United States Department of Agriculture
National Institute of Food and Agriculture

BeanCAP Project
2013 Advisory Board Meeting
2013 Field Phenotyping

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Colleagues in CO, MI, NE, ND, PR, WA

Prior Field Expts in 2011

- Two Major Field Trials – Association Mapping Studies – Entries from Middle Gene Pool

- Phenotyping 308 Genotypes at 4 Locations

- Separated in MesoAmerican & Durango Races

- Evaluated 96 Genotypes under drought stress & non stress at 7 Locations – CO, MI, ND, NE, ID, PR, WA……….. known as AM100 in PR

- Agronomic & Performance Traits measured

- Seed analysis Mike Grusak – USDA Houston.

AGRONOMIC DATA-DROUGHT EXPTS

- Drought Intensity Index (DII): Index for Experiment -
- Percent Reduction (%R):
- Geometric Mean (GM):
- Drought Susceptibility Index (DSI):
- Chlorophyll Content (CC): SPAD. – few locations
- Canopy Temperature (CT): IR Directional thermometer
- Other Traits unique to drought – Biomass & Shovelomics
- Soil Moisture, Neutron Probe, Gypsum sensors
- Soil Analysis at all locations
- Based on Replicated Stress and Non stress treatments

Field work in 2012

- Number of Major Field Trials were repeated
- Drought test in PR, NE & MI - 96 Genotypes
- AM100 Panel also evaluated for root rots, heat in PR
- CO, ND, NE, MI Participated in Yield Gains in Major Crops
- 20-entry pinto and 16-entry navy trials
- CSSA Publication – Brick, Kelly, Osorno & Urrea
- Specific RIL populations evaluated at various locations
- NE: Buster/Roza - 114 RILs (Miklas), Stampede/Red Hawk - 184 RILs (Osorno & McClean), Buster/SER22 - 345 RILs (Urrea & Porch); Shuttle Breeding PR-NE 448 lines
- ND: Stampede/Red Hawk - 184 RILs (Osorno & McClean), Buster/SER22 - 345 RILs (Urrea & Porch)
- MI: RIL populations were evaluated drought (CIAT), leafhopper (Porch), white mold resistance - genotyped using 6K SNP chip

2013 Phenotyping – Brick - CSU

- Conclude Fiber and Oligosaccharide assays

- Conduct screen with SNP markers for soluble, insoluble and total fiber, as well as raffinose and stachyose

- Identify genomic regions associated with higher fiber and oligosaccharide content

- Evaluate NMR as rapid screen for fiber content

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Phenotyping – Cichy – USDA - MI

- Conclude Phytic acid assays

- Develop RIL populations based on BeanCAP data

- Conduct transcriptome and e-QTL analysis of RIL populations for BNF and mineral transport

- Evaluate Andean Diversity Panel for BNF – MI and Zambia

- Identify markers for color retention in black beans

- Evaluate cooking time, canning quality, and mineral bioavailability of Andean beans

Root Traits Recorded
96 BeanCAP Panel

- Stress, non stress treatments

- Basal root number

- Basal root angle

- Taproot diameter

- Overall Root Score
  - 0-3= poor
  - 4-7= average
  - 8-10= excellent
  - Pictured: 4 – average

Shoot Traits – 96 Entry BeanCAP Panel

- Canopy temperature depression

- Normalized Difference Vegetative Index (NDVI)

- Canopy coverage

- Biomass at flowering

- 100 Seed Weight

- Yield

- Harvest Index

- Days to Flower

- Height

- Lodging

- Maturity

- Desirability

- Growth Habit

- Wilting score

Soil moisture was monitored

Phenotypic data will be subjected to Association Mapping Analysis – SNP chip
130 RIL population for Biological Nitrogen Fixation - MI and PR, QTL analysis with 6K-SNP chip

Phenotyping – Miklas – USDA-WA

Populations populated with SNP markers from BeanCAP

Trait	BeanCAP MA	BeanCAP Andean Diversity Panel	RIL populations
White mold	yes	yes	
Fusarium root rot	yes	yes	yes
Bacterial blight			yes
Halo Blight			yes
Bean rust		yes	
ALS		yes	
Drought		yes	yes

Phenotyping is not BeanCAP funded.... SNP genotyping is BeanCAP funded

Phenotyping – Osorno - NDSU

- Continue evaluation Stampede/Red Hawk RIL mapping population (184 RILs)

- Expand testing to other locations - discussion

- RIL pop. Buster /SER22 (extreme phenotypes)

- BeanCAP panel (extreme phenotypes for nutritional traits) for confirmation of results

- Core collection for Halo Blight (greenhouse) and Root rot complex (field)

- Andean Diversity Panel for Root rot complex (field)

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Phenotyping – Porch – USDA-PR

- 100 BeanCAP – AM 100 Panel 2012/2013 Drought, Non Stress - currently planted

- Evaluate AM 100 under Root Rot pressure

- Evaluate AM100 for Heat stress

- Buster/Rosa 140 RILs for drought

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Phenotyping – Urrea - UNL

- Sub-set of the Buster/SER22 (extreme phenotypes)
- Buster/Roza 140 RILs for drought
- Stampede/Red Hawk (serious adaptation issues with this inter-gene pool cross confounded with drought susceptibility)
- Continue shuttle breeding lines between PR & NE
- Evaluation of CIAT's lines for drought
- Developing another set of RILs of Buster/SER22, F2:3 generation

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Future Impacts

- Huge Interest in having access to SNP chip

- New opportunities – Association Mapping

- Andean Diversity Panel, NIFA drought

- Two NIFA projects on root rots in East Africa, MSU & UNL & CIAT

- New USAID proposal Climate Resilient Legumes

- Renewal of PULSE CRSP under FTF Initiative

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