

# Genomes to Fields

## Overview of GXE Project

ASTA GXE Organizational Meeting  
December 2016

[www.Genomes2Fields.org](http://www.Genomes2Fields.org)

# Genomes to Fields (G2F) Initiative:

- ✧ Goal: Catalyze and coordinate research linking genomics and predictive phenomics to expand our understanding of the interacting roles of crop genomes and crop environments (weather and management practices) to improve prediction ability



Schnable, Ware  
et al. (2009) Science



Computer scientist

Engineers

Mathematicians

Plant Scientists

Statisticians

Crop Modelers

Soil Scientists

Biologists

Bioinformaticians

Environmentpers

# GENOMES TO FIELDS (G2F)

[www.genomes2fields.org](http://www.genomes2fields.org)

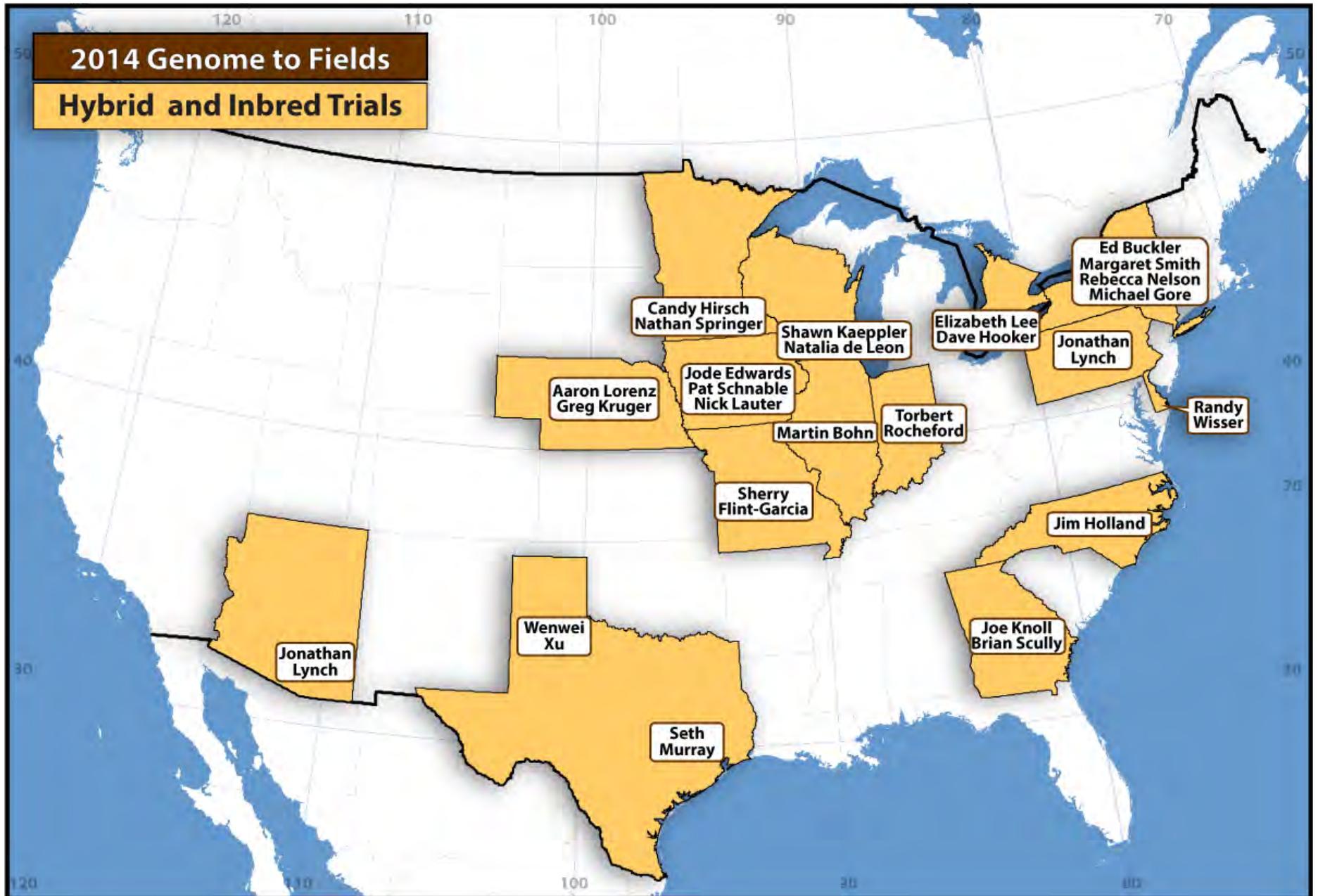
Modeling and  
analytical  
tools

HT phenotyping  
tools

Database  
development

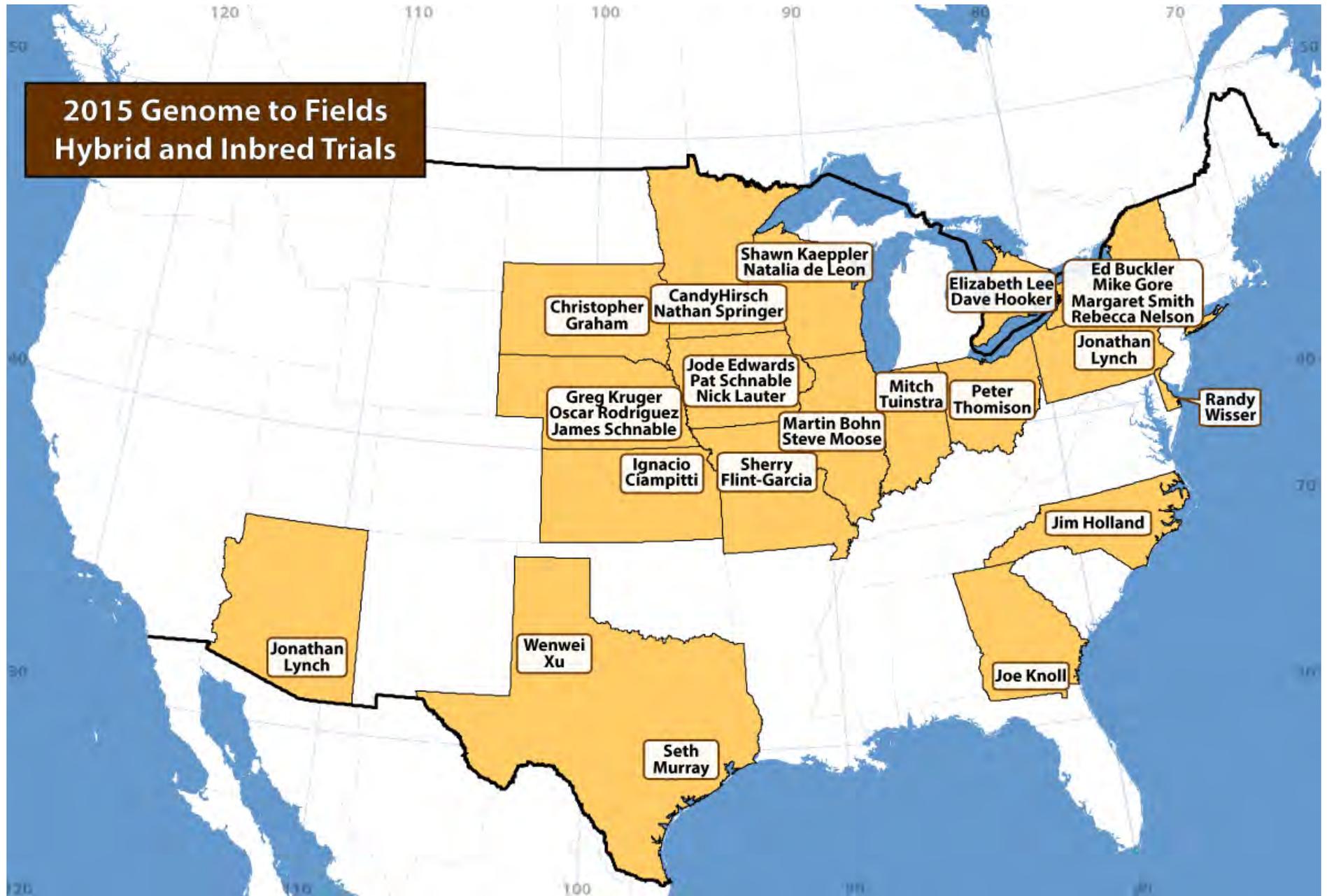
**G X E  
Project**

Student Training



Figures courtesy of Darwin Campbell

## 2015 Genome to Fields Hybrid and Inbred Trials





✧ Plan for 2017



# Phenotypic Data:

✧ Evaluation across all environments included:

- ❖ Days to anthesis
- ❖ Days to silk
- ❖ Ear height
- ❖ Plant height
- ❖ Plot weight
- ❖ Test weight
- ❖ Moisture
- ❖ Grain yield
- ❖ Stand count
- ❖ Root Lodging
- ❖ Stalk Lodging

✧ Additional traits measured at specific locations



## G X E Project 2014 – Hybrid Experiment:

- ✧ Set of ~250 hybrids, 2 reps per location
- ✧ Hybrids: ex-PVPs, RILs from biparental populations, breeding materials
- ✧ Set of 20 common hybrids across all locations
- ✧ Remaining hybrids overlapping sets moving south to north in the geography of NA
- ✧ Testers: LH198, LH195, LH185, CG102 & PB80



## G X E Project 2015 – Hybrid Experiment:

- ✧ Design was modified to expand diversity of materials included. Replication for 120 plots, except for northern and southernmost locations
- ✧ Each hybrid in at least 8 locations
- ✧ Hybrids: ex-PVPs, RILs from biparental populations, breeding materials
- ✧ Set of 45 hybrids across all locations + 15 regional
- ✧ Testers: PHB47, PHZ51, LH82 & LH195
- ✧ Added: Ohio, Kansas and South Dakota



# G X E Project 2016 (repeat in 2017):

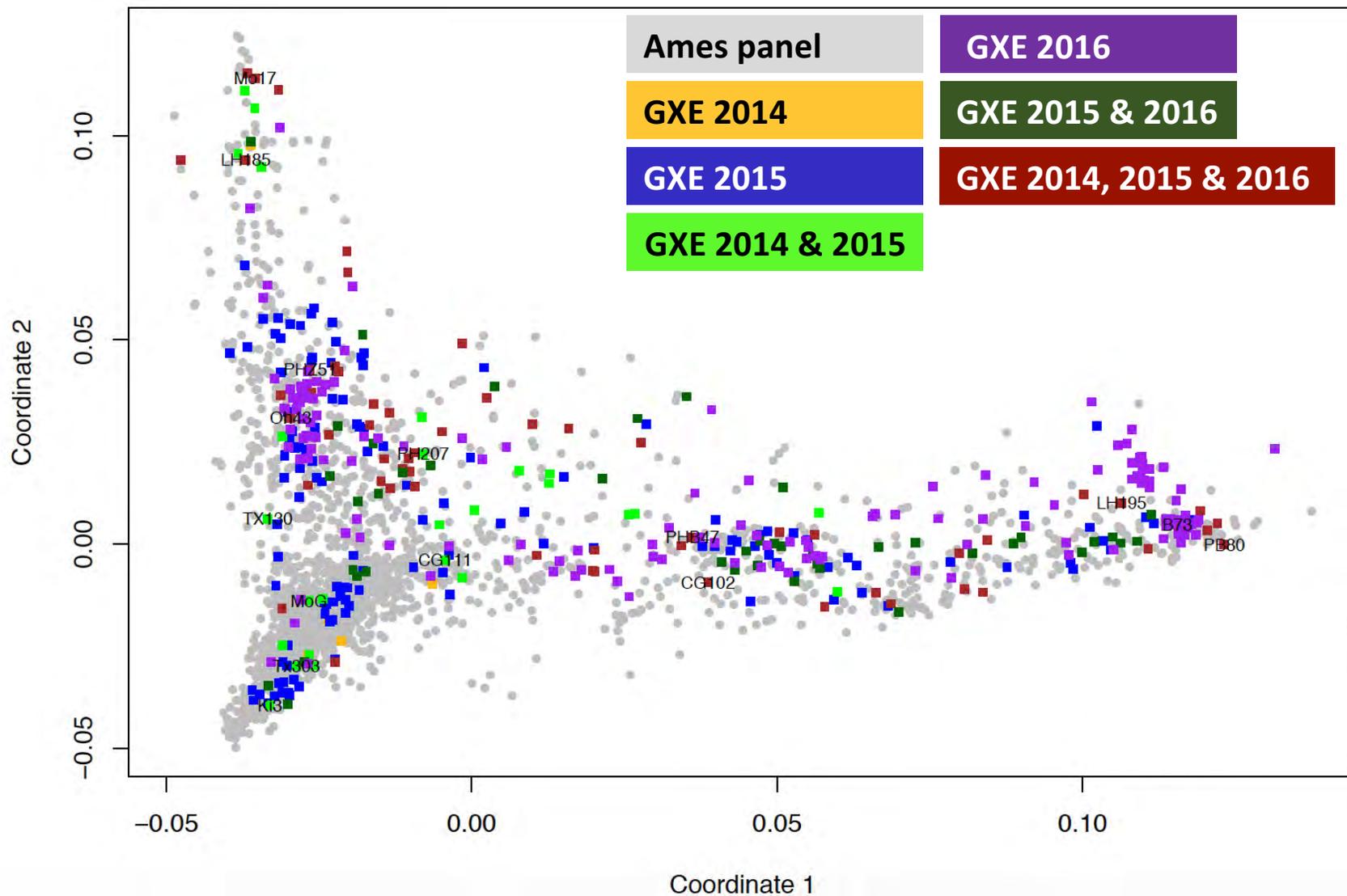
- ✧ Combination of five primary experiments:
  - a. Expired Plant Variety Protection (Ex-PVP) Factorial for Prediction – Liz, Jode, Martin
  - b. Backcross-Derived Line Group – Candy, Nathan, Sherry
  - c. Stiff Stalk G X E – Shawn, Natalia
  - d. GEM materials – Seth
  - e. Set of Common Hybrid – 50 across all locations, subsets of regionals
- ✧ Design:
  - ✧ Two replications per location, blocked by exp.
  - ✧ Materials present in 9 to 18 locations



# Genotypic Diversity – all lines genotyped using GBS:



Cinta Romay  
Cornell Univ



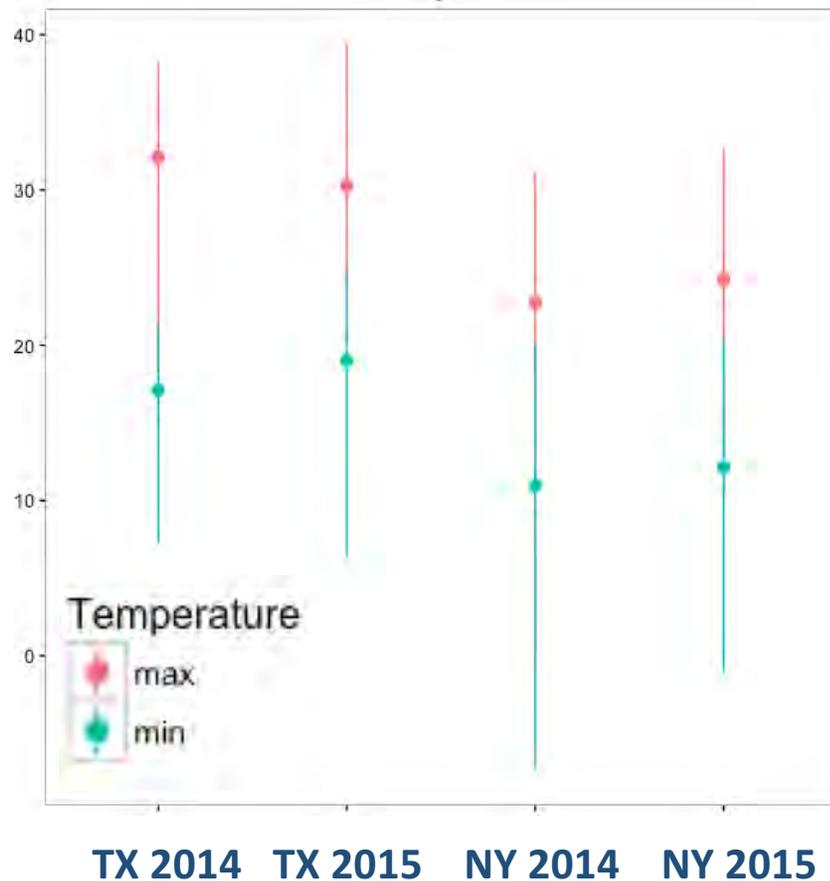
# Environmental Data:



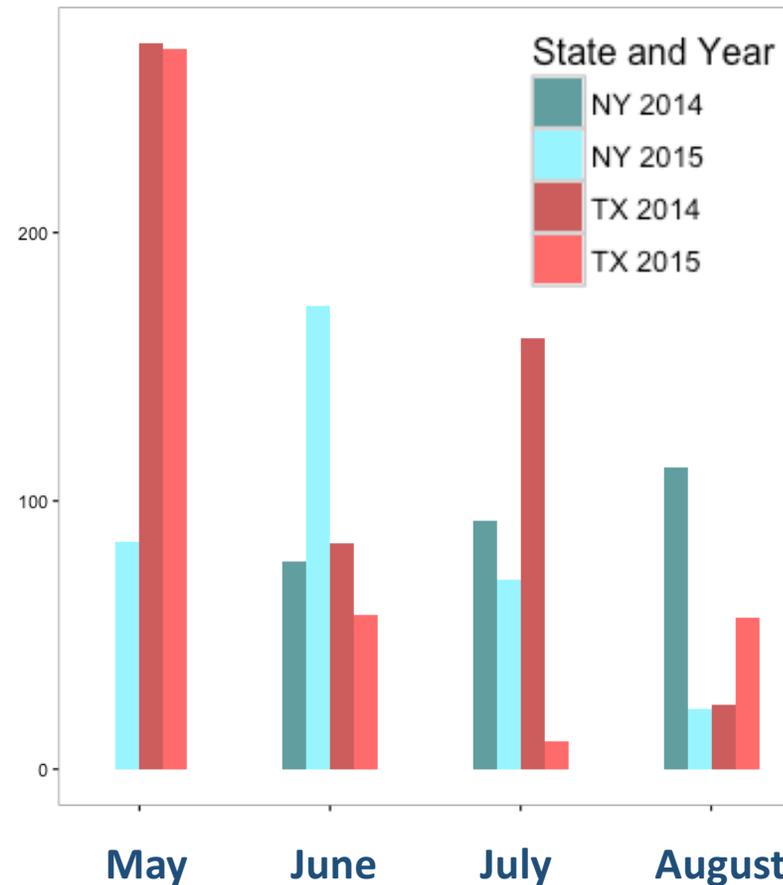
Renee Walton  
ISU

- ✧ Spectrum watchdog at each site – temperature, precipitation, solar radiation, wind speed, and related info + soil characterization

### Daily Max and Min Temperatures



### Accumulated Rainfall



## Scale and Scope:

Year	2014	2015	2016
No. of trials	22	27	34
No. of unique locations	21	25	30
No. of states/provinces	13	16	18
No. of Principal Investigators	19	25	30
No. of plots	12,678	13,650	17,040
No of unique inbreds:	380	553	310

By the end of 2016 → 76 unique locations



# Manuscript submission update:

- ✧ Title: “The effect of artificial selection on phenotypic plasticity in maize”
  - ❖ 2014 data
  - ❖ Joe Gage submitted to ~~Nature Plants on 12/6~~ – **TBD**
- ✧ Topic: “G X E interaction as a driver for enhance whole genome prediction”
  - ❖ 2014 & 15 data
  - ❖ Diego Jarquin – to be submitted before MGC
- ✧ Topic: “Expression of Productivity and Phenological Traits Across a Diverse Set of Environments”
  - ❖ 2014 & 15 (maybe also 2016?) data
  - ❖ Liz Lee
- ✧ Topic: “Evaluation of G X E in inbred backgrounds, the utility of indicator traits”
  - ❖ 2014 & 15 data
  - ❖ Celeste Falcon