

LEGUME INNOVATION LAB FOR COLLABORATIVE RESEARCH ON GRAIN LEGUMES

FY 2013 – 2014 WORKPLAN

Project Code and Title: SO2.1 - Farmer Decision Making Strategies for Improved Soil Fertility Management in Maize-Bean Production Systems

Lead U.S. Principal Investigator (PI) and affiliated Lead U.S. University:

Robert E. Mazur - Iowa State University

Host Country and U.S. Co-PIs and Institutions:

Eric Abbott - Iowa State University

Andrew Lenssen - Iowa State University

Ebby Luvaga - Iowa State University

Russell Yost - University of Hawaii at Manoa

Julia Bello-Bravo - University of Illinois at Urbana-Champaign

Barry Pittendrigh - University of Illinois at Urbana-Champaign

Moses Tenywa - Makerere University, Uganda

Onesimus Semalulu - Soils & Agro-meteorology, National Agricultural Research Laboratories, Uganda

Ricardo Maria - Institute of Agriculture Research of Mozambique

I. Project Problem Statement and Justification:

Smallholder farmers in Africa – women and men - manage complex multifunctional maize-bean cropping systems in diverse landscapes and agroecosystems. Common beans serve multiple important roles in their cropping systems, food security, nutrition, incomes, and livelihood resilience. They register low yields, and experience pervasive poverty and food insecurity. Low productivity of beans in maize-bean systems is due to low soil fertility, limited availability of improved seed varieties, excess water during plant growth, insects, and diseases. Typical yields of 200 to 500 kg ha⁻¹ are significantly less than the 2000 kg ha⁻¹ often obtained in researcher-managed fields. Poor and declining soil fertility is considered by far the primary constraint to common bean productivity, responsible for 30% of the widely acknowledged ‘yield gap.’ Grain legume research programs identify and develop improved technologies and management practices that can substantially increase yields. However, adoption of improved crop management practices, particularly those addressing soil fertility, has been modest for beans.

This research project is based on two premises: (1) sustainable intensification of agriculture production requires improved soil fertility management in which legumes are an integral part of cropping systems and (2) addressing soil-related constraints requires not simply increasing access to fertilizers or use of other soil amendments, but - fundamentally – enhancing smallholder farmers’ capabilities in diagnosing and finding solutions to important yield constraints.

Improved management capabilities will have four important short- and long-term benefits: (1) Empower farmers (especially women) to take an active role in identifying problems and solutions in bean production; (2) Improve household income through sale of increased bean production; (3) Provide higher volume of beans for traders along the value chain within the country as well as in cross-border trade; (4) Ensure greater availability of nutritious beans and less dramatic seasonal price fluctuations for net consumers (other rural households and urban consumers). The project will contribute directly to achieving four of the six Feed the Future focal areas: inclusive agriculture sector growth, gender integration, climate-smart development, and research and capacity building. For the Legume Innovation Lab, we address SO2 through improved smallholder production management decision-making.

Project activities will take place in key bean production regions in two important FTF focus countries – in Uganda (where maize and beans are promoted through FTF projects in 62 districts) and in Mozambique (FTF priority provinces are Nampula and Zambézia; beans is a priority crop). Increasing bean productivity can help reduce poverty and improve nutrition. In Uganda, beans are the most important legume crop, and fifth crop overall. In Mozambique, beans are a cash crop for 35% of producing households; the country is the largest informal exporter of maize and beans in southern Africa (50% share of regional exports in both). Poor soil fertility has been identified as a major factor in reduced bean yields, and both countries have weak extension systems and rural institutions, limiting access to crop technologies, inputs and credit to informal systems.

This project seeks to develop ‘tools’ (methods and procedures) that enable smallholder farmers with varying levels of education to better diagnose soil-related production constraints, and make improved site-specific crop system management decisions that contribute to higher productivity (including grain legumes) in the short term as well as improvements in soil fertility in the long term. It will also assess the effectiveness of innovative communication approaches and technologies to engage farmers with diverse characteristics and other key stakeholders in widespread dissemination and adoption of diagnostic and decision support aids in different agroecological contexts.

II. Planned Project Activities for April 1, 2013 – September 30, 2014

Objective 1: Characterize Smallholder Farmers’ Motivations, Current Knowledge and Practices, Problem Diagnoses and Solutions, and Risk Management Strategies

Collaborators:

Institute for Agricultural Research of Mozambique (IIAM - Maputo, Mozambique)

Suzie Aly, Agronomy and Natural Resources, suziealine@gmail.com

Manuel Amame, Agronomy and Natural Resources, mivamane@gmail.com

Rosalina Chavana, Socio-Economic Studies Center, rosinhamahanzule@yahoo.com.br

Carlos Filimone, Training and Technology Transfer, cfilimone@gmail.com

Ricardo Maria, Agronomy and Natural Resources, ricardo_dejesus@hotmail.com

Sostino Mocumbe, Documentation, Information and Communication, somocumbi@yahoo.com

Iowa State University (ISU - Ames, Iowa)

Eric Abbott, Greenlee School of Journalism, eabbott@iastate.edu

Andrew Lenssen, Agronomy, alenssen@iastate.edu

Ebby Luvaga, Economics, luvaga@iastate.edu

Robert Mazur, Sociology, rmazur@iastate.edu

Makerere University (MAK - Kampala, Uganda)

Moses Tenywa, Agricultural Production, tenywam@agric.mak.ac.ug

Paul Musaali, Geography, Geoinformatics and Climate Sciences, muspal@arts.mak.ac.ug

National Agricultural Research Laboratories Institute (NARL - Kampala, Uganda)

Onesimus Semalulu, Soils and Agro-meteorology, o.semalulu@gmail.com

University of Hawaii (UH - Manoa, Hawaii)

Russell Yost, Tropical Plant and Soil Sciences, rsyost@hawaii.edu

University of Illinois (UIUC - Urbana-Champaign, Illinois)

Julia Bella-Bravo, Strategic International Partnerships, juliabb@illinois.edu

Barry Pittendrigh, Entomology, pittendr@illinois.edu

Approaches and Methods

The team will establish a base understanding of smallholder farmers' motivation, current knowledge and practices in maize-bean cropping systems, problem diagnoses and solutions adopted – especially pertaining to soil fertility management - in Masaka District, Uganda, and Gurué District, Mozambique. This effort will begin with a state-of-the-art review of available country-specific reports and publications to characterize farmers' practices of field selection and preparation, crop and variety selection, planting methods and spacing, use of various types of inputs, intercropping and rotation patterns, problem identification and management practices utilized by farmers to date. It will also include information on uses made of crops - consumption, market sales, and storage.

A Participatory Rural Appraisal (PRA) will initiate the community level research process in each country to create a multifaceted understanding of smallholder farmers' current knowledge, practices, motivations, experiences and conditions in three selected communities in each country. Researchers and facilitators will draw on an array of methods and techniques, including semi-structured key informant interviews, focus group discussions with 10-15 community members and situation analysis at community and farm level. A stratified random sample of 50 farmers in the community will be interviewed regarding sources and use of information about bean crop and soil fertility management, problem diagnoses and solutions adopted, decision making practices and risk management strategies. This information will form the baseline for the multi-disciplinary team of researchers to observe and learn how farmers can use the existing knowledge to help determine and leverage their own means of improving current conditions. This will be combined with information drawn from the global knowledge base of appropriate practices and technologies. Contextual elements that will be considered for their relevance include agroecosystem features (terrain, soil nutrient and physical properties, cropping system, rainfall, diseases, pests); availability and accessibility of key resources (natural, physical, financial); and value chain development (input and output markets, value capture, linkages).

The farmer and soil surveys are initiated with informal meetings of groups of farmers to identify farmer leaders. Questions asked during this stage include “who is the best farmer in the village?” and “what is their yield?” Smallholder farmers often lack awareness of the importance of soil fertility management in achieving higher yields; however, some factors are widely recognized as relevant, including amount of rocks, shallow topsoil, slope, and color. The initial survey provides respondents the opportunity to select factors they believe impact bean production within their respective production systems and to rank the relative importance of their impacts. Factors considered in the survey instrument include water as a limiting factor, crop management, soil conditions, and biological factors. Water limitation includes inadequate and untimely rainfall, infiltration rate, and runoff. Crop management considerations are numerous and include inadequate plant populations due to poor seed, seedbed preparation, and stand establishment, stand loss, or adverse environmental conditions at key developmental stages. Soil conditions surveyed include physical and chemical properties. Physical properties include texture, coarseness, and susceptibility to crusting. Chemical properties that can influence yield include pH, concentrations of N, P, Ca, Mg, K, S, and various micronutrients. Biological factors potentially impacting yield include arthropods, diseases, and presence or absence of beneficial microbes, *Rhizobium* and mycorrhizae. Farmers within and among communities can be selected or stratified based on predominant soils characteristics for participation in development and testing of diagnostic aids, presented under Objective 3.

Obj. 1a. Conduct state-of-the-art reviews of literature and relevant management practices in Africa

(lead researchers: M. Tenywa, O. Semalulu, P. Musaali, R. Maria, C. Filimone, R. Chavana)

- 1a.1. Review reports and publications to characterize farmers' agricultural motivations, knowledge, practices, and problem diagnoses (also: S. Aly, M. Amame, A. Lenssen, R. Yost)

- 1a.2. Review reports and publications to characterize farmers' livelihoods, decision making processes, and institutional factors (also: E. Luvaga, R. Mazur)
- 1a.3. Review reports and publications to characterize rural information and communication agents and practices (also: S. Mocumbi, E. Abbott, J. Bello-Bravo)

Milestones

Apr. 2013 - Sept. 2013

- Initiate state-of-the-art reviews of literature and practices

Oct. 2013 – Mar. 2014

- Complete reviews and identify knowledge gaps

Obj. 1b. Collect and analyze primary data in research communities (lead researchers: M. Tenywa, O. Semalulu, P. Musaali, R. Maria, C. Filimone, R. Chavana)

- 1b.1. Conduct participatory rural appraisals (PRAs) (also: R. Yost, E. Abbott, J. Bello-Bravo)
- 1b.2. Facilitate community identification of innovative farmers (also: R. Yost, A. Lenssen)
- 1b.3. Conduct household interviews (community cross-section) (also: S. Aly)

Milestones

Oct. 2013 – Mar. 2014

- Conduct PRA and select study farmers in Masaka
- Conduct household interviews in Masaka

Apr. 2014 – Sept. 2014

- Conduct PRA and select study farmers in Gurué
- Conduct household interviews in Gurué
- Complete report on PRA in Masaka
- Complete report on PRA in Gurué

Obj. 1c. Characterize farmers' agricultural motivations, knowledge, practices, problem diagnoses and solutions (lead researchers: M. Tenywa, O. Semalulu, R. Maria, C. Filimone, R. Chavana)

- 1c.1. Characterize farmers' motivations (also: P. Musaali, E. Luvaga)
- 1c.2. Characterize farmers' agronomic knowledge and practices (also: R. Yost, A. Lenssen)
- 1c.3. Characterize farmers' problem diagnoses and solutions (also: R. Yost, A. Lenssen)

Milestones

Apr. 2014 – Sept. 2014

- Complete analysis of interview data in Masaka, identify gaps

Objective 2: Develop and Refine Models about Smallholder Bean Farmers' Decision Making

Collaborators:

Institute for Agricultural Research of Mozambique (IIAM - Maputo, Mozambique)

Rosalina Chavana, Socio-Economic Studies Center, rosinhamahanzule@yahoo.com.br

Carlos Filimone, Training and Technology Transfer, cfilimone@gmail.com

Ricardo Maria, Agronomy and Natural Resources, ricardo_dejesus@hotmail.com

Sostino Mocumbi, Documentation, Information and Communication, somocumbi@yahoo.com

Iowa State University (ISU - Ames, Iowa)

Eric Abbott, Greenlee School of Journalism, eabbott@iastate.edu

Ebby Luvaga, Economics, luvaga@iastate.edu

Robert Mazur, Sociology, rmazur@iastate.edu

Makerere University (MAK - Kampala, Uganda)

Moses Tenywa, Agricultural Production, tenywam@agric.mak.ac.ug

Paul Musaali, Geography, Geoinformatics and Climate Sciences, muspal@arts.mak.ac.ug

National Agricultural Research Laboratories Institute (NARL - Kampala, Uganda)

Onesimus Semalulu, Soils and Agro-meteorology, o.semalulu@gmail.com

Approaches and Methods

Building on the information obtained through the PRAs, the baseline household survey of practices and conditions will provide a detailed community-wide profile regarding farmers' practices of field selection and preparation, crop and variety selection, planting methods and spacing, use of various types of inputs, intercropping and rotation patterns, problem identification and management practices utilized by farmers to date, consumption, market sales, and storage. Responses of key informants and innovative farmers previously identified as part of Objective 1 will be contrasted with responses from the general farming community. Network analysis will be conducted to understand flows of key resources – information, production materials, labor, food, money, etc. These baseline data will serve as the reference point for monitoring changes in knowledge, attitudes, practices and conditions over time.

Key social, cultural, economic, institutional and contextual factors which shape farmers' decision making – individually and collectively - that will be analyzed include: gender and other roles (who makes which types of decisions); goals and priorities; criteria (factors considered and the relative importance of each); information base (nature, sources and credibility); resources required (and the social relationships and economic costs of accessing each); resource constraints (material, labor, etc.); risk assessment/tolerance; decision processes (timing, stages, sequencing); evaluation of experiences; and adjustments over time (responding to changes in both internal and external factors); group and network size and strength; collective action for enhancing access to vital resources; progress toward livelihood goals; and resilience. Institutional factors include culturally defined roles, community-based organizations, governance, and socioeconomic status (wealth, gender, ethnicity). These factors may influence current knowledge, attitudes, practices, and subsequently processes of information dissemination, training, utilization, and support to stimulate and sustain widespread implementation. Important outcomes from characterizing farmer decision-making processes in part comes from gaining insight into which households are more prone or able to make fundamental changes and why.

Obj. 2a. Characterize access to resources required for bean production (lead researchers: P. Musaali, R. Chavana)

- 2a.1. Analyze household survey data to describe resource base variation, characterize how access to key resources is obtained and negotiated, and describe the economic costs involved (also: C. Filimone, E. Luvaga)
- 2a.2. Interview farmers and key informants to explain criteria and process for land allocation and investments in farm inputs (also: R. Maria, M. Tenywa, O. Semalulu)
- 2a.3. Analyze household survey data to describe resource constraints (also: E. Luvaga, R. Mazur)

Milestones

Oct. 2013 - Mar. 2014

- Interviews on land allocation and investments conducted
- Analysis of resource access and constraints

Apr. 2014 – Sept. 2014

- Analysis of resource access and constraints

Obj. 2b. Characterize farmers' livelihood goals, resources, strategies and success through analysis of household survey data (lead researchers: R. Mazur, E. Luvaga, C. Filimone, R. Chavana, P. Musaali)

- 2b.1. Describe farmers' livelihood values, goals, and priorities
- 2b.2. Characterize their social networks, benefits derived, and risk management arrangements
- 2b.3. Describe sources, levels, and consistency of household income
- 2b.4. Analyze variations in household food security

Milestones

Oct. 2013 - Mar. 2014

- Analysis of livelihoods

Apr. 2014 – Sept. 2014

- Analysis of livelihoods

Obj. 2c. Assess influence of institutional factors (lead researchers: R. Maria, M. Tenywa, O. Semalulu)

- 2c.1. Identify farmer- and other community-based organizations (also: R. Chavana, P. Musaali)
- 2c.2. Identify nature of extension services (public and private) (also: C. Filimone)

Milestones

Oct. 2013 - Mar. 2014

- Description of local organizations
- Description of extension services

Apr. 2014 – Sept. 2014

- Description of local organizations
- Description of extension services

Objective 3: Develop and Validate Diagnostic and Decision Support Aids

Collaborators:

Institute for Agricultural Research of Mozambique (IIAM - Maputo, Mozambique)

Suzie Aly, Agronomy and Natural Resources, suziealine@gmail.com

Manuel Amame, Agronomy and Natural Resources, mivamane@gmail.com

Ricardo Maria, Agronomy and Natural Resources, ricardo_dejesus@hotmail.com

Iowa State University (ISU - Ames, Iowa)

Andrew Lenssen, Agronomy, alenssen@iastate.edu

Makerere University (MAK - Kampala, Uganda)

Moses Tenywa, Agricultural Production, tenywam@agric.mak.ac.ug

National Agricultural Research Laboratories Institute (NARL - Kampala, Uganda)

Onesimus Semalulu, Soils and Agro-meteorology, o.semalulu@gmail.com

University of Hawaii (UH - Manoa, Hawaii)

Russell Yost, Tropical Plant and Soil Sciences, rsyost@hawaii.edu

Approaches and Methods

To improve soil management decision making, diagnostic tools will be developed with and for farmers who have varying levels of education, based upon field-observable soil classification characteristics in diverse agro-ecologies in two target bean production regions in Uganda and Mozambique. Utilizing

farmer experience and input from soil scientists and systems agronomists in the team who will draw from the global knowledge base of appropriate practices and technologies, soil and cropping systems management strategies and options appropriate for various smallholder farm systems will be identified

Available soils maps developed by remote sensing technologies show that Gurué district has four predominant soil types, Ferralsols (Oxisols), Lixisols (Alfisols), Acrisols (Ultisols), and Nitosols-Luvisols (Ultisols and Alfisols). These soil orders vary widely in native fertility and bean production potential. Despite the lack of ground truthing during classification, reports are consistent that soil quality has suffered serious degradation. Shortened fallow periods, lack of fertilizer inputs, reduced organic matter concentration, and erosion from water have resulted in stagnant or decreased bean yields. Exactly which soil nutrients are inadequate for bean production has not been systematically addressed across a range of important soils. Additionally, because limestone was not available in either country, lime requirement for pH management is not known. Available aluminum (Al^{+3}) has not been determined in extensive areas. Where data are available, available P concentration usually is low in older, weathered soils typical of Uganda and Mozambique and other areas within SSA. The high concentrations of available Fe and Al in low pH soils rapidly complex available P, making it unavailable for uptake by plants, perhaps explaining in part why phosphorus fertilization does not always improve yield or N fixation by bean and other pulses.

To determine soil factors that limit bean productivity, a missing element study using bean and representative soils from each district studied will be conducted to determine nutrient deficiencies. This technique has been used successfully to identify the important soil factors that limit crop productivity in areas lacking substantial adequate databases on soil chemical and physical properties. Once chemical and physical constraints are identified, management strategies appropriate for smallholder farmers can be developed. Additionally, previously untested solution strategies can be tested on researcher-managed sites to determine validity of identified management strategies. Diagnostic aid development is in part based on results from the missing element studies. A key element in diagnostic aid development is the inclusion of farmers' input during all developmental phases, not just during testing.

Farmer assisted research studies will be conducted in each district comparing current farmer practices with practices developed by use of the diagnostic aid. Given inherent precipitation, soils, and other differences between Masaka and Gurué districts, we have the opportunity for a robust comparison of our overall methodology. Farmers will be surveyed annually after each cropping cycle to determine impact of diagnostic aids on bean productivity, soil quality, and potential for sustainable adoption.

An effective diagnostic aid provides implicit comparisons of 'what if' scenarios. Highly observable characteristics are compared, often in a dichotomous series. These decision support aids will provide farmers with information on improved practices to achieve particular objectives, and enable farmers to weigh 'trade-offs' between alternative approaches or practices. We anticipate that our diagnostic aid will rely in part on comparisons of plant growth and development, dry matter accumulation, and color of bean plants grown in the representative soils under different nutrient or management levels. Initially, images will be available from the nutrient omission and lime requirement studies, but in subsequent years, images will be available from innovative farmer fields where the aid was used, providing direct comparison of bean growth, development, and yield between management systems used with and without the aid. Additionally, comparisons can be done between innovative farmers and a control (not selected) farmer group where diagnostic aids were not used as a second level of comparison.

Actual data collected from the farmer assisted research include initial, annual, and final key soil chemical and physical properties. Initial properties determined typically will be those documented in the nutrient omission study in impact bean growth and development. Bean stand density, yield, yield components (pods/m², seed/pod, seed weight), seed protein and germination percentage are

determined in fields under both management systems and for the non-selected farmer control group. Statistical analyses used with data from the farmer assisted research will include paired-T tests within selected farmer groups, and analysis of variance with appropriate mixed models, and nonparametric tests, depending on specific parameter. Based upon insights gained from socioeconomic research on farmer decision making, integrated soil and crop management decision tools appropriate for varying levels of formal education will be developed and tested in various contexts and evaluated for their effectiveness over multiple years. For sustained utilization, we must ensure that the tools are useful and accessible to diverse populations (low education/literacy, socioeconomic characteristics, etc.). This is accomplished in part by including an array of relevant stakeholders, including smallholder farmers.

Obj. 3a. Determine soil fertility constraints for improved bean production among selected farmers/sites

(lead researchers: M. Tenywa, O. Semalulu, R. Maria, M. Amame, R. Yost, A. Lenssen)

- 3a.1. Collect representative soil samples from selected farmers' fields
- 3a.2. Analyze physical and chemical characteristics of soil samples
- 3a.3. Initiate nutrient omission study
- 3a.4. Initiate lime requirement study (in Uganda)
- 3a.5. Complete characterization of representative soil samples
- 3a.6. Complete report on nutrient omission study

Milestones

Oct. 2013 – Mar. 2014

- Collect soil samples in Masaka
- Analyze soil samples from Masaka
- Conduct nutrient omission study in Uganda
- Conduct lime requirement study in Uganda

Apr. 2014 – Sept. 2014

- Analyze soil samples from Masaka
- Conduct nutrient omission study in Uganda
- Collect soil samples in Gurué
- Analyze soil samples from Gurué
- Initiate nutrient omission study in Gurué

Obj. 3b. Develop diagnostic aids (lead researchers: M. Tenywa, O. Semalulu, R. Maria, M. Amame, R. Yost, A. Lenssen)

- 3b.1. Compile current diagnostic criteria used by farmers

Milestones

Oct. 2013 - Mar. 2014

- Determine diagnostic criteria used by farmers in Masaka

Apr. 2014 – Sept. 2014

- Determine diagnostic criteria used by farmers in Gurué
- Synthesis developed of current state of farmer knowledge for soil fertility, agronomic practices, pests, diseases, and known limiting factors for bean production in Masaka and Gurué

Objective 4: Develop and Assess Effectiveness of Innovative Approaches for Dissemination of Information and Decision Support Aids, Training, and Follow-up Technical Support

Collaborators:

Institute for Agricultural Research of Mozambique (IIAM - Maputo, Mozambique)

Rosalina Chavana, Socio-Economic Studies Center, rosinhamahanzule@yahoo.com.br
Carlos Filimone, Training and Technology Transfer, cfilimone@gmail.com
Sostino Mocumbe, Documentation, Information and Communication, somocumbi@yahoo.com

Iowa State University (ISU - Ames, Iowa)

Eric Abbott, Greenlee School of Journalism, eabbott@iastate.edu
Ebby Luvaga, Economics, luvaga@iastate.edu
Robert Mazur, Sociology, rmazur@iastate.edu

Makerere University (MAK - Kampala, Uganda)

Moses Tenywa, Agricultural Production, tenywam@agric.mak.ac.ug
Paul Musaali, Geography, Geoinformatics and Climate Sciences, muspal@arts.mak.ac.ug

University of Illinois (UIUC - Urbana-Champaign, Illinois)

Julia Bella-Bravo, Strategic International Partnerships, juliabb@illinois.edu
Barry Pittendrigh, Entomology, pittendr@illinois.edu

Approaches and Methods

The project will engage the core groups of farmers, women and men, in developing and testing innovative communications approaches and technologies for learning and sharing information about new options for sustainable improvement in increased yields and soil fertility. Given limited extension system resources in Uganda and Mozambique, horizontal peer-to-peer learning (field days, exchange visits, local community based organizations) and network dissemination will be important initial methods. To benefit those with low literacy skills – especially women, communication approaches and technologies that may be used include: print materials, participatory radio campaigns in local languages, portable and multifunctional MP3 recorder radios that can record and replay broadcasts, text and audio SMS messaging, on-air call-outs to farmers and to experts, ‘smart’ phones, and visual decision aids - including farmer recorded videos and animated videos (Scientific Animations Without Borders).

Dissemination, training and support will target priority decision-making points for individuals and groups. Horizontal farmer to farmer learning has been found to be preferred by many communities. Optimum levels of training and follow-up support will be determined to identify efficient use of resources (extension personnel, material, financial); this will facilitate development projects being able to utilize our research results for scaling up and achieving widespread impact. Emphasis in each country will be placed on utilizing communication approaches/technologies that maximize available and sustainable resources.

Monitoring and evaluating the impacts of project activities will involve collecting and analyzing baseline data, periodic monitoring of indicators, and time-lag evaluation. Methods for documenting outcomes in terms of increased productivity will involve one-time and some repeated measures using mobile phone-based surveys and other locally effective methods.

Obj. 4a. Assess existing information dissemination systems concerning bean production and soil fertility (lead researchers: P. Musaali, C. Filimone, S. Mocumbe, E. Abbott, J. Bello-Bravo)

- 4a.1. Examine previous studies/projects on dissemination of information to farmers; build inventory of institutions, providers, and messages; examine past sustainability factors for disseminating information (also: M. Tenywa)
- 4a.2. Identify and interview current agricultural information providers (extension, research, NGOs, farmer associations, etc.)
- 4a.3. Identify channels used and potential additional channels to reach farmers with information; assess effectiveness, cost, and reach of each

4a.4. Review PRA and survey data to assess and rank types of information that influence farmer's decisions (also: R. Chavana)

4a.5. Map current information development and delivery systems

Milestones

Apr. 2013 – Sept. 2013

- Review literature on bean production information dissemination systems

Oct. 2013 - Mar. 2014

- Interview agricultural information providers
- Determine coverage and effectiveness of current information dissemination systems

Apr. 2014 – Sept. 2014

- Determine relative importance of information dissemination systems that influence farmers

Obj. 4b. Work with existing institutions and organizations to identify and develop messages that would provide farmers with critical information to make decisions about beans and soil fertility, and pathways that could provide information in an effective, efficient, and sustainable manner (lead researchers: P. Musaali, C. Filimone, S. Mocubme, E. Abbott, J. Bello-Bravo, B. Pittendrigh)

4b.1. Convene collaborative workshop with agricultural scientists, extensionists, staff from local projects, NGOs, and farmers (also M. Tenywa, O. Semalulu, R. Maria)

4b.2. Develop and field test prototype messages

4b.3. Develop feedback system to enable farmers and farm groups to communicate to providers their needs, problems, and priorities

Milestones

Apr. 2014 – Sept. 2014

- Conduct collaborative workshop
- Develop and test prototype messages
- Design farmer feedback system

Objective 5: Enhance Institutional Research Capacity Relative to Grain Legumes

Collaborators

Institute for Agricultural Research of Mozambique (IIAM - Maputo, Mozambique)

Manuel Amame, Agronomy and Natural Resources, mivamane@gmail.com

Ricardo Maria, Agronomy and Natural Resources, ricardo_dejesus@hotmail.com

Iowa State University (ISU - Ames, Iowa)

Eric Abbott, Greenlee School of Journalism, eabbott@iastate.edu

Andrew Lenssen, Agronomy, alenssen@iastate.edu

Ebby Luvaga, Economics, luvaga@iastate.edu

Robert Mazur, Sociology, rmazur@iastate.edu

Makerere University (MAK - Kampala, Uganda)

Moses Tenywa, Agricultural Production, tenywam@agric.mak.ac.ug

Paul Musaali, Geography, Geoinformatics and Climate Sciences, muspal@arts.mak.ac.ug

National Agricultural Research Laboratories Institute (NARL - Kampala, Uganda)

Onesimus Semalulu, Soils and Agro-meteorology, o.semalulu@gmail.com

University of Hawaii (UH - Manoa, Hawaii)

Russell Yost, Tropical Plant and Soil Sciences, rsyost@hawaii.edu

University of Illinois (UIUC - Urbana-Champaign, Illinois)

Julia Bella-Bravo, Strategic International Partnerships, juliabb@illinois.edu

Barry Pittendrigh, Entomology, pittendr@illinois.edu

Approaches and Methods

A key element in building institutional research capacity to increase effectiveness and sustainability of agricultural research institutions that serve the bean sector in Uganda and Mozambique is to provide graduate student training. Our project will be training three graduate students in academic program in U.S. institutions and in research activities in host countries. Specific research foci and affiliations follow:

- one M.S. student from Uganda will study Sustainable Agriculture at Iowa State University and conduct research on agronomic and livelihood aspects of smallholder farmer decision making
- one Ph.D. student from Mozambique will study soils/crops at the University of Hawaii and conduct research on management influences on soil C and N pools
- one M.S. student from Mozambique will study Communication at Iowa State University and conduct research on innovative socio-technical approaches for dissemination of information and decision support aids

One M.S. student studying Agronomy at Iowa State University will conduct M.S. thesis field research in Uganda as part of this project. The student receives stipend and tuition scholarship from ISU, not this project. The student's research will test the management strategies developed from Objectives 1, 2, and 3 in replicated, researcher-managed studies, complimenting the FAR.

Three graduate students will receive training at Makerere University in M.S. programs that contribute directly to project objectives:

- one student will study soils/crops and conduct research on limiting nutrients (omission of elements) and lime requirements
- one student will study geography at Makerere University and conduct research on socioeconomic factors influencing decision making in crop and soil fertility improvement
- one student will study soils/crops at Makerere University and conduct research on assessment of suitability of decision support aids for different soils

Each county will have one research technician who gains experience in multidisciplinary research activities and specific skills in preparing and analyzing soil and crop samples. Additionally, short-term training needed for project work will be identified once the project research activities are initiated. Training will be needed by B.S. level agricultural technicians in techniques and methods of acquiring, verifying, and recording social science information. Training will also be needed regarding concepts for characterization of highly weathered, possibly acid, infertile soils to identify, verify, and record observations, perceptions and data documenting these conditions during visits with growers and producers. Ability to recognize other constraints to productivity will be evaluated and specific training to document observations and measurements developed based on initial exploratory surveys.

Milestones

Apr. 2013 – Sept. 2013

- Two students initiate graduate studies

Oct. 2013 - Mar. 2014

- Three additional students initiate graduate studies programs

Apr. 2014 – Sept. 2014

- Five students continue graduate programs

III. Contribution of Project to USAID Feed the Future Performance Indicators:

(Performance Indicators / Targets Spreadsheet for FY 2013, 2014 and 2015 = attached)

IV. Outputs:

Project activities are expected to produce the following outputs:

- Characterization of smallholder bean farmers' agricultural motivations, current knowledge and practices, problem diagnoses, and livelihood and risk management strategies (by 2015)
- Models of farmer decision making strategies that reflect Influences of social, cultural, economic, institutional and contextual factors are developed and refined (by 2016)
- Innovative diagnostic aids using observable characteristics that enable farmers to make site-specific management decisions are developed and validated (by 2016)
- Process for identifying alternative strategies and management practices for improving cropping system productivity and soil fertility is developed (by 2017)
- Effective and efficient methods and media for information dissemination to intermediate and end users are developed and assessed (by 2017)
- Capacity building through applied research-based training is conducted (2013 onwards)
- Research results published in peer-reviewed literature and at the Legume Innovation Lab website hosted by the Management Office at Michigan State University (2015 onwards)

The project's *Impact Pathway Worksheet* provides details of outputs, uses, and steps to achieving our vision of success.

V. Engagement of USAID Field Mission(s)

In Mozambique, project PIs from U.S. and Ugandan universities and from IIAM met with the USAID Mission Director and Feed the Future staff on May 29th in Maputo. This provided a tremendous opportunity for sharing information about USAID programs in Mozambique and the Legume Innovation Lab program. In-depth discussion of our project and the expertise of research team members revealed several key points of significant interest for Mission staff. These included soil test kits, animated videos about management practices, and use of agricultural technologies. In Uganda, the project Lead PI has met regularly since 2004 with USAID Mission agricultural development staff, and will continue to do so during future travel there to communicate the focus and approach of project activities and explore bases for collaboration. Once the Project Technical Description is finalized and approved by the Technical Management Advisory Committee, it will be shared with key staff in the Mission in Kampala. After communication is established with Mission staff regarding details of the project, the PI and Co-PIs will seek to establish ties with Mission development partners. We will be pleased to respond when the Missions express interest in an Associate Award that would enable us to provide technical assistance and access to grain legume technologies.

VI. Partnering and Networking Activities:

The project team will learn about relevant existing and emerging conservation agriculture approaches and technologies from WOCAT's global network of scientists, and explore opportunities to collaborate and coordinate research efforts with CGIAR scientists through CRP 3.5, the AGRA Soil Health Program, IFDC, CABI, McKnight Foundation which has programs with an integrated multi-functional intensification emphasis, Africa RISING which focuses on maize-legume based systems in the Eastern Highland of Africa, and the Bill and Melinda Gates Foundation. Project researchers will continue to explore bases for

collaboration with two African based networks under PABRA (the Pan-African Bean Research Alliance): the Eastern and Central Africa Bean Research Network (ECABREN) and the Southern Africa Bean Research Network (SABRN). The project team, particularly collaborating research institutions in Uganda and Mozambique, will identify partnering and networking activities to ensure that appropriate public and private sector institutions can engage in follow-up adaptive research and field validation, in addition to technology transfer, in FTF countries and regions so that research outputs are disseminated on a wide scale for quantifiable developmental impact.

VII. Leveraging of Legume Innovation Lab Resources:

The project team will explore opportunities to collaborate and coordinate research efforts with CGIAR scientists through CRP 3.5, the AGRA Soil Health Program, IFDC, McKnight Foundation, Africa RISING, and the Bill and Melinda Gates Foundation. We will identify how such opportunities would complement and coordinate with planned activities described in this Workplan of the Legume Innovation Lab project.

VIII. Timeline for Achievement of Milestones of Technical Progress

(Milestones of Progress = attached)

Training/Capacity Building Workplan for FY 2013 - 2014

Degree Training

Trainee #1

First and Other Given Names: Naboth

Last Name: Bwambale

Citizenship: Uganda

Gender: Male

Training Institution: Iowa State University

Supervising Legume Innovation Lab PI: Robert Mazur

Degree Program for training: M.S.

Program Areas or Discipline: Graduate Program in Sustainable Agriculture

If enrolled at a US university, will Trainee be a 'Participant Trainee' as defined by USAID? Yes

Host Country Institution to Benefit from Training: Makerere University

Thesis Title/Research Area: agronomic and livelihood aspects of smallholder farmer decision making

Start Date: August 2013

Projected Completion Date: December 2015

Training status: (active, completed, pending, discontinued or delayed): Active

Type of USG Support (full, partial or indirect) for training activity: Full

Trainee #2

First and Other Given Names: *to be determined*

Last Name: *to be determined*

Citizenship: Uganda

Gender: *to be determined*

Training institution: Makerere University

Supervising Legume Innovation Lab PI: Moses Tenywa

Degree Program for training: M.S.

Program Areas or Discipline: Soil Science and Crop Production

If enrolled at a US university, will Trainee be a 'Participant Trainee' as defined by USAID?

Host Country Institution to Benefit from Training: Makerere University

Thesis Title/Research Area: limiting nutrients (omission of elements) and lime requirements

Start Date: August 2013

Projected Completion Date: August 2015

Training status: (active, completed, pending, discontinued or delayed): Pending

Type of USG Support (full, partial or indirect) for training activity: Partial

Trainee #3

First and Other Given Names: António José

Last Name: Rocha

Citizenship: Mozambique

Gender: Male

Training institution: University of Hawaii - Manoa

Supervising Legume Innovation Lab PI: Russell Yost

Degree Program for training: Ph.D.

Program Areas or Discipline: Agronomy and Tropical Soils

If enrolled at a US university, will Trainee be a 'Participant Trainee' as defined by USAID? Yes

Host Country Institution to Benefit from Training: Institute of Agricultural Research of Mozambique (IIAM)
Thesis Title/Research Area: management influences on soil C and N pools
Start Date: January 2014
Projected Completion Date: September 2017
Training status: (active, completed, pending, discontinued or delayed): Pending
Type of USG Support (full, partial or indirect) for training activity: Full

Trainee #4

First and Other Given Names: Sostino
Last Name: Mocumbe
Citizenship: Mozambique
Gender: Male
Training institution: Iowa State University
Supervising Legume Innovation Lab PI: Eric Abbott
Degree Program for training: M.S.
Program Areas or Discipline: Communications
If enrolled at a US university, will Trainee be a 'Participant Trainee' as defined by USAID? Yes
Host Country Institution to Benefit from Training: Institute of Agricultural Research of Mozambique (IIAM)
Thesis Title/Research Area: approaches for dissemination of information and decision support aids
Start Date: January 2014
Projected Completion Date: August 2016
Training status: (active, completed, pending, discontinued or delayed): Pending
Type of USG Support (full, partial or indirect): Full

Trainee #5

First and Other Given Names: Lance
Last Name: Goettsch
Citizenship: United States
Gender: Male
Training institution: Iowa State University
Supervising Legume Innovation Lab PI: Andrew Lenssen
Degree Program for training: M.S.
Program Areas or Discipline: Agronomy
Host Country Institution to Benefit from Training: Makerere University
If enrolled at a US university, will Trainee be a 'Participant Trainee' as defined by USAID? No
Thesis Title/Research Area: management strategies to enhance bean productivity and soil fertility
Start Date: August 2014
Projected Completion Date: December 2016
Training status: (active, completed, pending, discontinued or delayed): Active
Type of USG Support (full, partial or indirect): Partial

Trainee #6

First and Other Given Names: *to be determined*
Last Name: *to be determined*
Citizenship: Uganda
Gender: *to be determined*
University to provide training: Makerere University
Supervising Legume Innovation Lab PI: Paul Musaali

Degree Program for training: M.S.
Program Areas or Discipline: Geography
If enrolled at a US university, will Trainee be a 'Participant Trainee' as defined by USAID?
Host Country Institution to Benefit from Training: Makerere University
Thesis Title/Research Area: factors influencing decision making in crop and soil fertility improvement
Start Date: January 2014
Projected Completion Date: August 2016
Training status: (active, completed, pending, discontinued or delayed): Pending
Type of USG Support (full, partial or indirect): Partial

Trainee #7

First and Other Given Names: *to be determined*
Last Name: *to be determined*
Citizenship: Uganda
Gender: *to be determined*
Training institution: Makerere University
Supervising Legume Innovation Lab PI: Moses Tenywa and Onesimus Semalulu
Degree Program for training: M.S.
Program Areas or Discipline: Soil Science and Crop Production
If enrolled at a US university, will Trainee be a 'Participant Trainee' as defined by USAID?
Host Country Institution to Benefit from Training: National Agricultural Research Laboratories Institute
Thesis Title/Research Area: assessment of suitability of decision support aids for different soils
Start Date: January 2015
Projected Completion Date: August 2017
Training status: (active, completed, pending, discontinued or delayed): Pending
Type of USG Support (full, partial or indirect): Partial

Equipment (costing >\$5,000):

Specific Type of Equipment to be purchased: 4-wheel drive vehicle
Justification for equipment to achieve Workplan objectives: logistics for fieldwork in Gurué, Zambézia province, throughout the year, especially during the growing season (4-month period of intense rains)
Institution to benefit from equipment: Institute of Agriculture Research of Mozambique
Institution to purchase equipment: Institute of Agriculture Research of Mozambique
Amount budgeted for equipment item: \$45,000