BeanCAP
Common Bean Coordinated Agricultural Project
Progress Report and Work Plan
10/1/2009 – 12/31/2009

North Dakota State University
Phil McClean, Juan Osorno, Julie-Garden Robinson, Christina Johnson

Progress During this Reporting Period (10/1/2009 – 12/31/2009)

A. Describe your research, education, and/or outreach activities completed in this reporting period

Research: ***Association Mapping***. An association mapping (AM) population was developed with the input of many common bean researchers. This included public and private sources. One major caveat was that all genotypes entered in the population must be freely available to any researcher for crossing purposes. This will allow researchers to maximize the data that will be generated from the project. To date, the population consists of over 350 lines, of which ~100 are from private companies. Seed was sent to Dr. Juan Osorno. This ensured a single shipment to those who will be growing the seed to maturity.

CAP Project. The CAP project began by collating the CAP markers defined by a former graduate student in the McClean lab. The CAP project is now supported by a graduate student, Ms. Samira Mafi. Those were tested on a new mapping population. That data will supplement SNP data generated by the Hyten/Cregan lab to develop a new linkage map of common bean. This population was developed through the F2 generation during this time period. F2 tissue was used for screening purposes.

Education: The primary effort to date has been recruitment of students into the program. At this point, it has been difficult to find a student to make the commitment.

Extension: The narrative of the first animation was developed. The purpose of this animation is to describe the interactions between the plant and the soil that increases mineral availability. The animation will use a mixture of media, including photographs, animated stills, and live action animation. Two part-time animators were hired. During this period, their primary responsibility was to learn the Maya software.

WWW site development was commenced. Mr. Dave Krauss was recruited to be our WWW designer and administrator. Mr. Krauss was recruited by Dr. Kelly at MSU. Mr. Krauss, Dr. Kelly, and Dr. McClean met at MSU to discuss the organization of the BeanCAP WWW portal. The domain name (www.beancap.org) was secured. Design issues relative to page layout and content were resolved. The next task was to design a BeanCAP logo. The was considered by all members of the executive committee. In the end, it was determined that a logo featured DNA, plant, and bean seed images best represented the project. That logo is represented on the cover page of this document.

The BeanCAP project was a featured presentation at the Bean Improvement Cooperative meeting held in Fort Collins, CO in mid-October. The integration of the project with the common bean sequencing project was also described. This talk lead to several invitation to present the project to the National Dry Bean Council and Bush Brothers and Company.

B. List the deliverables and outcomes achieved during this reporting period

Research:

- AM population established
- AM population distributed for greenhouse and field increase
- Initial screening of existing CAP markers
- Graduate student hired for CAP project

Education:

- Undergraduate student recruitment

Extension:

- Development of the narrative for the first animation
- Layout, design, and content of BeanCAP WWW portal

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

A. Describe your research, education, and/or outreach activities for the upcoming reporting period

Research: Dr. Ken Kmecik, Seminis Seed, has agreed to grow plants in the greenhouse. This seed described for the AM population will be distributed to all of the labs performing a nutritional analysis. Seed will be sent to Dr. Phil Miklas who is funded to grow the population in a disease-free environment. In addition, Dr. Kmecik has agreed to grow the seed in a disease free location (Idaho). This seed increase will support the association mapping experiment that will be conducted in year two of the project. {**NOTE**: Dr. Kmecik was not part of the initial project. He has agreed gratis to support the BeanCAP project by performing the greenhouse growout and the field increase. This is just one example of leveraging the project with other human and research resources.)

Following the diversity screening using the Golden Gate SNP assay system, individual SNPs that map to specific restriction enzyme cleavage sets will be developed. Within each market class, SNPs that can be converted into CAP markers will be selected. Those loci will be tested to confirm they are functional for CAP marker analhysis. Only those SNP loci with a minor allele frequency of 0.1 will be considered. If necessary, potential dCAP markers will be developed.

Education: One major effort will be the continued recruitment of students into the program. Additional venues will be tried beyond students in the College of Agriculture, Food Science, and Natural Resources. This will primarily focus on biology majors. The co-PDs will design a curriculum for students involved in the summer intern program. This will be focused around a mixture of field layout and design (as it relates to plant breeding), phenotypic evaluation, nutritional screening evaluation, and DNA-based laboratory research. Recipricol visits to high schools by Dr. Osorno, and reverse visits by high school classes to his breeding program will be arranged. Other activities will include the development of promotional materials. This will be a cooperative effort among all co-PDs involved with the education component of the project. Finally, Dr. Osorno will attend one agriculture education conference to advertise the BeanCAP intern program.

Extension: The primary extension activities will launching of the BeanCAP WWW presence, be the establishment of the Ning learning community, and populating the Moddle learning site with education materials related to plant breeding. Additional animations will be develop that continue to emphasize the soil and plant aspects of mineral nutrition.

B. List the deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period.

Research

- Develop the first set of race-specific CAP markers

Education

- Recruitment of students into the BeanCAP intern program
- Design and development of intern program promotional materials
- High school visits to NDSU breeding program
- Visits by Dr. Osorno to regional high schools to promote plant breeding
- Visits by Dr. Osorno to a agricultural education conference

Extension

- Launch the BeanCAP WWW site.
- Establish the Ning learning community will be established and advertised it to the Phaseolus community
- Populate the Moodle learning site with learning materials related to plant breeding as a career
- Develop animations focused on the themes of root biology, the role soil chemistry plays on nutrient uptake; and the flow of soil minerals from the root to various parts of plants will be developed
- Supporting still images and quizzes hat support the education component of the BeanCAP project tthe learning points that are the focus of the animations

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USDA/ARS Children's Nutrition Research Center, Houston, TX
Michael A. Grusak

Progress During this Reporting Period (10/1/2009 – 12/31/2009)

A. Describe your research, education, and/or outreach activities completed in this reporting period.

Research: Our major activities in this project will be to analyze mineral concentrations and iron bioavailability potential in the dry bean and snap bean samples that will be shipped to us by other cooperators. As of this reporting period, no samples are yet available. However, in anticipation of the first samples coming in 2010, we have been assessing various software and hardware configurations that will allow us to document and inventory the samples once they arrive. In the past, we have used simple numerical and lettering identifiers for all samples, and excel spreadsheets to record information on sample identity and storage location. However, all of our past experiences have usually involved unique samples. For this project, in which the same genotypes will be grown in different locations and different years, we wish to ensure sample identity x location x year throughout the project, especially to allow us to return to samples for additional analyses if these are required. Thus, we are looking into some off-the-shelf software packages and inexpensive bar code readers to purchase and use with this project.

Regarding our analytical techniques, we have established new program parameters on our ICP-OES (inductively coupled plasma – optical emission spectrometer) that will allow us to include selenium (Se) in our mineral analyses. New standard solutions have been purchased that include Se, along with our other minerals to be assayed; these will be used for instrument calibration. For the Caco-2 *in vitro* cell culture studies to assess iron bioavailability, we (myself and Dr. Paz Etcheverry [the junior faculty in my lab who is in charge of these studies]) have been discussing how we will handle the small scale processing of samples (e.g., cooking methods) prior to the analyses, and how best to pilot test various procedures.

Extension: My group provided feedback on the BeanCAP logo designs.

B. List the deliverables and outcomes achieved during this reporting period

Research

- Assessed sample tracking software and bar code scanners.
- Established new procedures and acquired standards for Se analysis with ICP-OES.
- Discussed possible pilot protocols to test bean processing methods for subsequent Caco-2 assays of iron bioavailability.
- Provided feedback on the BeanCAP logo designs.

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

A. Describe your research, education, and/or outreach activities for the upcoming reporting period.

Research: A decision will be made on software and bar code scanner for sample tracking; equipment will be purchased in early 2010 and placed into operation before receiving first bean samples. Pilot Caco-2 studies will be conducted with a few market classes of bean to test different processing methods and to ensure consistent results. This will be important, because we will be receiving small batches of dry beans and snap beans, which may be difficult to process at this scale. Once samples are available from the NDSU greenhouse grow-out this winter, we will process and analyze all samples for mineral concentrations (ICP-OES) and iron bioavailability (Caco-2).

Extension: Offer assistance, as needed, in the development of the " **Nutritional Genetics and Genomics: Healthy Foods from the Field to the Table"** WWW presence. In particular, I will be available to help with content on the animations to be focused on 1) root biology and the role soil chemistry plays on nutrient uptake; and 2) the flow of soil minerals from the root to various parts of plants. My background in plant physiology, mineral nutrition, and root and seed biology should be useful in this effort.

B. List the deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period.

- Purchase sample tracking software and bar code scanner.
- Complete pilot Caco-2 studies to determine processing methods for anticipated bean samples.
- Perform mineral analyses and iron bioavailability assays on greenhouse grown material.
- Attend CAP meetings at PAG XVIII.
- Assist with animation package for BeanCAP web presence.

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Colorado State University
Mark A. Brick, Henry Thompson, and Elizabeth Ryan

Progress During this Reporting Period (10/1/2009 – 12/31/2009)

A. Describe your research, education, and/or outreach activities completed in this reporting period.

Identification and seed increase of bean cultivars selected for research objectives: The overall objective of research activities include development of research tools to better understand the genetic and genomic factors that define a nutritional crop. This objective will be accomplished by utilizing association mapping among 400 dry bean and 200 snap bean lines that will also be evaluated for nutritional characteristics and genomics experiments throughout the BeanCAP project. All of these lines will be genotyped and that data will be used for the statistical analysis to discover loci associated with the nutritional traits under study. To date the Colorado State University team has contributed eight pinto, one white kidney and one black breeding line for these activities. The seed was sent to NDSU for to provide uniform and clean seed stocks to be increased in the greenhouse at NDSU.

Nutritional profiling the common bean germplasm. In year 1, the project will develop nutritional profiles for genotypes representing all of the major market classes of common bean grown in the US. To study the maximum potential for each of the traits under consideration, plants will first be grown under controlled greenhouse conditions at NDSU. Seed and pods (for snap beans) will then be sent to the testing locations for nutritional profiling. Traits will only be evaluated with the greenhouse materials, whereas other nutritional traits will be profiled with cultivars used in all experiments. The Colorado State University Team will assay all seed and fresh pods for antioxidants, phenolics, and soluble and insoluble fiber. To carry out the laboratory analyses we submitted paper work to hire a full time Research Associate. This was hampered by a hiring freeze at Colorado State University and the necessary paper work to hire someone with laboratory experience without the time to conduct an open search. To date we have been approved for the Research Associate position and identified a suitable candidate for the position. We are presently waiting for the offices of Human Resources and Equal Opportunity to approve the direct hire. If approved, we have arranged the research associate to start on January 12, 2010 to develop and test the assays for the nutritional components assigned to the Colorado State University team.

Design and implementation of young plant breeder training program. This objective will allow us to train young plant breeders how a crop can be improved for nutritional quality. We have identified two undergraduates that are interested in the internship for 2010 and one high school student. The additional high school student will be identified in early January. After the beginning of the spring semester we will bring together these individuals and start their interships by designing weekly activities.

B. Deliverables and outcomes achieved during this reporting period.

Research

- Identification and submission of seed for bean cultivars for seed increase at NDSU.
- Submission of job description for Research Associate to conduct assays on nutritional components in bean.
- Identification and selection of a Research Associate to conduct assays for nutritional components in bean.
- Identification of lab space and equipment for assays for nutritional components in bean.

Education

- Identification of two undergraduate interns to work on the project in 2010.
- Identification of one high school student to work as intern in the project for 2010.
- Identification of two high schools that will provide contact visits in 2010, two more high schools will be identified in early 2010.

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

Research: ***Nutritional profiling common bean germplasm*****.** At the end of year 1, the project will have developed assay techniques to profile bean genotypes representing all of the major market classes of common bean grown in the US. The techniques developed in year 1 will be used to assay for bean grown under field conditions at multiple US locations in years 2 and as needed. In year 1, plants will first be grown under controlled greenhouse conditions at NDSU. The following set of nutritional traits will be develop by the investigators at Colorado State University.

1. **Antioxidants, phenolics, and anthocyanins** (Brick/Thompson/Ryan; all experiments). The colored components of the various common bean market classes are products of various steps along the anthocyanin biosynthetic pathway and are extracted as phenolics. The molecules themselves have beneficial antioxidant activity, but variation both within and among various market classes is unknown. The **Cancer Prevention Laboratory at Colorado State University** will perform these analyses.

2. **Soluble/insoluble fiber** (Brick/Thompson/Ryan; greenhouse seed grown seed only). As beans pass through the gut, some carbohydrates are broken down and absorbed, while others are insoluble and pass into the colon. In the colon, they may be broken down into various short-chain fatty acids that decrease the onset of colon cancer. The **Cancer Prevention Laboratory at Colorado State University** will perform these analyses.

Association Mapping: Colorado State University will contribute to the Association Mapping experiment by evaluating all dry bean genotypes in replicated trials under normal production conditions in year 2. For this experiment, we will evaluate days to flowering, days to maturity, plant

height, lodging, growth habit, 100 seed weight, and yield to determine if these traits may be correlated with nutritional traits. Association Mapping statistical analyses will also be performed to discover those loci associated with each trait.

Education: ***Design and implementation of young plant breeder training program*****.** During year one, two undergraduates and two high school students will be hired to work and train on plant breeding projects in the Department of Soil and Crop Sciences with emphasis on dry bean breeding. Four site visits will be made to local and regional high schools with the undergraduates sharing their experiences and participating in presentations on the role of plant breeders in a global society. Follow up visits will be made to the high schools that provided the interns for 2010 with interaction with the biology teachers at each site. The replacement high school trainees will be interviewed for year 2 of the project.

B. Deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period.

Research

- Assays will be developed and validated for all nutritional traits assigned to Colorado State University.
- The research associate will be trained to conduct all nutritional assays.
- A subset of cultivars will be assayed for all traits assigned to CSU.

Education

- All student interns will have completed one semester of their training program.
- Establishment of contacts and presentations at four local or regional high schools.
- Completion of the first month of the summer internships for two undergraduates and two high school students.
- Interns will identify instructional material for teaching and presentations at local high schools.

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USDA/ARS – Beltsville, MD
David Hyten
Perry Cregan

Progress During this Reporting Period (10/1/2009 – 12/31/2009)

A. Describe your research, education, and/or outreach activities completed in this reporting period

Research: In preparation for the analysis of the 192 diverse common bean genotypes using the newly developed Illumina GoldenGate OPA (Oligo Pool All) 1536 Common Bean SNP Panel, this first OPA was tested as follows. DNA of 188 F2 plants derived from the cross of the genotypes Stampede (pinto) x Redhawk (red kidney) as well as two replicates of the Stampede and the Redhawk parental DNA were analyzed with the 1536 Common Bean GoldenGate SNPs following standard procedures defined by Illumina, Inc. The final step in the procedure is the hybridization of Cy3 and Cy5 labeled PCR products from the 1536 SNP assays to the Illumina Sentrix Array Matrix (SAM). The Cy3 and Cy5 hybridization is the read on the Illumina BeadStation and after analysis of the resulting fluorescence data the SNP allele present at each SNP locus in each genotype is determined. Unfortunately, the hybridization intensities obtained from the two SAMs used to analyze the Stampede x Redhawk population were extremely low and did not provide useful genotype data. We had the same experience with two SAMs analyzed at the same time to which PCR products derived from our Universal Soy Linkage Panel 1.0 GoldenGate SNPs had been hybridized. Thus, we were fairly certain that the lack of fluorescence was not a failure of the Common Bean SNP Panel. We alerted the Illumina Technical Representative who visited our Laboratory on December 16. He determined that the problem was a faulty set of SAMs. Illumina, Inc. has agreed to replace the defective SAMs which should be arriving in the near future. Fortunately, we have residual PCR product from the analysis of the Stampede x Redhawk population. Once the new SAMs are received these residual products can be hybridized to the replacement SAMs. The Illumina Technical Rep is fairly certain that reliable allele calls should be obtained using the residual labeled PCR product.

B. List the deliverables and outcomes achieved during this reporting period

Research:

- Development of first Golden Gate SNP OPA set (1536 loci)
- Assessed the success rate at 80% for BAT93 and Jalo EEP 558

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

A. Describe your research, education, and/or outreach activities for the upcoming reporting period

Research: ***SNP Diversity data***. A total of 192 common bean genotypes will be analyzed with the 1536 SNPs of the first Common Bean SNP Panel. The common bean lines included in the set of 192 will capture the diversity of common bean germplasm being used by bean breeders and geneticists in the U.S. and around the world. In particular, representatives of the three important "races" of common bean will be included. These are the Durango, Mesoamerican and Nueva Granada races. The pinto and great northern market classes fall in the race Durango, the navy and black market classes in the race Mesoamerican and the kidney market class and most snap beans in the race Nueva Granada. Large numbers of each market class will be included in the 192 genotypes so that it will be possible to obtain good estimates of the level of nucleotide diversity both within each of the three races as well as within each of the market classes including the snap beans.

***Solexa sequence data*:** Based upon the analysis of the 192 diverse genotypes with the Common Bean 1536 SNP Panel, two genotypes from each of the market classes: pinto, navy, black, Great Northern, kidney, and snap beans will be selected that are polymorphic for the greatest number of SNP loci. Genomic DNA of the two genotypes from each of the six pairs of genotypes will be isolated and a reduced representation library will developed from each of the 12 genotypes by cutting the genomic DNA with a set of restriction enzymes. The resulting digests will be subjected to size selection and the fragments in the 200-250 basepair size range will be isolated. The 12 resulting reduced representation DNA libraries will be prepared for paired-end sequence analysis on the Solexa Genome Analyzer.

B. List the deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period.

Research

- SNP genotype data for the 192 genotypes of the Common Bean Diversity Panel
- Diversity analysis of the 192 genotype of the Common Bean Diversity Panel
- Selection of two maximally diverse genotypes from each of the pinto, navy, black, Great Northern, kidney, and snap bean market classes
- Creation of reduced representation genomic DNA libraries from the two diverse genotypes of each market class

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USDA/ARS – Prosser, WA
Phil Miklas

Progress During this Reporting Period (10/1/09 – 9/30/10)

A. Describe your research, education, and/or outreach activities completed in this reporting period

Research: The primary responsibility of this location is the increase of association mapping (AM) population. The first step was to create the list of genotypes that comprised this population. I assisted Juan Osorno (NDSU) and Jim Kelly (MSU) with the compilation and acquisition of 350+ lines for the AM population.

B. List the deliverables and outcomes achieved during this reporting period

Research

- The genotypes that make up the AM have been compiled

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

A. Describe your research, education, and/or outreach activities for the upcoming reporting period

Research: We will increase seed (obtain, plant, maintain, and harvest) for ~400 dry bean breeding lines for an association mapping population.

Education: Student intern(s) will be trained in small-plot experimental research as it pertains to dry bean yield and agronomic trials. High school students will be trained in DNA markers, PCR, and Mendelian genetics for dry bean traits.

Outreach: I have been recently elected the president of the Bean Improvement Cooperative. As president it is my responsibility to maintain and update pertinent information relating to the BeanCAP on the Bean Improvement Cooperative website

B. List the deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period.

Research

- Obtain seed of the lines for the AM population by May 1
- Plant the lines by June 10
- Record general observations by end of September
- Harvest of the plots by end of October (This deliverable will overlap with the Year 2 work plan.)

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Michigan State University
James D. Kelly

Progress During this Reporting Period (10/1/2009 – 12/31/2009)

A. Describe your research, education, and/or outreach activities completed in this reporting period

Research: Coordinated with Dr. Phil Miklas and Dr. Juan Osorno on the assembly of over 350 dry bean genotypes from public and private sector breeding programs in North America. Seed samples from a group of 105 bean cultivars from MSU was sent to NDSU. A separate master list of all bean genotypes is available. Seed of these lines from different breeding programs has been sent to Dr. Osorno at North Dakota State University and is being assembled to initiate a seed increase as part of the activities to measure nutritional traits in a diverse group of bean genotypes that can be grown in North America.

Extension: Initiated discussions with Phil McClean during visit to MSU on protocols to establish BeanCAP portal. Comparisons were made with other CAP web sites to determine how best to display information forthcoming on the web site.

Education: Recruited two undergraduate students at MSU, one in Horticulture (Junior) and one in Crop and Soil Sciences (Freshman) as part of the undergraduate education training internships outlined in the BeanCAP. The students worked 10 hours/week during the fall semester and are involved in aspects of DNA extraction, running SCAR markers, greenhouse crossing and disease inoculation under guidance of technical staff in the bean breeding program.

Management: Attended the BeanCAP reverse site visit at CSREES offices in Washington DC to present and discuss the BeanCAP proposal to the review panel (July 2009). Others who attended the meeting included, Paul Gepts, Mike Grusak, and David Hyten,

B. List the deliverables and outcomes achieved during this reporting period

Research

- The genotypes that make up the AM have been compiled

Extension

- Began design of BeanCAP WWW site portal

Education

- Recruited two undergraduate students for the undergraduate education program

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

A. Describe your research, education, and/or outreach activities for the upcoming reporting period

Extension: The BeanCAP WWW site portal will be completed. It will contain links to the project proposal and site visit reports, progress reports, contact information, upcoming meetings, and links to plant breeding education resources.

Education: The two undergraduate students at MSU will continue to receive training in plant breeding techniques as part of the BeanCAP during spring 2010 semester. The students will continue to work 10 hours/week during the fall semester and are involved in aspects of DNA extraction, running SCAR markers, greenhouse crossing and disease inoculation under guidance of technical staff in the bean breeding program. The students will work in field program during the summer starting in May 2010 to learn field research activities, including planting selection, note taking and harvest.

Plans will be made to visit high schools in mid-Michigan area to discuss plant breeding as a career with students intending to follow science based curriculum at the university Michigan State University.

B. List the deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period.

Extension

- BeanCAP WWW site portal will be launched

Education

- High school will be visited and the field of plant breeding will be discussed
- Student interns will be trained in the laboratory and the field

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Oregon State University
James R. Myers

Progress During this Reporting Period (10/1/2009 – 12/31/2009)

A. Describe your research, education, and/or outreach activities completed in this reporting period.

Research: One-hundred forty U.S. snap bean cultivars were identified for association mapping (Obj. 2) in consultation with snap bean breeders from Harris Moran, Pure Line, Seminis, and Syngenta seed companies, and Seneca Foods. An additional 10 European lines will be included to bring the number to 150.

B. List the deliverables and outcomes achieved during this reporting period:

Research

- List of snap bean cultivars to be used in the project was developed.

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

Research: Seed of the selected 150 snap bean cultivars will be planted at the Vegetable Research Farm, Corvallis, OR at the end of May for DNA collection and to be grown out during the summer for phenotypic characterization as part of the association mapping study (Obj. 2).

B. List the deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period:

Research

- Seed of all cultivars obtained and planted by June 1.

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University of Nebraska-Lincoln
Carlos A. Urrea

Progress During this Reporting Period (10/1/2009 – 12/31/2009)

A. Describe your research, education, and/or outreach activities completed in this reporting period

Research: Thirty one Nebraska genotypes were provided for the BeanCAP nutritional analysis as follows: fourteen great northern and 7 pinto Nebraska cultivars and germplasm released up to date, and ten elite breeding lines (5 great northern and 5 pinto lines).

Education: I attended a Multicultural Youth Leadership Conference High school Career Fair on September 18, 2009 hosted by Western Community College, Scottsbluff, NE. I talked about career opportunities in the Agronomy and Horticulture emphasizing Plant Breeding.

Western Community College located in Scottsbluff, NE, was contacted to identify potential undergraduate students to be working during the 2010 school year on bean breeding activities.

Gering High School students visited the molecular bean lab on October 9 2009. Students were exposed to DNA extraction. Some students expressed their interest in working during 2010 summer. Some students expressed their interest in working in bean breeding activities.

B. List the deliverables and outcomes achieved during this reporting period

Education

- Some high school students expressed their interest to work during summer 2010 for the dry bean breeding program.

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

A. Describe your research, education, and/or outreach activities for the upcoming reporting period

Research: Two undergraduate students will be carrying projects in the dry bean breeding program. They will be involved in bacterial wilt screening and fingerprinting bean breeding lines to molecular DNA markers. They will also learn how to create variability through hybridization.

Education: One or two high school student will be involved in preparation of dry bean trials to be planted during summer 2010. They will help to prepare seeds, randomize experiments, layout experiments, and help planting those trials. They will also learn about plant phenology and disease ratings.

Visit Scottsbluff, Gering, and Mitchell, NE High Schools to talk about career breeding opportunities.

Visit at least one High School in Wyoming to talk about career breeding activities.

B. List the deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period.

Education

- Breeding materials will be prepared for the high school visits.
- Students will be able to complete their assignments. A written report will be written by each student involve in the project.
- High school students will share their experiences on working in dry bean breeding with their classmates.

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University of California, Davis
Paul Gepts

Progress During this Reporting Period (10/1/2009 – 12/31/2009)

Describe your research, education, and/or outreach activities completed in this reporting period

Research: ***Project Objective 2***: I worked with Steve Temple (bean breeder at UC Davis) to identify breeding lines and varieties to be included in the panel for nutritional trait testing. Information and seeds were provided to Juan Osorno (NDSU). ***Project Objective 2***: I have refined the existing marker database in PhaseolusGenes to complete information for individual entries (e.g., fragment size, Tm, reference, URLs) and eliminate duplicates. The marker database now includes 1396 markers or sequence-tagged sites. Graduate student Shelby Repinski has assembled a list of references with mapped QTLs for white mold, which will be integrated into PhaseolusGenes (CMap component).

B. List the deliverables and outcomes achieved during this reporting period

Research

- Genotypes information contributed to association mapping population development

Plans for Upcoming Reporting Period (1/1/2010 – 6/30/2010)

A. Describe your research, education, and/or outreach activities for the upcoming reporting period

Research: ***Objective 1***: I expect to receive seeds from the screening panel to extract DNA and test it for quality control. This DNA will then be sent to P. Cregan at USDA-ARS (Beltsville) for SNP analysis. ***Objective 3:*** I will continue adding markers to the MarkerDB in PhaseolusGenes (mainly SSRs from CIAT in Colombia: BM214-313, Instituto Agronômico in Campinas, Brazil, and Purdue U.). I will also establish a list of mapped QTL for disease resistance traits, in addition to the white mold list already established. Prototype databases for phenotypic and molecular diversity will be established.

Extension: I plan to give a presentation to the California Edible Legume Workgroup in the last week of February 2010.

B. List the deliverables and outcomes that will be achieved during this reporting period. This will be the benchmarks for progress during this upcoming period.

Research

- An expanded PhaseolusGenes databases with 1600 markers,
- Some 50 QTLs included in the database (MarkerDB and CMap)
- and the first sets of phenotypic and molecular diversity data.