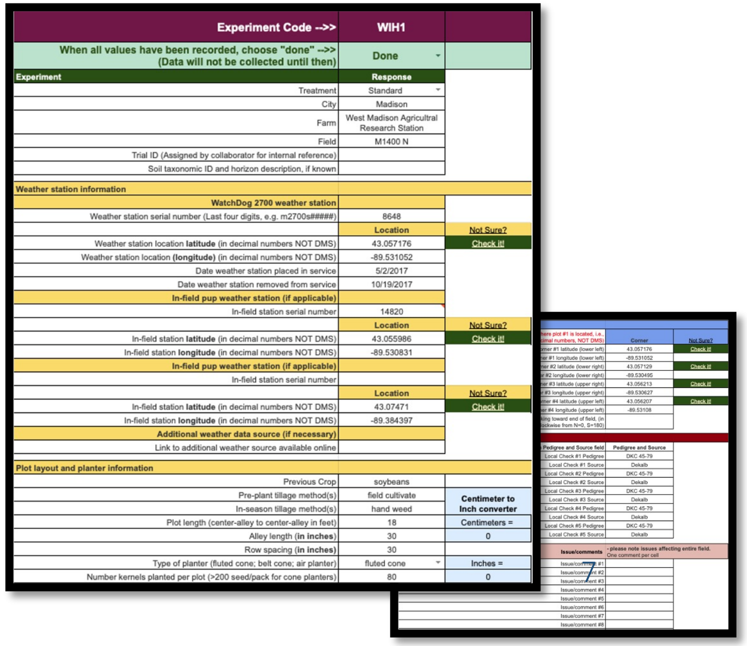


Soil Data:

- Soil Texture
- Soil Composition: %Sand, Silt, and Clay
- N, K, Zn, Fe, Mn, Cu, Ca, Na levels
- Soil pH

MetaData:

- Field applications
- field GPS coordinates,
- specific machinery,
- field layout
- Any issues throughout the season *(n= 30+)*



Experiment Code -->>	WIH1	
When all values have been recorded, choose "done" -->> (Data will not be collected until then)	Done	
Experiment	**Response**	
Treatment	Standard	
City	Madison	
Farm	West Madison Agricultral Research Station	
Field	M1400 N	
Trial ID (Assigned by collaborator for internal reference)		
Soil taxonomic ID and horizon description, if known		
Weather station information		
WatchDog 2700 weather station		
Weather station serial number (Last four digits, e.g. m2700s#####)	8648	
	Location	Not Sure?
Weather station location **latitude** (in decimal numbers NOT DMS)	43.057176	Check it!
Weather station location **(longitude)** (in decimal numbers NOT DMS)	-89.531052	
Date weather station placed in service	5/2/2017	
Date weather station removed from service	10/19/2017	
In-field pup weather station (if applicable)		
In-field station serial number	14820	
	Location	Not Sure?
In-field station **latitude** (in decimal numbers NOT DMS)	43.055986	Check it!
In-field station **longitude** (in decimal numbers NOT DMS)	-89.530831	
In-field pup weather station (if applicable)		
In-field station serial number		
	Location	Not Sure?
In-field station **latitude** (in decimal numbers NOT DMS)	43.07471	Check it!
In-field station **longitude** (in decimal numbers NOT DMS)	-89.384397	
Additional weather data source (if necessary)		
Link to additional weather source available online		
Plot layout and planter information		
Previous Crop	soybeans	
Pre-plant tillage method(s)	field cultivate	**Centimeter to Inch converter**
In-season tillage method(s)	hand weed	
Plot length (center-alley to center-alley in feet)	18	Centimeters =
Alley length (**in inches**)	30	0
Row spacing (**in inches**)	30	
Type of planter (fluted cone; belt cone; air planter)	fluted cone	Inches =
Number kernels planted per plot (>200 seed/pack for cone planters)	80	0

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High Intensity Phenotyping (HIPs)

- Sites where specific tools, conditions or processes are used on a smaller (common set of materials) to assess utility
- Reduced number of sites use 22 Hybrids and 22 Inbreds
- Test new phenotyping technologies/methods

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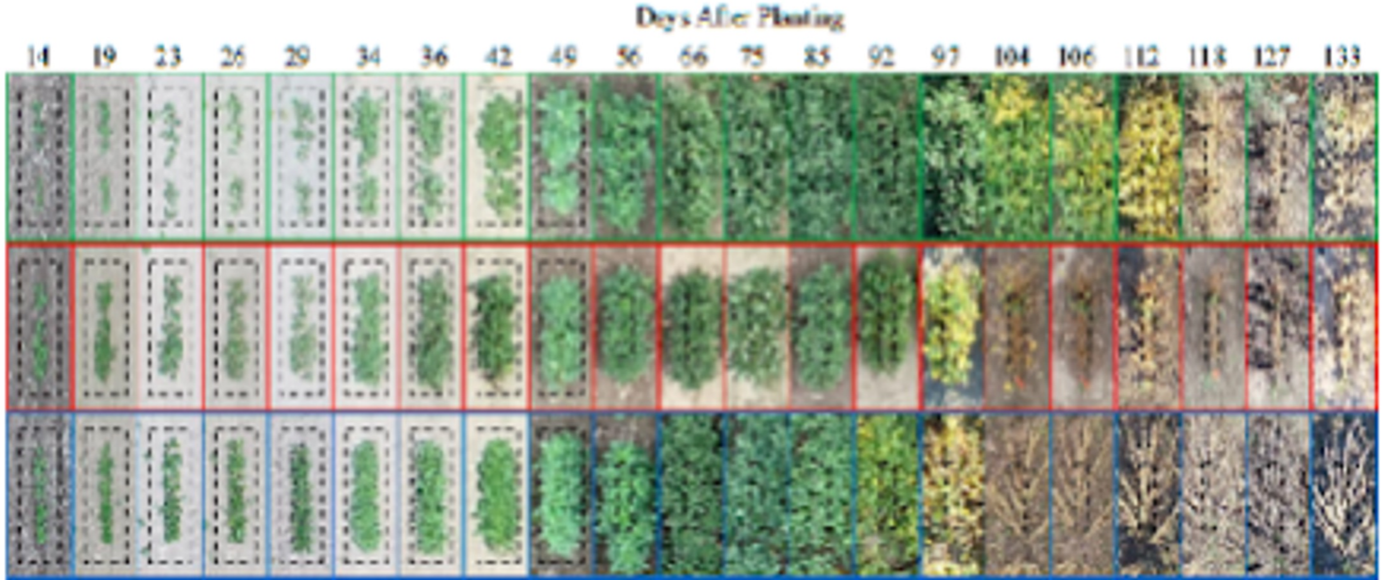
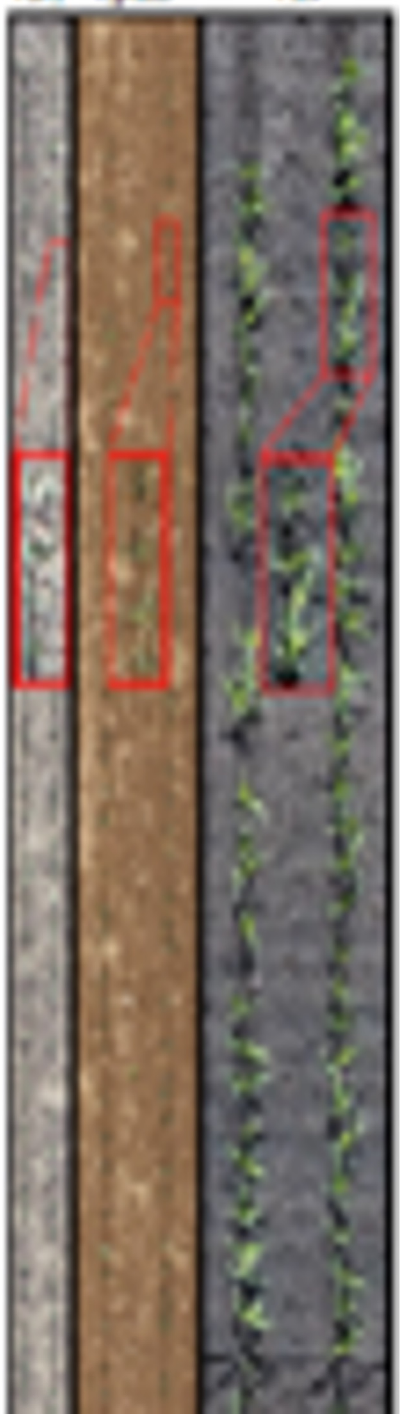
UAV Phenotyping

- 9 collaborators flying drones once per week to obtain images
- Developed SOP to follow and standardize flights
- Use Progeny Software to Stitch and analyze phenotypic traits

progeny

Spalding
, U Wisc





Data Is Made Publicly Available:

https://www.genomes2fields.org/resources/

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Home | About | Funded Projects | Publications | Awards | Meetings | Resources

- Ear Imaging Data
- Data Downlads
- Standard Operating Procedures (SOP)
- Newsletters
  - 2018-12-31
  - 2018-07-18
  - 2017-08-11
  - 2017-04-10
  - 2016-06-21
- Genomes2Fields Links & Media Articles
- Genomes2Fields Logos & Images
- Photos & Videos

Data Downloads

Field Season	Release to Public (DOI)
2020	https://doi.org/10.25739/hzzs-a865 (Phenotypic and environment data)
2019	https://doi.org/10.25739/t651-yy97 (Phenotypic and environment data)
2018	https://doi.org/10.25739/anqq-sg86 (Phenotypic, genotypic, and environment data)
2017	https://doi.org/10.25739/w560-2114 (Phenotypic, genotypic, and environment data)
2016	https://doi.org/10.25739/yjnh-kt21 (Phenotypic, genotypic, and environment data)
2015	https://doi.org/10.25739/erxg-yn49 (Phenotypic, genotypic, and environment data)
2014	https://doi.org/10.25739/9wjm-eq41 (Phenotypic, genotypic, and environment data)

Please report data errors or inconsistencies that you might identify to g2f@wisc.edu

Outputs:

ORIGINAL RESEARCH ARTICLE
Front. Genet. | doi: 10.3389/fgene.2020.592769

Utility of Climatic Information via Combining Ability Models to Improve Genomic Prediction for Yield within the Genomes to Fields Maize Project

Provisionally accepted The final, formatted version of the article will be published soon. Notify me

Diego Jarquin[1*], Natalia De Leon[2], Maria C. Romay[3], Martin O. Bohn[4], Edward S. Buckler[3], Ignacio A. Ciampitti[5], Jode W. Edwards[6], David Ertl[7], Sherry Flint-Garcia[8], Michael A. Gore[9], Christopher Graham[10], Candice Hirsch[11], James Holland[12], David Hooker[13], Shawn Kaeppler[2], Joseph Knoll[14], Elizabeth C. Lee[13], Carolyn J. Lawrence-Dill[6], Jonathan Lynch[15], Stephen Moose[4], Seth C. Murray[16], Rebecca Nelson[17], Torbert R. Rocheford[18], James C. Schnable[19], Pat Schnable[20], Margaret Smith[21], Nathan M. Springer[22], Peter Thomison[23], Mitch Tuinstra[18], Randall J. Wisser[24], Wenwei Xu[25], Jianming Yu[26] and Aaron J. Lorenz[11]

Original Article | Open Access | Published: 01 July 2020

Temporal covariance structure of multi-spectral phenotypes and their predictive ability for end-of-season traits in maize

Mahlet T. Anche, Nicholas S. Kaczmar, Nicolas Morales, James W. Clohessy, Daniel C. Ilut, Michael A. Gore & Kelly R. Robbins

Theoretical and Applied Genetics 133, 2853–2868(2020) | Cite this article

The importance of dominance and genotype-by-environment interactions on grain yield variation in a large-scale public cooperative maize experiment

Anna R Rogers, Jeffrey C Dunne, Cinta Romay, Martin Bohn, Edward S Buckler, Ignacio A Ciampitti, Jode Edwards, David Ertl, Sherry Flint-Garcia, Michael A Gore ...
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0, https://doi.org

The Plant Phenome Journal OPEN ACCESS

SCIENCE NOTES | Open Access

ImageBreed: Open-access plant breeding web-database for image-based phenotyping

Nicolas Morales, Nicholas S. Kaczmar, Nicholas Santantonio, Michael A. Gore, Lukas A. Mueller, Kelly R. Robbins

First published: 15 May 2020 | https://doi.org/10.1002/ppj2.20004 | Citations: 2

ELSEVIER
Field Crops Research
Volume 249, 1 April 2020, 107737

Stalk Bending Strength is Strongly Associated with Maize Stalk Lodging Incidence Across Multiple Environments

Rajandeep S. Sekhon [a], Chase N. Joyner [b], Arlyn J. Ackerman [a], Christopher S. McMahan [b], Douglas D. Cook [c], Daniel J. Robertson [d]
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Outputs:

https://www.genomes2fields.org/funded-projects/

80%

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Home About Funded P

Funded Projects

- USDA: Genetic Control of GxE Interaction
- NSF: Development of a PhenoNet
- USDA: Genetically-Informed Envirotyping Tools
- USDA: Aerial and Ground Phenotyping Analytical Tools
- USDA: Low-cost Nitrate Sensors
- ARPA-E: In-Soil Sensors
- ARPA-E: Root Genetics in the Field
- USDA: G2F High Throughput, Field Based Phenotyping Workshop
- USDA: Hybrid Performance Predictability
- FFAR: Harnessing Endophytes to Improve Crop Efficiency and Production
- ARA: Linking Digital Readouts to Traits of G2F Hybrids
- USDA: Cyber-Ecosystem for Genomes to Fields
- USDA: High Intensity Phenotyping Sites

Genomes To Fields (G2F) Funded

Sorted by Project's Start Date in Ascending Order

Understanding the Effect of Long-Term Selection on the Genetic Control and Mo Interaction

Funding Agency: United States Department of Agriculture (USDA)
Award #: 2016-67013-24419

Principal Investigator(s): Natalia De Leon

Project Start Date: November 1, 2015
Project End Date: October 31, 2019

High productivity in crops has been achieved through decades of rigorous selection and breeding. Through superior varieties is expected to have diminished compared to their less improved counterparts. The abilit conditions is largely determined by the extent of the genetic variability present in those individuals. The hy in crop species has therefore reduced the plasticity that allows plants to change their phenotypic expressic To test this hypothesis, this project will first aim to dissect the genetic architecture of this phenotypic plasti X E), by evaluating the phenotypic and genotypic variability of a diverse collection of maize hybrids grown a project that is part of the Genomes to Fields initiative. As part of this project, we also plan to exploit the ge of maize inbred lines derived from the Iowa Stiff Stalk (BSSS) maize population. This set of diverse material any selection was ever applied on it, also inbreds derived from earlier cycles of selection and then finally el this population that have undergone intense selection. Comparisons of genotypic and phenotypic variatior initial answer to our primary research questions. In addition to that, increased planting density has been ic enhancing productivity in modern maize. Another objective of this project is to determine if insensitivity to plants to tolerate environmental influences. For that, a subset of the BSSS derived lines will be evaluated a overall project are expected to enhance our understanding of how rigorous selection and breeding could a surroundings. Deepening our understanding of how the interaction between plants and environments is m process of practical plant breeding programs.

Genomes To Fields Collaborators and Cooperators

- Tim Beissinger (Göttingen)
- Martin Bohn (UIUC)
- Ed Buckler (ARS)
- Darwin Campbell (ISU)
- Alejandro Castro (UW)
- Ignacio Ciampitti (KSU)
- Liang Dong (ISU)
- Jode Edwards (ARS)
- David Ertl (IA Corn)
- Sherry Flint-Garcia (ARS)
- Christopher Graham (SDSU)
- Candy Hirsch (UMN)
- Jim Holland (ARS)
- Elizabeth Hood (AR State)
- David Hooker (Guelph)
- Joseph Gage (Cornell)
- Jack Gardiner (ISU)
- Fiona Goggin (AR State)
- Richard Minyo (OSU)
- Mike Gore (Cornell)
- Patricio Grassini (UNL)
- Jerry Hatfield (ARS)
- Diego Jarquin (UNL)
- Shawn Kaeppler (UW)
- Joe Knoll (ARS)
- Greg Kruger (UNL)
- Nick Lauter (ARS)
- Carolyn Lawrence-Dill (ISU)
- Liz Lee (Guelph)
- Natalia de Leon (UW)
- Sanzchen Liu (Kansas)
- Argelia Lorence (AR State)
- Aaron Lorenz (UMN)
- Jonathan Lynch (PSU)
- Bridget McFarland (UW)
- John McKay (Colorado)
- Nathan Miller (UW)
- Steve Moose (UIUC)
- Seth Murray (TAMU)
- Rebecca Nelson (Cornell)
- Torbert Rocheford (Purdue)
- Oscar Rodriguez (UNL)
- Cinta Romay (Cornell)
- James Schnable (UNL)
- Pat Schnable (ISU)
- Brian Scully (ARS)
- Rajandeep Sekhon (Clemson)
- Kevin Silverstein (UMN)
- Maninder Singh (MI State)
- Margaret Smith (Cornell)
- Edgar Spalding (UW)
- Nathan Springer (UMN)
- Srikant Srinivasan (ISU)
- Yiwei Sun (ISU)
- Kelly Thorp (ARS)
- Kurt Thelen (MSU)
- Peter Thomison (OSU)
- Addie Thompson (MI State)
- Mitch Tuinstra (Purdue)
- Jason Wallace (UGA)
- Rod Williamson (IA Corn)
- Jacob Washburn (USDA)
- Wenwei Xu (TAMU)
- Jianming Yu (ISU)

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