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

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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
  - Board needs an extension replacement

Leveraging the Project

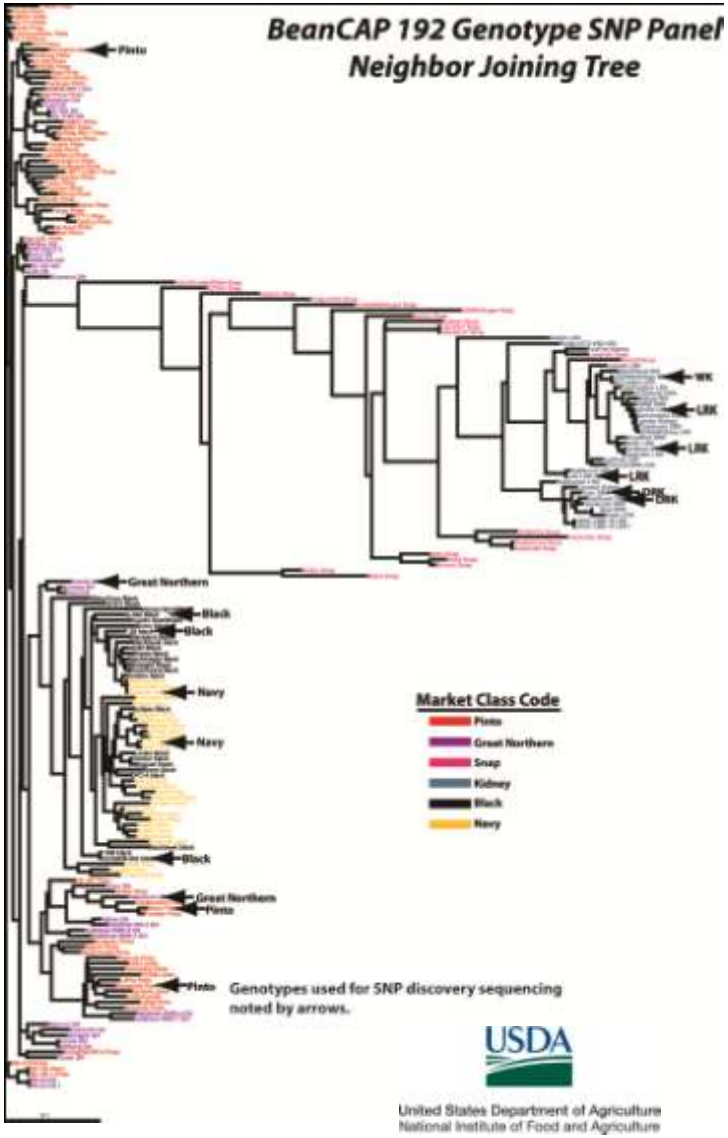
Seminis

- Performed large scale seed increase of BeanCAP association mapping population

ConAgra

- Offered to perform canning trials on BeanCAP field grown materials

Objective 1: Market-class specific markers

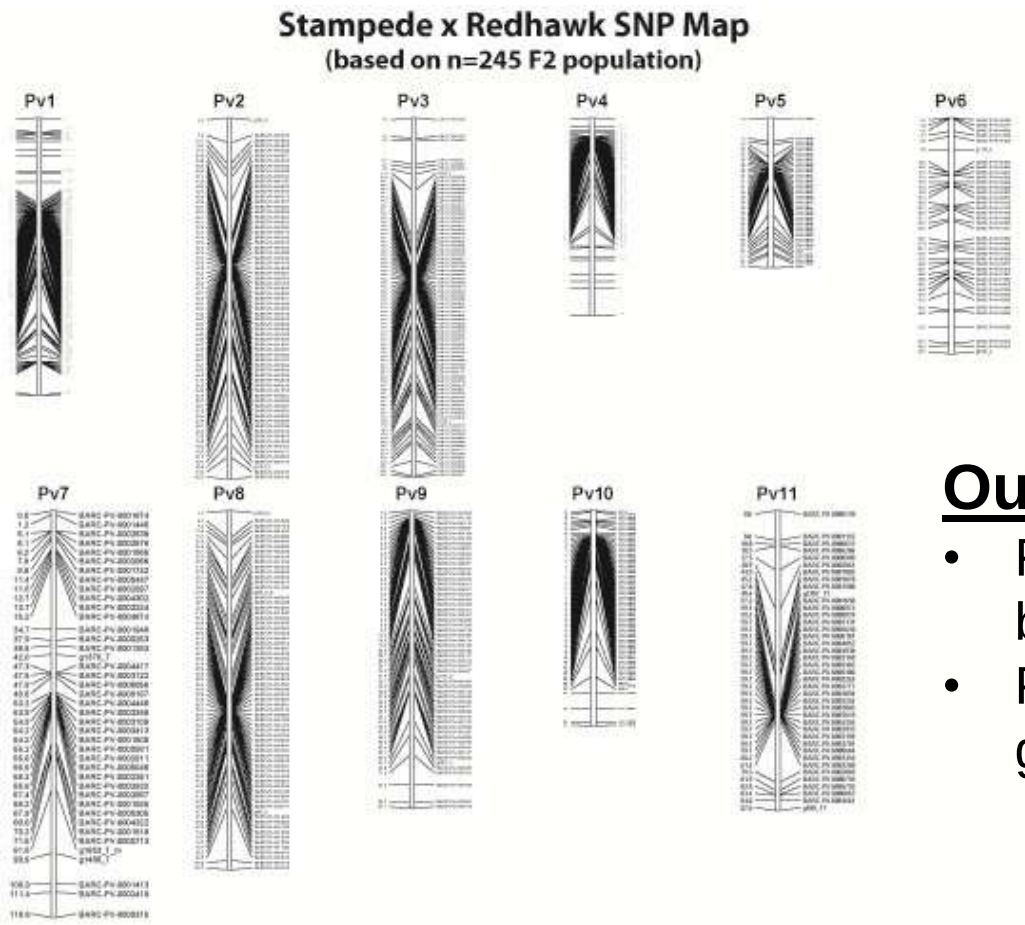


High-throughput Illumina SNP markers

Outcomes

- First 1536 Illumina Golden Gate SNP assay was developed
- Market class clusters defined
- Unknown breeding relationships defined
- Parents for market class specific SNP discovery identified
- Sequence data collected

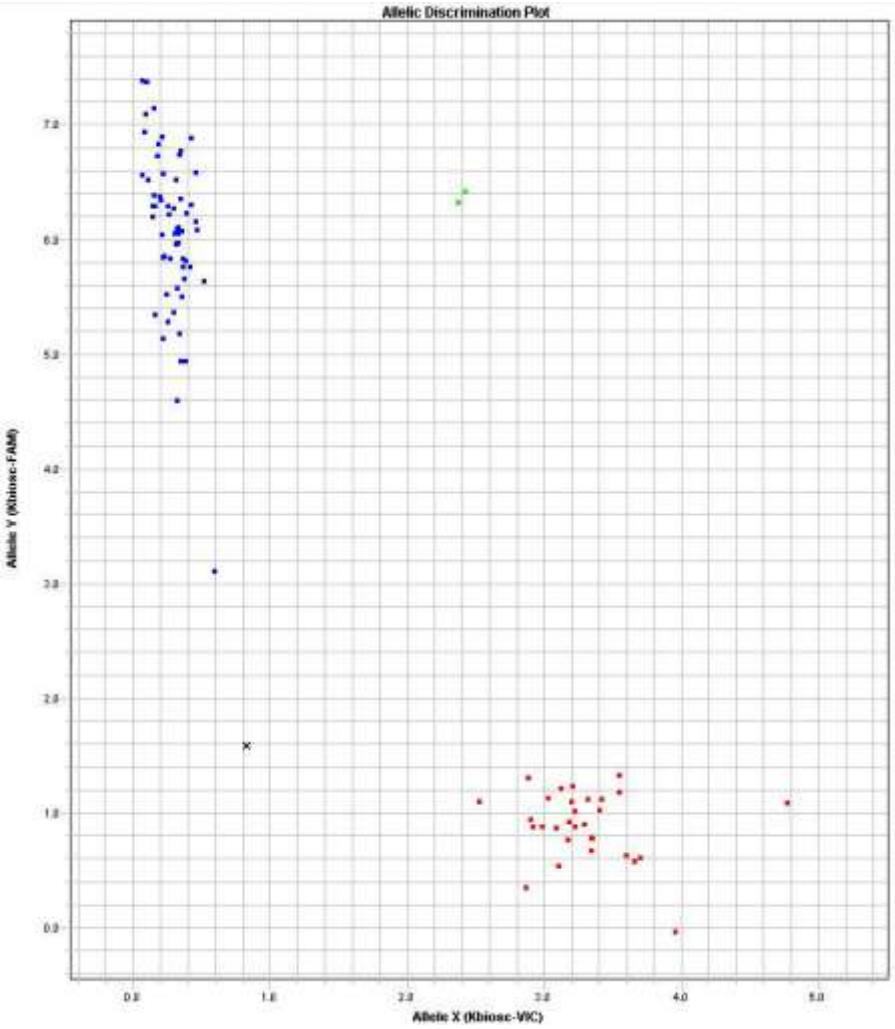
High-throughput Illumina SNP markers



Outcomes

- First SNP based map of common bean developed
- Project in collaboration with the genome sequencing project

Objective 1: Market-class specific markers



Medium- and low-throughput markers

Outcomes

- Advisory Committee urged another approach than CAPS be developed
- KASPr (KBioscience) SNP system adopted
- RT-PCR amplification
- 1.5 hr assay
- If SNP panels are developed
- $0.18 per assay as performed by KBioscience with project provided DNA

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Medium- and low-throughput markers

BeanCAP Stated Outcome

- Six markers per chromosome per market class for the entire project
- 35% of the way to the goal in one year

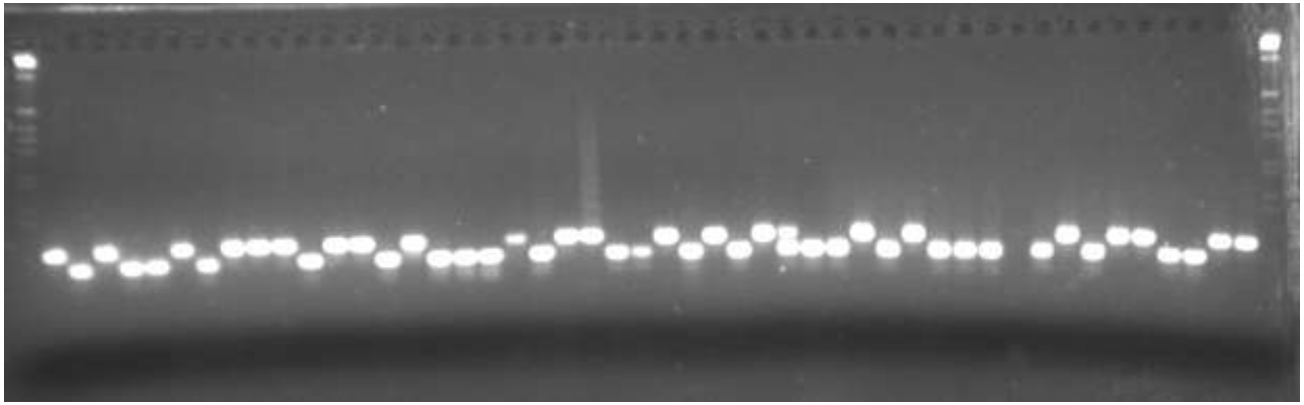
	Chromosome											
Market class	**Pv1**	**Pv2**	**Pv3**	**Pv4**	**Pv5**	**Pv6**	**Pv7**	**Pv8**	**Pv9**	**Pv10**	**Pv11**	**Total**
Navy	16	6	2	2	11	4	5	2	0	2	8	58
Pinto	12	30	0	2	7	6	6	0	10	3	20	96
Black	1	1	2	0	4	2	0	1	0	0	1	12
Great northern	20	30	6	1	3	5	3	2	2	4	11	87
Kidney/snap	11	1	2	38	5	0	1	7	5	10	15	95

Medium- and low-throughput markers

BeanCAP Added Outcome

- Genome sequence information utilized
  - G19833 and BAT93 methyl-filtration contigs
  - Coupled with G. max synteny and used to discover indels
- PCR-based indel markers developed
- 3 hr assay, NO restriction digestion needed
- Goal
  - Develop market-class specific indel markers

Segregation at an indel marker →



Objective 2: Nutritional Phenotypic Analysis

Elemental Analysis of Field Grown Snap Beans

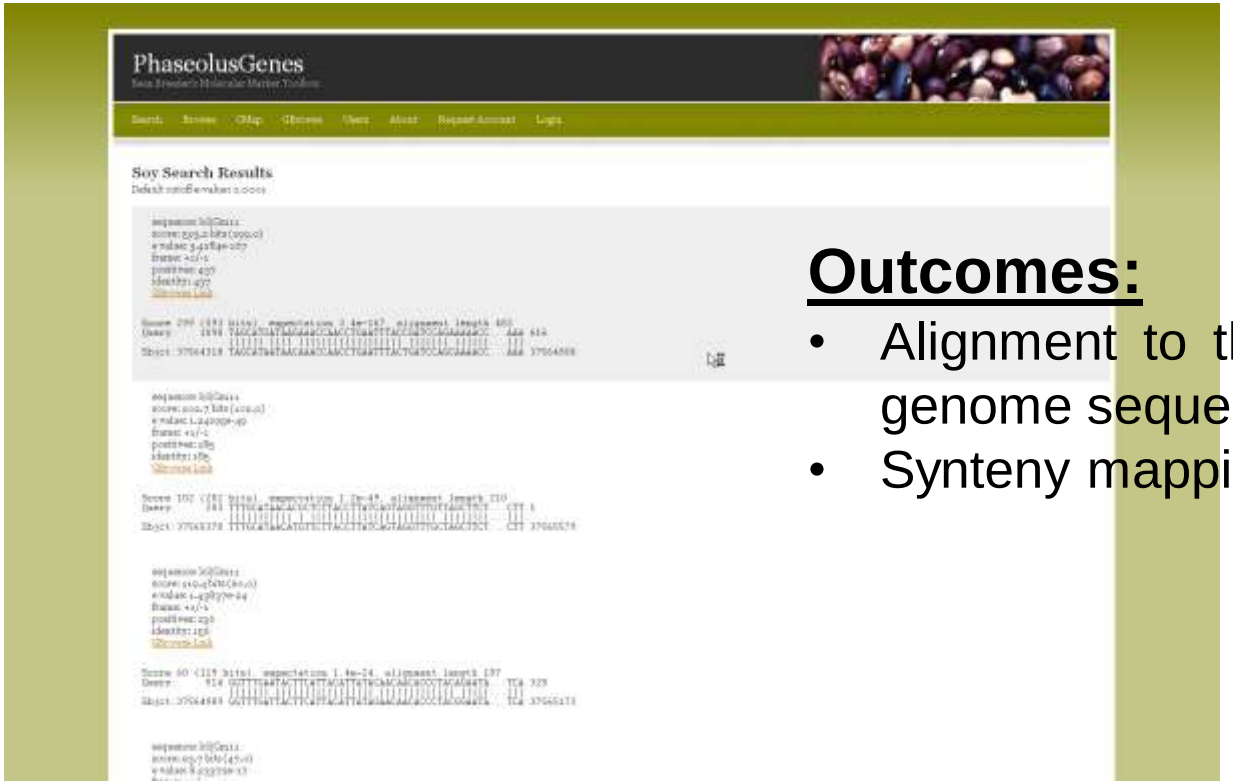
Outcome

- Snap bean selections
  - 1.8- to over 20-fold phenotypic diversity
- BeanCAP genotypes
  - Values consistent with the USDA Nutrient Database

Nutrient Class	BeanCAP samples					USDA market samples		
Macro (mg/g DW)	**Range**	**Fold**	**Mean**	**SD**	**n**	**Mean**	**SD**	**n**
Ca	3.68 – 8.20	2.2 x	5.71	0.99	104	3.82	0.14	153
K	13.34 – 27.47	2.1 x	18.43	2.50	104	21.80	0.46	154
Mg	2.10 – 3.77	1.8 x	2.86	0.31	104	2.58	0.07	151
P	2.15 – 4.96	2.3 x	3.39	0.59	104	3.93	0.08	140
S	1.17 – 2.33	2.0 x	1.68	0.24	104	NA		
Micro (µg/g DW)								
Cu	2.29 – 7.18	3.1 x	4.90	0.94	104	7.13	0.41	161
Fe	48.81 – 148.23	3.0 x	79.85	15.44	104	106.40	7.95	155
Mn	13.66 – 57.95	4.2 x	28.08	7.39	104	22.31	0.83	150
Na	1.81 – 36.76	20.3 x	11.81	7.13	104	619.83	18.18	154
Ni	2.58 – 6.37	2.5 x	4.48	0.74	103	NA		
Se	0.18 – 0.78	4.3 x	0.46	0.15	94	0.60	0.00	1
Zn	21.30 – 42.14	2.0 x	30.39	4.10	104	24.79	2.17	152

Objective 3: Database Development

PhaseolusGenes Features

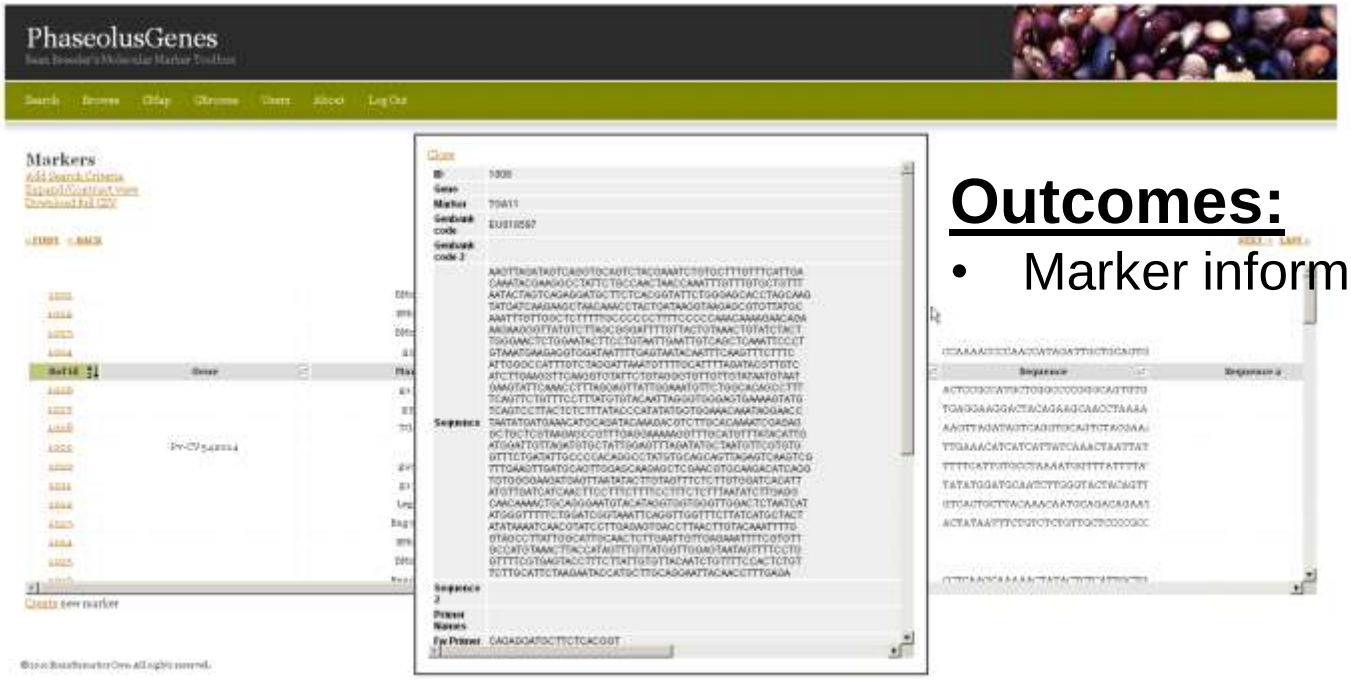


Outcomes:

- Alignment to the soybean genome sequence
- Synteny mapping

Objective 3: Database Development

PhaseolusGenes Features

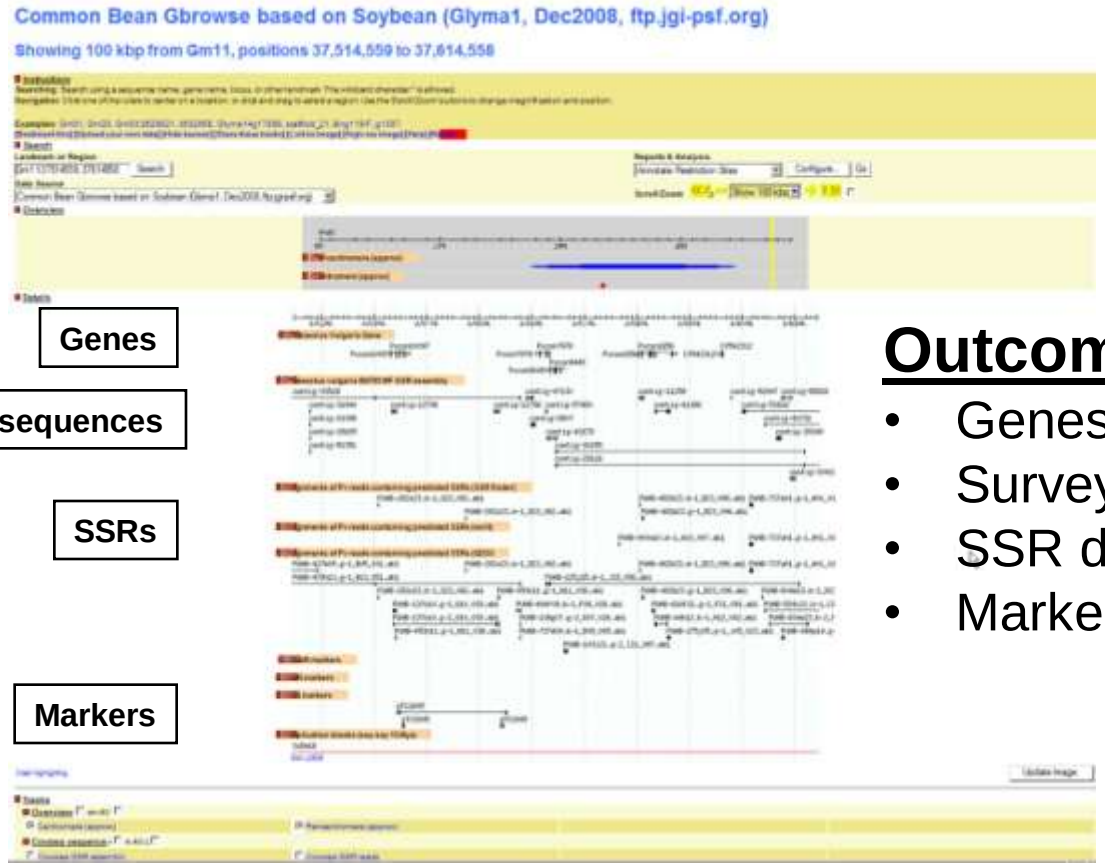


Outcomes:

- Marker information

Objective 3: Database Development

PhaseolusGenes Features



Outcomes:

- Genes data
- Survey sequence data
- SSR data
- Marker data

Objective 4: Early Breeder Training Program









Outcomes:

- Training in parent selection, field selection, phenotypic identification, molecular marker research, and public speaking
- Summer intern program at NDSU, MSU, UNL, and CSU.
- Training for high school and undergraduate students

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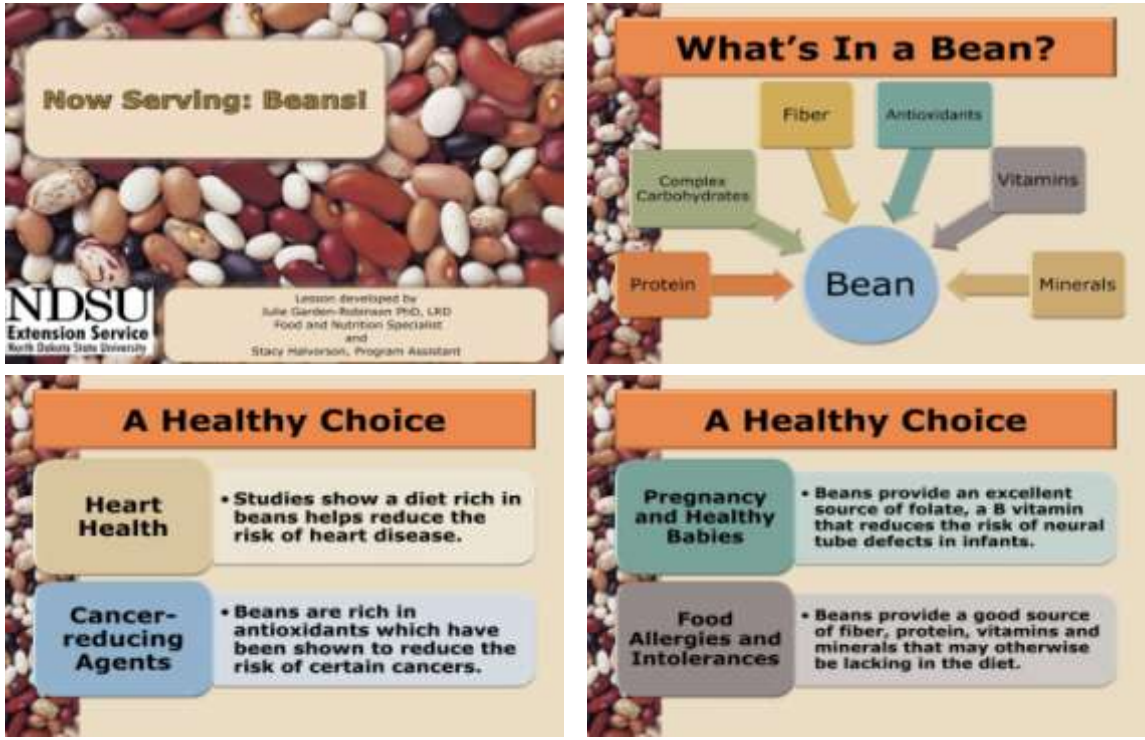
Objective 5: Educational Multimedia Development

Nutrition Game



Outcomes:

- New teaching tool focusing on nutrition
- Dissemination to educators

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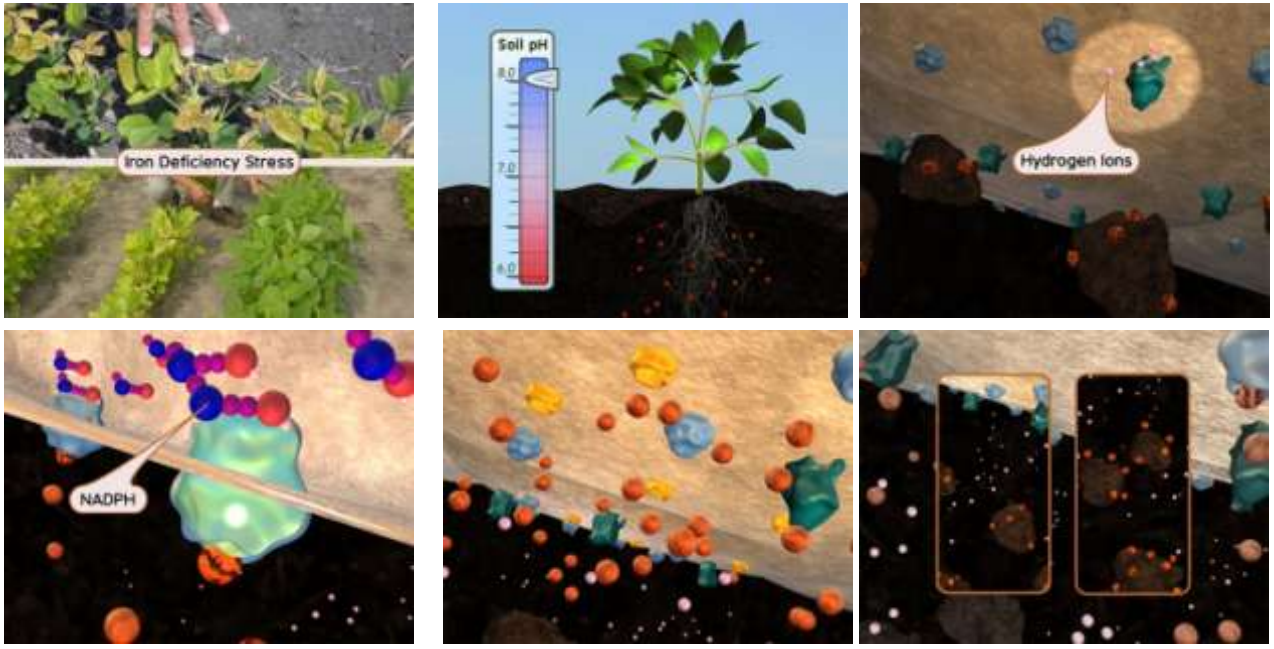
Objective 5: Educational Multimedia Development

Nutrition Animation



Outcomes:

- Scientific knowledge tools
- Wide-ranging dissemination

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57 Active Participants

Phillip McClean, North Dakota State University (NDSU), PD; **Juan Osorno**, NDSU, Co-PD, education lead, plant breeding; **Julie Garden-Robinson**, NDSU, Co-PD, extension; **Michelle Grant**, NDSU, Administrative assistant; **Christina Johnson**, NDSU, Artistic lead; **Shane Reetz**, NDSU, Documentary lead; **Lindsey Duppong**, NDSU, Infrographics artist; **Samira Mafi Moghaddam**, NDSU, Marker development; **Rian Lee**, NDSU, Marker development; **Sujan Mamidi**, NDSU, Statistical analysis; **Alexander Johnson**, NDSU, Undergraduate plant breeding intern; **Mariah Smith**, NDSU, High school plant breeding intern; **Austen Lund**, NDSU, High school plant breeding intern; **Angela Linares**, NDSU, Graduate student, intern training/seed dispersal; **Albert J. Vander Wal**, NDSU, Research technician, seed dispersal; **Carlos Urrea**, University of Nebraska, Lincoln (UNL), Co-PD; **Doug Valade**, UNL, High school summer intern student; **Misty Griffitts**, UNL, Undergraduate summer intern student; **Nicole Schnittger**, UNL, Undergraduate summer intern student; **Tania Torres**, UNL, Undergraduate school term intern student; **Emily Hoehn**, UNL, Undergraduate school term intern student; **Michael Grusak**, USDA/Houston, Co-PD; **David Dworak**, USDA/Houston, Research technician; **Stephanie Mercado**, USDA/Houston, Research technician; **Jim Myers**, Oregon State University; Co-PD, Nutritional analysis, plant breeding; **Deborah Kean**, OSU, Faculty research assistant, field (retired); **Annie Chozinski**, OSU, Faculty research assistant, field; **Joel Davis**, OSU, Faculty research assistant, lab nutrition analysis; **Michelle Bullock**, OSU, Student field worker; **Paul Gepts**, University of California, Davis (UCD), Co-PD, data base development; **Shelby Repinski**, UCD,Graduate student, QTL entry to database; **Adriana Gomez**, UCD, Graduate student, QTL entry to database; **Dawei Lin**, UCD, Bioinformatics and database lead; **Jose Boveda**, UCE, Database/web programmer; **Joe Fass**, UCD, Lead programmer; **Nikhil Joshi**, UCD, Bioinformatics programmer; **Monica Britton**, UCD, Bioinformatics analyst; **Jim Kelly**, Michigan State University (MSU), Plant breeding, education; **Jacob Emmendorfer**, MSU, High school plant breeding intern student; **Damien Johnson**, MSU, High school plant breeding intern student; **Philip Munoz**, MSU, Undergraduate plant breeding intern student; **Mary Harris**, MSU, Undergraduate plant breeding intern student; **Phil Miklas**, USDA/Prosser, Co-PD; Field increase of core population; **Perry Cregan**, USDA/Beltsville,Marker development and screening; **David Hyten**, USDA/Beltsville, Marker development and screening; **Edward Fickus**, USDA/Beltsville, Marker development technician; **Ken Kmecik, Seminis**, Greenhouse/field increase of core population; **Mark Brick**, Colorado State University (CSU), Plant breeding, education, nutrition analysis; **Henry Thompson**, CSU, Nutrition analysis; **Sarah Dominick**, CSU, Undergraduate plant breeding intern; **Hannah Walters**, CSU, Undergraduate plant breeding intern; **Bryan Fisher**, CSU ,High school plant breeding intern; **Colton Heeney**, CSU, High school plant breeding intern; **Jordon Leone**, CSU, High school plant breeding intern; **Leslie Brick**, CSU, Research associate, nutrition analysis; **Dimas Echeveria Moreno**, CSU, Research associate, nutrition analysis.

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