Project Sponsor

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Project Participants

Colorado State University

NDSU

University of Nebraska Lincoln

USDA ars Agricultural Research Service
www.ars.usda.gov

Michigan State University

Oregon State University OSU

UC DAVIS

Project Management Highlights

Monthly conference calls

- Participants
  - Steering committee
  - Advisory committee members
  - Any project participant
- Goal
- Up-date everyone on recent project activity
- Plan upcoming activities
- Minutes provided on-line

Advisory Board resignation

- Dr. Chuck Hibberd, Purdue Extension resigned
  - Dr. Christine Bruhn agreed to serve on board
- Dr. Fred Bliss, resigned
  - Dr. Steve Beebe agreed to serve on board

Objective 1: Market-class specific markers

Market class	n	% polymorphic SNPs
Snap Bean	134	59.6
Pinto	91	50.3
Small red	29	48.7
Pink	17	45.5
Great Northern	48	41.5
Small White	6	39.2
Navy	43	36.4
Black	42	33.0
Light red kidney	32	30.3
Dark red kidney	15	23.8
White kidney	8	17.6
Cranberry	19	14.3

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Objective 1: Market-class specific markers

Linkage group	SNPs mapped in 2011	SNPs mapped previously	Total SNPs	LG length (cM)
Pv01	760	73	833	143.7
Pv02	518	48	566	197.0
Pv03	531	55	586	175.9
Pv04	708	47	755	154.8
Pv05	666	29	695	135.1
Pv06	199	28	227	103.8
Pv07	192	30	222	141.1
Pv08	824	38	862	196.8
Pv09	449	41	490	159.7
Pv10	763	42	805	135.4
Pv11	923	54	977	122.3
Total	**6553**	**485**	**7018**	**1665.5**

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Market Class	Indels (>7 nt) preprocessing	Indels (>7 nt) postprocessing
Pinto	9,634	1,358
Navy	1,515	339
Black	1,954	299
Light red kidney	5,524	649
Dark red kidney	1,378	66
Total	20,005	2,711

Current catalog of common bean markers

- **10,453 SNP markers**
- **2,711 indel markers**
  - ***13,164 new markers for common bean***

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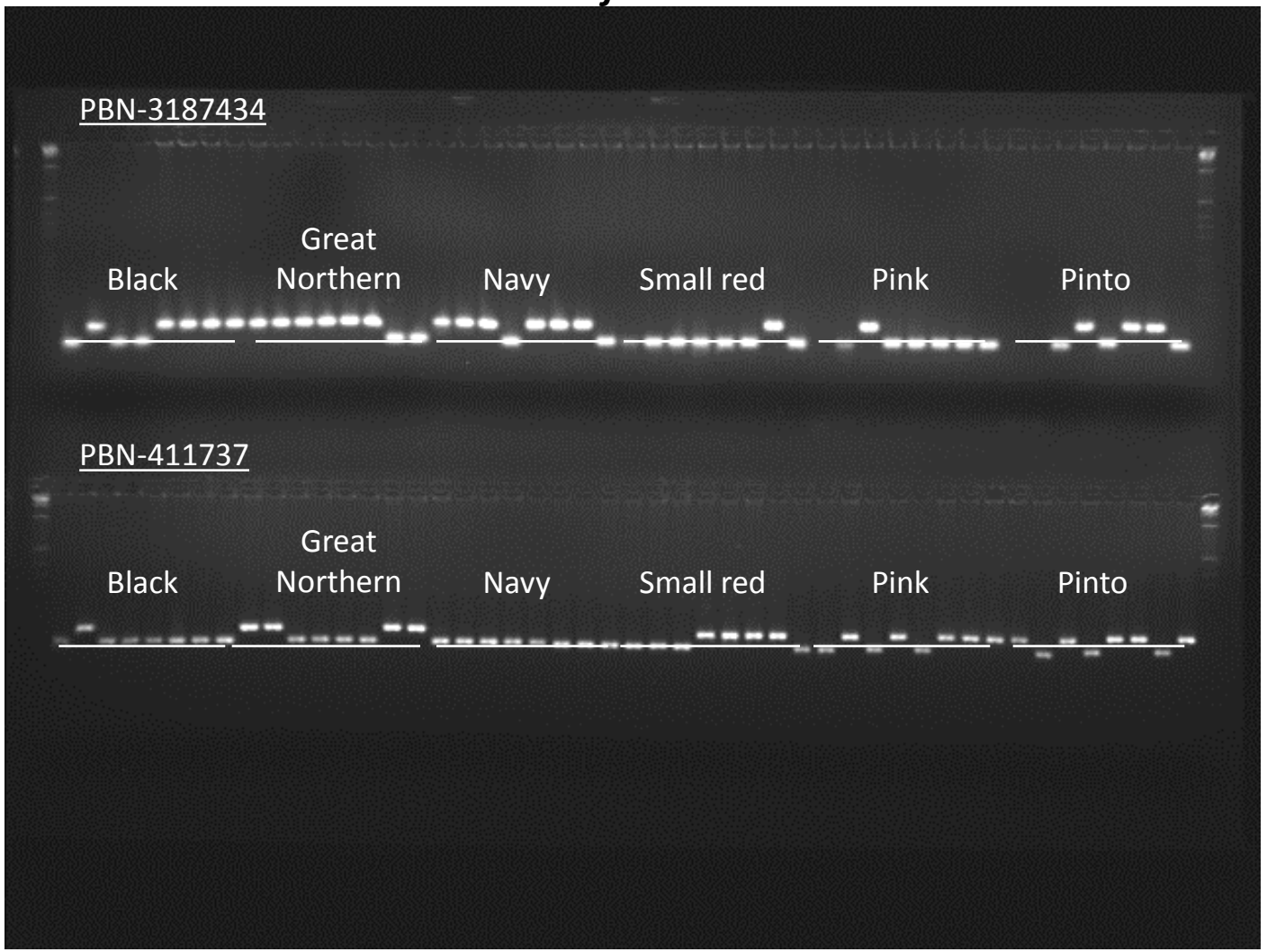
Objective 1: Market-class specific markers

Pinto indel markers useful in other market classes



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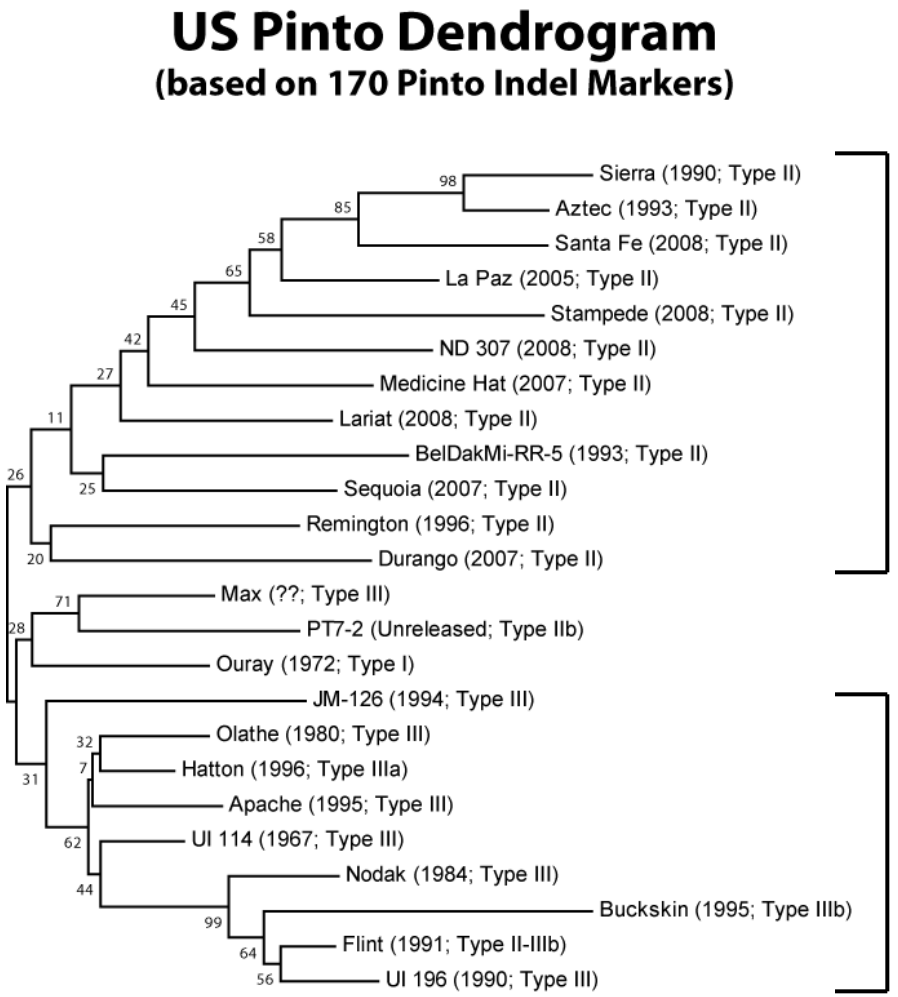
Objective 1: Market-class specific markers



Newer, upright pintos

$F_{st} = 0.25$

Older, prostrate pintos

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Objective 1: Market-class specific markers

Generation Challenge Programme

CULTIVATING PLANT DIVERSITY FOR THE RESOURCE POOR

FOR IMMEDIATE RELEASE TO MARK WORLD FOOD DAY ON 16 OCTOBER

MEDIA RELEASE – 14 October 2011

A boon to bean breeding in the tropics

Scaling to thousands: A first ever for beans, BeanCAP's landmark donation will greatly accelerate the quest for better beans

BELTSVILLE (MD), USA – The Bean Coordinated Agricultural Project (BeanCAP) is pleased to announce the release – into the public domain – of the first instalment of resources to boost molecular breeding in common beans. BeanCAP is releasing to the Generation Challenge Programme (GCP) of the Consultative Group on International Agricultural Research (CGIAR) information on more than 1,575 bean SNPs that will broaden the genetic tools available to developing-country bean breeders. 'SNPs' (pronounced 'snips') is a technical term, and the abbreviation is derived from 'single nucleotide polymorphism' – an advanced molecular-marker system widely used in genetic science, but SNPs have not been available in critical amounts to bean breeders until this landmark release. By reducing not only time but also cost, the use of SNPs for molecular breeding greatly increases the efficiency of crop breeding. This means it has high potential for improving food production in the tropics by developing new varieties better adapted to increasing environmental challenges.

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Objective 2: Nutritional Phenotyping

Elements	BeanCAP range	Fold range
Macro (mg/g DW)		
Ca	0.40 – 3.75	9.5 x
K	10.50 – 15.78	1.5 x
Mg	1.21 – 2.40	2.0 x
P	3.25 – 6.52	2.0 x
S	1.50 – 2.60	1.7 x
Micro (µg/g DW)		
Cu	6.59 – 13.86	2.1 x
Fe	47.16 – 101.39	2.1 x
Mn	10.05 – 19.98	2.0 x
Na	not detected	
Ni	0.62 – 6.28	10.2 x
Se	0.28 – 1.01	3.6 x
Zn	31.03 – 68.54	2.2 x

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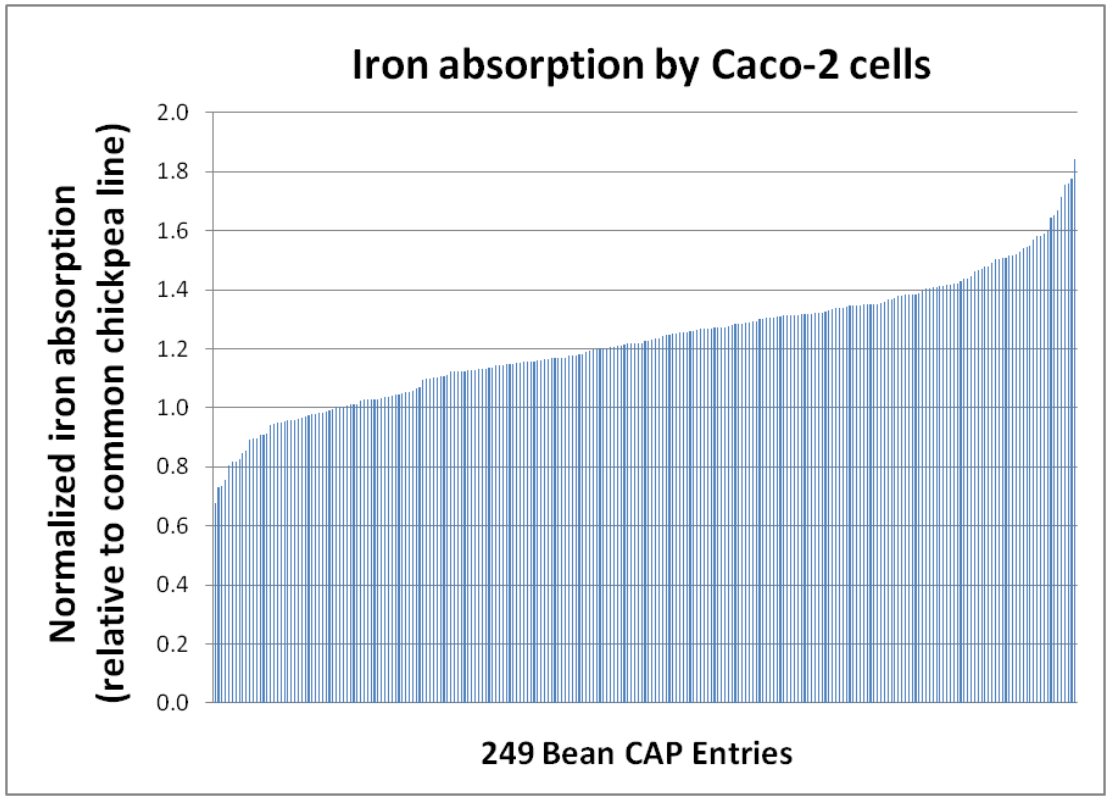
Objective 2: Nutritional Phenotyping



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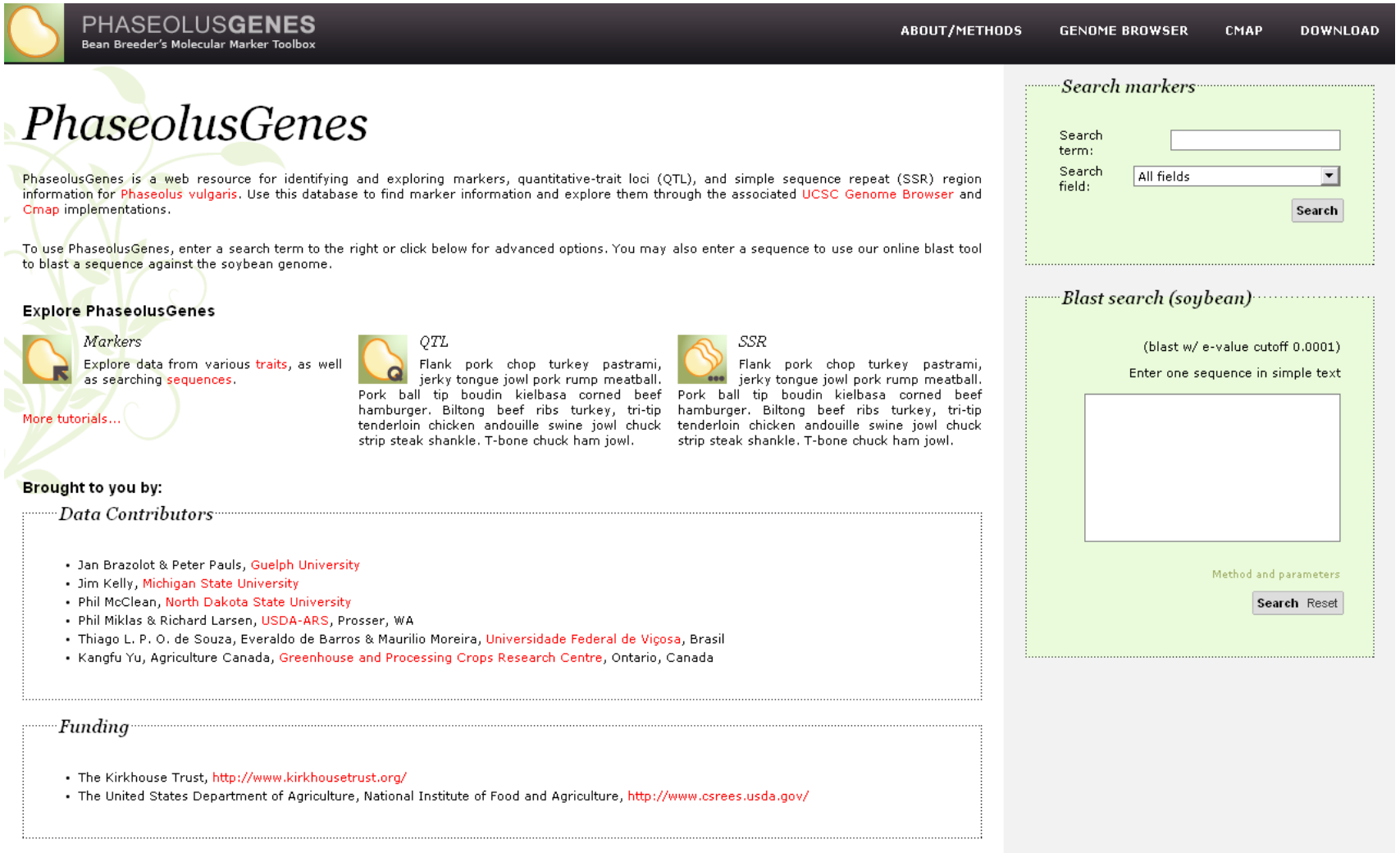
Objective 3: PhaseolusGenes Database



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Objective 3: PhaseolusGenes Database

MAPPED MARKERS			
Type/Source	**Name**	**Total**	**Mapped**
STS			
Hougaard et al. 2008	Leg	195	105
Various		12	11
Murray et al. 2002	Bng	130	89
Kami et al. , unpubl.	D	113	9
Kim et al. 2006	COS	120	0
McConnell et al. 2010	g	302	295
David et al. 2008	B4 BACs	114	114
Total STS		986	623
Genes		25	15
SCARS		78	69
SSRs			
Blair et al. , various	BM	692	210
Yu et al. 2000	Pv	37	19
Buso et al. 2006, Grisi et al. 2007	PVBR	81	55
Hanai et al. 2010	PVM	140	45
Hanai et al. 2007	FJ	40	0
Benchimol et al. 2007, Oblessuc et al. 2009	IAC, IAC-SSR	173	0
Cardoso et al. 2008	SSR-IAC	99	0
Total SSR		1,262	329
Total		**2,351**	**1,036**

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Objective 3: PhaseolusGenes Database

Name	Parents	Pop	Type	Source	Type of markers	# markers
Bean01	BJ	RI	MA	Freyre et al. 1998	Phenotypic, RFLP, RAPD, AFLP; SCAR;Allozyme	234
Bean02	BJ	RI	MA	McClean 2007; McConnell et al. 2010	STS: g, CAPS, dCAPS, indel; SCAR; RAPD, AFLP	450
Bean03	BJ	RI	MA	Navarro Gomes & Gepts 2011	STS: g, Leg, Bng, D, RFLP;	485
Bean04	BJ	RI	MA	Galeano et al. 2011	STS: Leg; SNP: g	424
Bean05	DOR364 x BAT477	RI	MM	Galeano et al. 2011	SSR, SSR-BES, RAPD, AFLP	291
Bean06	DOR364 x G19833	RI	MA	Galeano et al. 2011	SSR, SNP, STS: RFLP, Leg	499
Bean07	Consensus	NA	NA	Galeano et al. 2011	SSR; SNP; STS: Leg, g, Bng	1,010

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Objective 4: Early Breeder Training

- Two graduates of program are in graduate plant breeding programs
- 19 student interns for 2010
- ~170 high school students visited during 2010

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Objective 5: Multimedia Development

2011 Outcomes

- Spillin' the Beans (Julie Garden-Robinson)
  - Bean nutrition curriculum
- Mineral transport animation (Christina Johnson)
- Recruiting documentary, Part 2 (Bree Reetz, Shane Reetz)
  - How to make a difference: Norman Borlaug Story
- Root biology documentary (Shane Reetz)
- Shovelomics How-to (Shane Reetz)
  - New techniques for screening root traits

2012 Plans

- Genetic Diversity Documentary (Part 3)
  - How plant breeding solves problems: US wheat stem rust story
- Young Plant Breeders Documentary (Part 4)
  - Why students are interested in plant breeding
- Minerals and human nutrition animation(s)

85 Active Participants

North Dakota State Univ: **Phillip McClean**, PD; **Juan Osorno**, Co-PD, education lead, breeding; **Julie Garden-Robinson**, Co-PD, extension; **Michelle Grant**, Administrative assistant**; Bradley Bisek**, intern; **Nicole Dallman**, intern; **Kataryna Cookman**, intern; **Mitchell Bauske**, intern; **Lyndsie Park**, intern; **Peter Totten**, intern; **Christina Johnson**, Artistic lead; **Shane Reetz**, Documentary lead; **Bree Malingnen**, Infrographics artist; **Samira Mafi Moghaddam**, Marker development; **Rian Lee**, Marker development; **Sujan Mamidi**, Statistical analysis; **Stacy Halvorson**, extension associate; **Leah Whigham**, nutrition researcher; **Deb Habedank**, childcare director; **Todd Weinmann**, extension agent; **Steve Sagaser**, extension agent; **Chelsea Langus**, intern; **Alexandra Idso**, intern; **Aimee Henning**, intern, **Kendra Otto**, intern; **Emily Westrom**, intern; **Amy Hutchinson**, intern; **Kayla Bahtiraj**, intern. ***Univ Nebraska, Lincoln***: **Carlos Urrea**, , Co-PD; **Nicole Schnitger**, intern; **Misty Griffitts**, intern; **Scout Wilson**, intern; **Charity Berkey**, intern; **Danielle Becker**, intern; ***USDA/Houston***: **Michael Grusak**, Co-PD, nutritional analysis; **Paz Etcheverry**, cooperator; **David Dworak**, technician; **Lori Center**, technician; **William Carter**, intern; ***Oregon State Univ***: **Jim Myers**,; Co-PD, Nutritional analysis, breeding; **Annie Chozinski**, faculty research assistant; **Kara Young**, intern; **Katrina Maguell**i, intern. ***Univ California, Davis***: **Paul Gepts**, Co-PD, data base development; **Shelby Repinski**, Graduate student, QTL entry to database; **Adriana Navarro Gomez**, Graduate student, QTL entry to database; **Sun Lei**, Graduate student; **Tania Gioia**, Graduate Student; **Dawei Lin**, Bioinformatics and database lead; **Jose Boveda**, Database/web programmer; **Joe Fass**, Lead programmer; **Nikhil Joshi**, Bioinformatics programmer; **Monica Britton**, Bioinformatics analyst; **Zhi-Wei Lu**, Bioinformatics analyst. ***Michigan State Univ***: **Jim Kelly**, Co-PD, Breeding, education; **Evan Wright**, technician; **Amy Lasley**, MSU, graduate student; **Valerio Hoyos Villegas**, graduate student; **Rosa Castanon**, intern; **Brittany Lane**, intern. ***USDA/Prosser***: **Phil Miklas**, Co-PD, Field increase of core population; **Susan Swanson**, technician; **Jennifer Trapp**, technician; **Jeff Coulson**, technician. ***USDA/Beltsville***: **Perry Cregan**, Co-PD, Marker development and screening; **David Hyten**, Marker development and screening; **Edward Fickus**, Marker development technician; **Qijiain Song**, Bioinformatics analysis; **Gaofeng Jia**, marker and bioinformatics analysis; **Josaine Rodriques**, Federal University of Vicosa, Brazil, SSR analysis, graduate; **Charles Quigley**, research DNA sequencing. ***Seminis***: **Ken Kmecik**, Greenhouse/field increase of core population. ***Colorado State Univ***: **Mark Brick**, Breeding, education, nutrition analysis; **Henry Thompson**, Nutrition analysis; **Soni Hueftle**, intern; **Griffin Carpenter**, intern; **Keera Brown**, intern; **Alyssa Bollig**, intern; **Dimas Echeveria Moreno**, Research associate, nutrition analysis. ***USDA/East Lansing***: **Karen Cichy**, Co-PD, Nutritional analysis; **Nicole Butler**, graduate student; ***USDA/Mayguez, PR***: **Tim Porch**, Co-PD, Field stress analysis; **Abraham Montes**, technician; **Franquie Colon**, research assistant; **Gregory Howard**, research; **Edlin Gonzalez**, research.