Final Report

Texas Location Support of the Genomes to Field Initiative – 2017

Investigators
Seth Murray, Jacob Pekar
Texas AgriLife Research, College Station, TX.

Overall, this was another very successful year for the Genomes to Fields (G2F) project with great weather and very high consistency between replicates (Table below). Harvest and weather data collection went smoothly and has been sent to the G2E curator. The overall G2F project has now expanded to over 24 locations and 37 environments; many of the environments grow the same experiments which allows investigation of how genetics and environments interact.

We have learned a tremendous amount already about maize adaptation to different environments from this project and it has reinforced the uniqueness of the Texas environment to many of the participants in terms of what corn is adapted here, as well as the logistics involved with planting in March. We have observed that the "G2F" brand is gaining a lot of traction for funding of corn research in Washington D.C. and in companies. We thank the Texas Corn Producers Board for helping to support this project!

Two project changes were made since we submitted our proposal in October of 2016 proposed 1) Dr. Seth Murray was on a Faculty Development Leave working for the USDA-Office

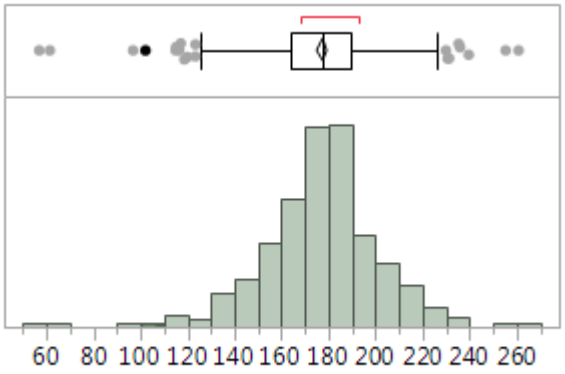
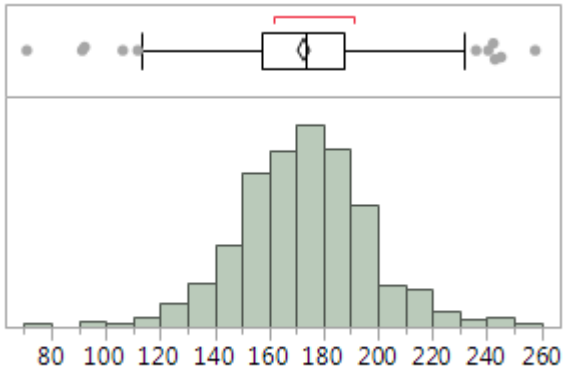
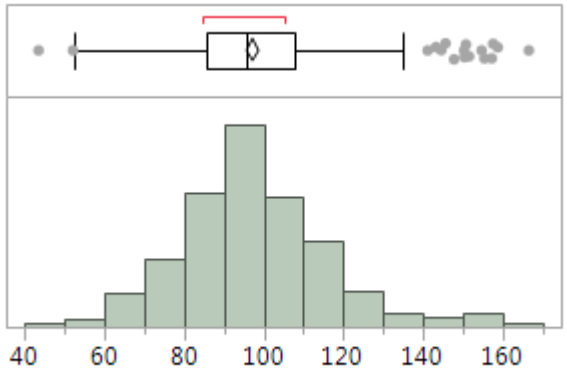
of the Chief Scientist in Washington D.C. so Jacob Pekar took the lead in this project with Colby Ratcliff, David Rooney and Nathalia Cruzato supporting the various activities. 2nd) we were pleasantly surprised to learn after this project was funded by TCPB that a competitive USDA-NIFA grant was funded to extend the G2F project to three test environments and expand the unmanned aerial vehicle data collection and tool development ($498,000 spread over three years and three investigators). This is the second time we have used TCPB and commodity board support to help leverage Federal dollars into corn research. From the NIFA project we ended up planting an early optimal planting, an early dryland planting, and a late stress planting (in the past we have only planted an early optimal). We ended up with timely and sufficient rainfall so the dryland planting ended up primarily being a study on reduced fertilization, but did provide additional replicates and unique data of interest.

The university farm received roughly 20" of rain from hurricane Harvey which devastated other crops, such as cotton, but 99% of all corn trials were harvested before the rains set in. We are thankful that our undergraduate and graduate students were able to push themselves with long hours in order to accomplish everything before the hurricane. Multiple UAV flights were preformed on G2F and RGB pictures are still being processed for analysis.

In addition from our summer nursery we harvested 34 crosses from a crossing block and 287 crosses from an isolation block with LH195 to enter into G2F next year; this totaled 151,661g of seed. Additionally we just finished harvesting our winter nursery which had some G2F crosses; this was better than the last few years but not as good as we initially believed after pollination.

Picture of detasseling isolation block for 2018 planting sources seed production.

As mentioned, TCPB funds supported our initial participation in G2F while leveraging USDA-NIFA funds allowed us to plant different treatments and further expand the use of automated phenotyping technologies (which we are still in the process of analyzing). Because it might be of the most interest to the board, here we present the yield results. It is important to note that although a few TAMU lines were included, these were mostly finished and released lines and there was no additional IP generated. It should also be noted that the goal is not to find the highest yielding lines but to have a spread of novel genetic diversity so that we can determine how genetics and environment interact. By using the DNA genotyping data, weather data, and additional locations this will allow corn researchers and breeders to produce higher yielding lines that are better adapted to specific environments but also more stable over all environments.

Early planting – optimal condition (G2FE)	**Early planting – dryland (DG2F)**	**Late stress planting (G2LA)**
Bushels per acre distribution (raw data) **271** bushel per acre maximum **178** bushel per acre median **57** bushel per acre minimum	**Bushels per acre distribution raw data** **258** bushel per acre maximum **174** bushel per acre median **71** bushel per acre minimum	**Bushels per acre distribution raw data** **167** bushel per acre maximum **96** bushel per acre median **43** bushel per acre minimum
		

Early planting – optimal condition (G2FE)

Estimates of sources of variation in the experiment for bushels per acre. More variation in pedigree means there was repeatable information gathered and large differences between different hybrids.

Random Effect	Percent of Test Variation
Pedigree	74.0
Rep	na
Range	0.6
Row	2.6
Residual	22.8

Average yield of top 20 and bottom 10 entries (best linear unbiased predictors - BLUPS)

Bu/acre	Pedigree
259	REV28HR20 (2016)
230	G6611 VTTP (2017)
228	G7601VTTP (2017)
226	B73/TX779
225	DKB 64-69 (2016)
225	DKB 64-69
223	PHW52/PHR55
223	LH195/PHR03
222	LH195/LH210
220	LH195/PHR55

Early planting – dryland (DG2F)

Estimates of sources of variation in the experiment for bushels per acre. More variation in pedigree means there was repeatable information gathered and large differences between different hybrids.

Random Effect	Percent of Test Variation
Pedigree	67.5
Rep	1.9
Range	4.5
Row	3.1
Residual	22.9

Average yield of top 20 and bottom 10 entries (best linear unbiased predictors - BLUPS)

Bu/acre	Pedigree
235	DKB 64-69 (2016)
224	LH195/PHR55
223	DKB 64-69
222	LH195/LH123HT
221	G6611 VTTP (2017)
215	PHHB9/PHR55
210	G7601VTTP (2017)
210	PHW52/NK787
208	LH195/LH210
208	LH195/PHP60

Late stress planting (G2LA)

Estimates of sources of variation in the experiment for bushels per acre. More variation in pedigree means there was repeatable information gathered and large differences between different hybrids.

Random Effect	Percent of Test Variation
Pedigree	52.0
Rep	4.3
Range	2.5
Row	4.7
Residual	36.5

Average yield of top 20 and bottom 10 entries (best linear unbiased predictors - BLUPS)

Bu/acre	Pedigree
163	REV28HR20 (2016)
151	DKB 64-69 (2016)
146	DKB64-69
141	LAMA2002-58-3-B-B-B-B-B-B-1-B19-B18-B22/LH195
139	PHV63/NK787
134	TX740/LH195
132	LH195/PHN47
131	G6611 VTTP (2017)
128	PHG39/TX205
128	LH195/NK787

219	B73/TX775
218	LH195/NK787
216	2369/PHN82
213	LH195/PHN47
213	PHHB9/PHR03
212	LH195/PHM57
212	LAMA2002-58-3-B-B-B-B-B-B-1-B19-B18-B22/LH195
212	LH195/PHJ65
212	PHHB9/PHR55
210	LH216/LH195
209	TX714/TX777
	Bottom 10
138	PHV63/Q381
137	BGEM-0089-N/LH195
134	NILASQ4G41I03S2/LH123HT
130	PHP38/PHP60
129	PHN11_PHG47_0251/PHB47
124	CGR03/CG108
123	PHP38/Q381
121	PHP02/PHG47
117	CG44/CGR01
60	CG60/LH162

208	TX714/TX775
208	PHW52/PHR55
206	LAMA2002-58-3-B-B-B-B-B-B-1-B19-B18-B22/LH195
205	LH195/PHM57
205	LH195/NK787
204	LH195/PHR03
203	PHW52/PHR03
200	B73/PHN82
200	PHHB9/PHR03
199	BH8900VIP3111 (2016)
	Bottom 10
129	LH195/Q381
129	PHW52/Q381
128	PHP02/PHG47
127	PHG80/PHZ51
126	PHP38/PHP60
124	W10001_0022/PHB47
122	PHN11_PHG47_0251/PHB47
110	PHV63/Q381
94	CG44/CGR01
88	CG60/LH162

127	G7601VTTP (2017)
121	NILASQ4G11I02S2/LH123HT
121	LH195/LH210
120	NILASQ4G21I05S2/LH123HT
120	LH195/LH123HT
120	PHHB9/LH210
119	PHW52/LH210
119	PHV63/PH210
116	NILASQ4G41I07S2/LH123HT
116	PHP38/LH210
115	PHV63/PHN47
	Bottom 10
71	B14A/H95
71	PHW52/PHZ51
68	PHHB9/PHZ51
68	W10001_0022/PHB47
68	B37/H95
68	PHP38/Q381
67	PHV63/PHP60
65	CG60/LH162
63	B97/PHB47

370 Olsen Boulevard; 2474 TAMU; College Station, TX 77843-2474
Tel. 979.845.4195; email. sethmurray@tamu.edu web. http://soilcrop.tamu.edu/staff/murray-seth-c/

Objective 2: *Train students and participate in cooperative tests.*

Multiple undergraduate students have been a tremendous help in our note taking and field agronomics. Participation in these practices are a great instrument in teaching aggies production practices and research fundamentals. During planting, we had a total of seven undergraduates that assisted us in field preparation, seed packaging, and sowing. The program has recently upgraded to an automated steering and planter tripping system via Trimble, which has given us the unique opportunity to offer some precision agriculture experience in both production practices and in research. This is a valuable skill that will be sought after for a future agriculturist. Undergraduates are also assisting us in the laboratory for DNA extractions and genotyping program material. Tissue sampling and DNA extraction are currently being collected for decisions toward our fall nursery and toward multiple graduate student projects which we expect will lead into decisions for what material to introduce into G2F. Current Team in the Texas A&M Maize Breeding and Quantitative Genetics Program Technical Support

Jacob Pekar – Research Associate & Ph.D. Student – Ph.D. Projects: Inbred aflatoxin SCIN test, Aflatoxin 4 Way and 8 Way population breeding and testcrosses.

B.S. Texas Tech; M.S. University of Kingsville; Started July. 2013 in the maize program.

David Rooney – Research Assistant

B.S. Texas A&M University; Started May. 2016 in the maize program

Graduate Students

Steven Anderson – Graduate Research Assistant, Ph.D. - M.S. Projects: Mapping quantitative traits in the four parent maize population (1200+ lines) B.S. University of Central Florida; M.S. Texas A&M University; Started Jan. 2014 in the maize program.

Nancy Wahl – Graduate Research Assistant, PhD - PhD Projects: Meta-Analysis of the SERAT projects. RNA expression in aflatoxin resistant and susceptible lines after inoculation.

Fabian Echeverria – Graduate Research Assistant, PhD - PhD Projects: RNA gene expression in coffee rust resistance and fungicides. B.S. Institute of Technology of Costa Rica; M.S. University of Costa Rica; Started Jan. 2015 in the maize program.

Nathália Penna Cruzato – Graduate Research Assistant, Ph.D. - Projects: High-throughput phenotyping techniques for plant breeding, maize G2F project; B.S. Universidade Estadual Paulista "Júlio de Mesquita Filho" (UNESP), Brazil; M.S. Agrocampus Ouest, France; Started Jan. 2017 in the maize program.

Colby Ratcliff – Graduate Research Assistant, M.S. - Graduate Research Assistant, M.S. Projects: Detecting hail damage using Unmanned Air Vehicle (UAV) and Ground Vehicle (GV) and yield loss potential from damage. B.S. Texas A&M University; Started Jan. 2016 in the Maize Program.

Undergraduate Student Assistants

Malik Williams – Current College Sophomore in Iowa, previously High School student at College Station; Started June 2015 in the maize program. From: Houston/ College Station, TX.

Clarissa Conrad – B.S. Soil and Crop Sciences, Started May. 2016 in the maize program. From: Dallas, TX.

Caitlin Leakey – B.S. Ag. Science, Expected graduation date: May 2019; Started May. 2016 in the maize program. From: Houston, TX.

Dalton Askew – B.S. Human Resources Development, Expected graduation date: May 2019; Started Oct. 2016 in the maize program. From: Buna, TX.

Susie Lin – B.S. Plant and Environmental Soil Sciences, Expected graduation date: Dec 2018; Started Feb. 2017 in the maize program. From: Middletown, DE.

Regan Lindsey – B.S. Sociology, Expected graduation date: May 2019; Started Feb. 2017 in the maize program. From: Snyder, TX.

Joshua Keck – B.S. Agricultural Engineering. Expected graduation date: May 2020: Started May 2017 in maize program. From ames, IA. Rotational student

Jacob Keck – B.S. Agronomy, expected graduation date: May 2019. Started May 2017 in maize program. From Ames, IA. Rotational student

Raul Ramirez – B.S. Plant and Environmental and Soil Science. Expected graduation date: Aug 2017. Started Feb 2017. From: Brookshire TX