Impact Assessment of Dry Grain Pulses CRSP Investments in Research, Institutional Capacity Building and Technology Dissemination for Improved Program Effectiveness (SO4.1)

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I. Abstract of Research and Capacity Strengthening Achievements

In FY 13–14, this project worked towards completing or initiating several activities under the three objectives: 1) provide technical leadership in the design, collection and analysis of data for strategic input and impact evaluation; 2) conduct ex ante and ex post impact assessment; and 3) build research capacity in the area of impact assessment. The project has worked with other Legume Lab projects to plan and initiate a baseline survey in Guatemala to better understand the current status of the climbing bean/maize intercropping production system, and in Benin to assess the market potential for biopesticides. In FY13–14, the project completed an assessment study in Central America examining the factors contributing to the success and sustainability of seed systems for grain legumes in different socioeconomic and agricultural systems contexts and initiated the planning of implementing a study on willingness to pay for different types of seeds with a focus on northern Tanzania. Results of the analysis of the randomized field experiment conducted in Burkina Faso to assess the effectiveness of animated videos shown on the cell phone to train farmers on two postharvest cowpea storage technologies are presented. Towards the capacity building goal, two short-term training courses on the theory and methodology of doing impact evaluation were conducted in collaboration with CIAT and other national partners in the LAC region.

II. Project Problem Statement and Justification

Impact assessment is essential for evaluating publicly-funded research programs and planning future research. Organizations that implement these programs should be accountable for showing results, demonstrating impacts, and assessing the cost-effectiveness of their implementation strategies. It is therefore essential to document outputs, outcomes and impacts of public investments in research for development (R4D) activities. Anecdotal data and qualitative information are important in communicating impact to policy makers and the public, but must be augmented with empirical data, and sound and rigorous analysis.

Building on the momentum and experience gained over the last three years, the proposed research will contribute towards evidence-based rigorous ex ante and ex post assessments of outputs, outcomes and impacts with the goal of assisting the Legume Innovation Lab program and its Management Office (MO) to achieve two important goals—accountability and learning. Greater accountability (and strategic validation) is a prerequisite for continued financial support from USAID and better learning is crucial for improving the effectiveness of development projects and ensuring that the lessons from experience—both positive and negative—are heeded. Integrating this culture of impact assessment in publicly funded programs such as the Legume Innovation Lab will ultimately help increase the overall impact of such investments.

III. Technical Research Progress

Objective 1. Provide technical leadership in the design, collection and analysis of data for strategic input and impact evaluation

During this past fiscal year, as part of this project, the PIs worked with other research project PIs to assess the feasibility of integrating data collection and impact evaluation strategies as part of their Legume Innovation Lab project design. For many projects, the project team either participated in the planning meetings and /or had follow-up discussions while the teams were finalizing their workplans, to identify opportunities for collecting baseline data and integrating impact evaluation research as part of the project design.

After consulting with the PIs of each of the funded projects, several opportunities were identified for baseline assessments and/or impact studies and these are grouped into three types—activities for which there is agreement and resources to do the study, activities for which there is a need to explore resources, and activities which are not ready for impact assessment. The outcome of this consultation and review of each project was summarized in the workplan. As part of the FY 14 workplan, this project has collaborated on the following baseline data collection efforts:

1. Socioeconomic baseline study on the constraints and opportunities for research to contribute to increased productivity of climbing beans in Guatemala: This is a joint activity with the SO1.A1 project team under their objective "*Genetic improvement of climbing black beans for the highlands of Central America*." This study is led by ICTA and is designed to establish a baseline about production of climbing beans in the highlands of Guatemala, and to better understand the current status of the climbing bean/maize intercropping production system. The plan is to collect information and data concerning cultivated area, number of different species grown, number of farmers utilizing this cropping system, production problems, seed quality and culinary preferences to help establish priorities for the climbing bean breeding program.

   Status of this activity as of the end of FY 14: Currently, the survey instrument is being developed (a draft version is under revision) in collaboration with SO1.A1 and the local partner in Guatemala, ICTA. This questionnaire will contain seven sections to collect:

   a. general information about the interviewee

b. general information about the farm
c. general information about the bean plots planted in the season of interest
d. general information about bean production
e. bean sales and postharvest management
f. socioeconomic characteristics of household members
g. importance of the bean crop and bean consumption in the household

Additionally, ICTA is assembling data on bean production in the five selected Departments (Chimaltenango, Huehuetenango, Quetzaltenango, Quiche, and San Marcos) and the list of municipalities and villages in them, to use during the sampling of villages. The survey instrument will be finalized in November 2014. The sampling will be done before the training of enumerators, which is planned for January 2015. Soon after the training of enumerators, data collection will begin. Data tabulation and cleaning will be done by ICTA, in collaboration with Legume Lab's SO4.1 project. It is expected that data would be clean and ready for analysis by the end of April.

2. Study on the market potential for biopesticides in Benin: This is a collaborative activity with the SO1-B1 project team, specifically with Dr. Leonard Hinnou from INRAB–Benin, under their objective 3 "*Scaling of solutions.*" This study is designed to assess the potential groups that can develop, market and sell biopesticides, and serve as the logical "pass-off" groups in host countries for scaling up these technologies. This study will serve as a baseline to assess the market potential for biopesticides (e.g., what farmers are willing to pay, what will be the costs to enter the market place for small industries, what are skill sets that need to be developed for women's groups to potentially make and profit from selling such materials, etc.) and will determine the networks of NGOs and other organizations where the project can "pass-off" educational approaches (e.g., animations) for scaling. A draft of one of the instruments that will be used for data collection was developed in French by INRAB–Benin partners and revised by SO4.1 collaborators. However, given the language limitations, only general suggestions were provided by this team. The survey was implemented in late summer 2014.

3. Other activities implemented under this objective in FY13 and FY14 include:

   a. Providing technical support to SO2.1 project: This project worked with the SO2.1 project team to provide input and technical support in the baseline survey and data collection efforts implemented by that project in the host countries in FY 14. This input was given in the form of discussions with the project PI during the survey planning stage and the review of survey instruments designed to collect the baseline data in the project pilot sites.
   b. In collaboration with the SO1.B1 project PIs, we finalized the report of the biocontrol agent baseline assessment study conducted in Burkina Faso in 2012 and was designed to collect information about the 2011 production season. This report was published as an MSU Staff paper in December 2013. Given the importance of cowpea (*Vigna unguiculata*) as a staple in Burkina Faso and many other countries in West Africa, and

being the legume pod borer (*Maruca vitrata*) one of the major cowpea pests affecting the crop, the Legume Lab project led by the University of Illinois is developing alternative strategies to control these insect pests and reduce the levels of pesticide used on the crop, including implementing a comprehensive biocontrol program. This study was designed to collect baseline data (and eventually end line data in year four of this extension phase) to be able to evaluate the long-term impacts of biocontrol research.

The sampling areas in this baseline survey were designated by first selecting target geographic provinces, then randomly selecting villages within these provinces according to their geographic location and then systematically randomly selecting households within each village. The sample design covered a total of 560 households distributed across 56 villages, 10 provinces, and two ecological zones called *bio-areas*. The results were disaggregated by province and bio-area to be able to assess the impact in areas where the beneficial insects will be released (i.e. south bio-area) versus in areas where they will not be released (i.e. north bio-area). Main results of the baseline survey are summarized below:

- Insects were the main biotic stress affecting the crop and drought was the main abiotic stress reported by farmers.
- More than one-half of farmers reported that the incidence of insect pests in 2011 was worse when compared with the two previous years.
- Insect incidence (especially of legume pod borer) was more problematic in the north bio-area. The use of chemical insecticides in 2011 on the cowpea crop was common, especially in the north bio-area, perhaps as a result of the higher incidence of pests in this bio-area.
- Farmers who applied insecticides to the cowpea crop mostly used three insecticides and very few farmers (less than one-third) reported that the trend on the quantity applied has decreased over time. It is expected that the number of farmers reporting using less insecticides will increase after the project intervention.
- Contrary to prior expectations from researchers regarding the quality of insecticides, farmers reported that they were satisfied with the effectiveness of the insecticides they used.
- The findings about pesticides management (i.e., proper storage, correctly identifying pesticides labels, sickness due to pesticide poisoning) suggest that farmers in the south bio-area may be better informed on how to manage and use pesticides than farmers in the north bio-area.
- Cowpea grain yields (adjusted for intercropping) from farm data averaged 317 kg/ha. While observed yields were much higher than yields observed in three regions of Senegal (average 241 kg/ha), these were lower than country-level yields estimated from FAOSTAT (470 kg/ha) and much lower than the yields reported in the village-level questionnaire (667 kg/ha).
- Both the total grain harvested and the value of harvest were statistically significantly higher in the south bio-area (337 kg with a market value of CFA 97,710 or U.S. $211 vs.

148 kg of grain with a market value of CFA 43,001 or U.S.$93). Harvesting fodder was a common practice.

- The importance of the cowpea crop as a source of income and food security was confirmed since across all households, cowpea grain sales as a source of income, share of annual grain consumption satisfied by own production, and length of time that food grain reserves of cowpea last after harvest were all important factors, especially among farmers living in the south-bio area.

Objective 2. Conduct ex ante and ex post impact assessments

Under this objective, following research studies and activities were accomplished in FY 2013–14.

2a. The economics of supply and demand for the sustainable development of legume grain seed system

The impact of research investment in crop improvement research is dependent upon the availability (supply) and affordability (demand) of seeds of improved varieties. Assessment of factors that contribute to the success and sustainability of seed systems for grain legumes in different socioeconomic and agricultural systems contexts is therefore an important area of research to enhance the impact of past research by the CRSP and future investments by the Legume Innovation Lab. This project conducted following field research to address the following research question.

What factors contribute to the sustainability of seed systems?

The seed dissemination project implemented in four countries in Central America under the Bean Technology Dissemination (BTD) project offers a good opportunity to do an in-depth analysis of the unique features of different models for seed multiplication and distribution so as to identify principles of sustainability present/absent from these different models and derive implications and lessons for broader applicability to other countries where Innovation Lab research programs are active. A research study focused on identifying "elements of sustainability of the bean seed system" was jointly planned with the Monitoring and Evaluation (M&E) component of the BTD project (which was led by M. Maredia), and included the following components: a) Three surveys in Nicaragua (completed in 2012): i) A survey of 153 Community Seed Banks (CSB), ii) a survey of 480 Nicaraguan farmers who received bean seed in 2011, and iii) the cost of production record keeping by158 CSBs during the 2011–12 bean seed growing season; b) Assessments in Honduras and Guatemala to evaluate the effectiveness of different models of bean seed dissemination used in the two countries and assess the constraints, challenges, and factors contributing to the success (or failure) of different models, and to evaluate the benefits of improved seed distributed by the BTD project from the perspective of the Beneficiaries.

Field work to address the objectives of the assessment studies in Honduras and Guatemala involved:

1. Conducting interviews (using semistructured questionnaires) with representatives of organizations/entities along the seed value chain and collecting data/information that would help us assess the constraints, challenges, and factors contributing to the success

(or failure) of different seed distributions systems. These interviews were conducted in July–August 2013 by Dr. Byron Reyes, Assistant Professor and David DeYoung, a graduate student in AFRE, MSU; both with the necessary language skills and extensive experience working in this region.

2. Conducting surveys of beneficiaries of the seed distribution efforts. The sample of farmers surveyed (about 500 in each country) was selected using a two-stage cluster sampling method. The survey focused on farmers' perception of the efficiency and effectiveness of the methods used to distribute the seeds, the quality of seed received through the BTD project, and the economic gains experienced from planting improved variety seeds. The field work was carried out in summer 2013 (July–August) through NITLAPAN of the *Universidad Centroamericana* (UCA). David DeYoung from Michigan State University participated in enumerator training and provided supervisory role during the field work, along with the staff of NITLAPAN. Data entry and cleaning were done by NITLAPAN and survey data files were submitted to Michigan State University for analysis and reporting in 2013. Using these datasets, two reports were generated:
    a. Effectiveness of the bean seed dissemination models implemented under the Bean Technology Dissemination (BTD) Project: *Results of key informant interviews in Guatemala, Honduras and Nicaragua* and
    b. Farmer perspective on the use of and demand for seeds of improved bean varieties: Results of beneficiary surveys in Guatemala, Honduras and Nicaragua. These reports were recently reviewed by the BTD project managers and will be published as MSU Staff Papers before December 2014.

Main Results of this Study

The models used for bean seed disseminations, which varied across the three countries, were analyzed based on the following principles of sustainability.

- Cost-**recovery**: can the system recover the cost of producing, multiplying and distributing seeds?
- Quality: can the system supply quality seeds to farmers?
- Quantity: can the system supply enough quantity of quality seeds to meet the needs?
- Diversity: can the system supply adequate quantity and quality of diverse varieties of seeds to meet the needs?
- Service/accessibility: can the system deliver these seeds in a timely manner in locations that are accessible to farmers?
- Price: can the system supply these seeds at an affordable price?

The experience and evidence from the three countries suggest:

- Organized farmers can produce high quality seed in desired quantities. Between 46 percent (GUA)-65 percent (NIC) of beneficiary HH reported the quality was superior to other seeds planted in that season. All key informants indicated that farmers were satisfied with the quality of the seed they received and that good quality of the seed was a

strength of the project. Overall the system developed to achieve the goals of the BTD project was able to supply quality seeds, but there is room for improvement.

- The demand for seed was more than what the project was able to satisfy. Fourteen percent of farmers in Honduras, 23 percent in Guatemala and 44 percent in Nicaragua wanted more seed from the project. According to the key informants interviewed in Honduras, the country has limited capacity to respond to this type of initiatives or that higher volumes would require improved facilities. Limited resources available for distributing seed was mentioned as a weakness and a constraint by key informants in all three countries.
- Community based seed system may not have adequate capacity to meet the seed needs of the community in terms of diversity of varieties demanded. For example, this was identified as a disadvantage of CSBs by 28 percent of respondents in Nicaragua and 19 percent of farmers in Honduras.
- There exists willingness to pay for seed with a premium over the grain price. However, in some communities meeting the seed needs based on 100 percent cost-recovery principle may not be possible. Scaling up efforts must be based on a two-pronged approach of subsidies and cost recovery. Model based on seed production closer to the end users may have better chance of recovering the cost of seed production in the form of in-kind payment.
- Flexibility in payment method and proximity/presence of seed production/distribution closer to the community are identified as the strength of the models used. Future seed system development efforts should integrate these features.
- Despite favorable quality rating, the average yield and seed to grain ratio reported by farmers were not very impressive. Thus, integrating seed distribution efforts with technical support (or vice versa) may be a better strategy to realize the full potential of the quality seeds in farmers' fields.

Potential work beyond C. America

Assessment of factors important for the sustainability of bean seed systems is a high priority area also for PABRA. Our interactions with the PABRA Theme Leader (J. C. Rubyogo) and CIAT socioeconomist (E. Katungi) indicates some ongoing research by PABRA/CIAT in Uganda, Ethiopia and Tanzania to understand the complexity of legume seed availability and accessibility, and their keen interest to collaborate with us in expanding the research to other grain legumes (i.e., cowpea) and other countries. In FY 13–14, we explored collaborative research opportunities with the PABRA/CIAT researchers focused on following research topics:

- Role of grain market **in** sustaining seed demand
- Limitations and potential of private seed sector and farm based seed production in bean seed production and marketing
- Viability of quality declared seed (QDS)
- Strategies to reduce the cost of production and distribution of quality declared seeds or certified seeds

- Willingness of smallholder farmers to pay for quality seed over grain?

The scope of activities addressing these research questions in FY 14 and beyond was contingent upon availability of resources. As a priority, and based on available resources and interest from potential collaborators, we made a decision to implement research study in one country (Tanzania) addressing the question of willingness to pay for quality seed over grain. The methodology/ approach to address this research question consists of first conducting field experiments (FE) in farmers' fields to demonstrate the value of planting seed vs. grain of the same variety (to keep the genetic component of the planting material constant) and then conducting biding experimental auctions (BEA) to test farmers' willingness to pay for seed vs. grain. These experiments will include treatments related to the type of materials used for planting: grain (saved from previous harvest or purchased from farmers), quality-declared seed, and certified seed (one and two). The experiments could be designed to understand the following elements of seed demand—quantity of seed, frequency of seed purchase, and willingness to pay for seed for a given quantity and frequency. The major field costs of doing this study will include conducting the field experiments in different sites (to represent different agroecological and socioeconomic conditions) and going to the field to conduct follow up visits and the BEA experiments.

To date, we have identified collaborators from the Sokoine University of Agriculture (SUA) and CIAT–Tanzania for this study about willingness to pay for seed, to be conducted in northern Tanzania. Two MSU faculty members (Byron Reyes and Robert Shupp) traveled to Arusha, Northern Tanzania, early in October to plan the study and meet with potential seed suppliers and collaborators. During this visit, the districts where this study will be implemented were identified and the draft study design was discussed. Currently, SUA and CIAT collaborators are collecting information about the price of several grades of seeds (i.e., certified, quality declared) and preparing a budget for this study. MSU faculty is preparing a final draft of the study design (draft available upon request from the authors). The planned activities for the coming months include purchasing all grades of seed that will be needed for the study, sampling of hamlets and farmers to be included in the study, implementation of field experiments (March 2015) and biding experimental auctions (July 2015), and preparing survey instruments for baseline and follow up data collection (both to be done in June–July 2015).

2b. Systematic analysis of existing datasets to assess the role of grain legumes in smallholder farming systems:

In FY13–14, as part of objective 2, we initiated the exploration of available secondary data (i.e., the Living Standards and Measurement Survey/Integrated Agricultural Surveys—LSMS/ISA) to develop profiles of potential clients and beneficiaries of grain legume research, and to understand the constraints and potential impact of the adoption of new technologies by grain legume growers. With the assistance of a graduate student supported through a Departmental fellowship, datasets based on the most recently available nationally representative LSMS–ISA surveys were put together for the following six countries: Niger, Nigeria, Ethiopia, Tanzania, Uganda and Malawi. These dataset include area, production and farming practices data for major grain legume crops across more than 25,000 plots and more than 20,000 households. The plan over the next fiscal

year is to continue explore these datasets and to apply descriptive and statistical/econometric analysis techniques to generate information that can help us understand:

- The role of grain pulses in farmers' livelihood and food security strategies
- Factors influencing the adoption of productivity enhancing technologies in grain legumes by resource poor farmers

Results of this study will be made available in the form of a report as well an Impact Brief and will highlight major results of this cross-country study and include implications of the findings on what might the Legume Innovation Lab be doing to increase adoption and impact of its research investments.

2c. Field Experiment on the Dissemination of Postharvest Technologies in Burkina Faso

This is a joint activity with the UIUC and INERA research team (under the former CRSP IPM-omics research project). The field activities for this study were concluded in January 2013 and data were submitted to MSU in late Spring 2013. Data analysis and report writing occurred as part of FY 13–14 workplan. The description of this study and the results are reported here.

Problem statement and study objectives

Cowpea bruchids (*Callosobruchus maculatus*) can cause damage to cowpea (*Vigna unguiculata*) seeds in storage, resulting in postharvest losses. To address these problems researchers have tested and come up with several nonchemical, low-cost and simple approaches such as (i) exposing the grain to the solar heat to kill the insects and eggs, and (ii) triple bagging the grain in plastic sacks, among other solutions. These techniques have been developed and well-recognized among the scientific community for a long time. Recently, as part of the "Scientific Animations without Borders^{SM}" (SAWBO) project, researchers at the University of Illinois at Urbana Champaign (UIUC) and its partners have developed animated videos on these two technologies to increase accessibility of this knowledge to low-literate farmers around the world. These educational videos can be delivered at a low cost through the Internet and easily shared with a large number of end users through digital media such as cell phones and DVDs. This approach thus has the potential to bridge the gap that exists between research and impact by using the information and communication technology and a community's own social networks as channels to transfer scientific knowledge at a low cost to a large number of farmers.

The success of this approach, however, depends on two critical ingredients:

1. the effectiveness of animated educational materials in inducing learning among low-literate farmers; and
2. the development of innovative (i.e., cost-effective) strategies to deploy these educational materials to a large number of farmers.

This study uses a randomized control trial (RCT) field experiment conducted in Burkina Faso in 2012–13 to primarily address the first issue. However, one of the indicators of learning (and thus the success of the knowledge delivery method) is the use/adoption of the technology/practice being conveyed through a delivery mechanism, and often the constraint to the adoption of a

technology is that it is either not available or economically inaccessible to farmers in rural areas. Thus, a second research question addressed by the field experiment is whether the technology adoption outcome (after learning takes place) is a function of the availability/accessibility of inputs to farmers or the nature of technology itself.

Methodology and Data

As part of the UIUC led CRSP project, the Agricultural and Environmental Research Institute (INERA) had planned to pilot test the deployment of the two videos on postharvest technologies in selected villages in Burkina Faso using the government extension system. This opportunity was used to design the pilot initiative as a field experiment based on the principle of randomization in the assignment of the treatments. The experiment consisted of two treatments (labeled 1 and 2) to address research question 1 (i.e., effectiveness of animated videos in inducing learning), and two treatments (labeled A and B) to address research question two (i.e., does learning induce adoption, if input availability is not a constraint). For research question two, the focus was only on the triple bagging technology. In treatment 1, extension agents used the animated videos to deliver the information on the two postharvest technologies. In contrast, in treatment two, they used the traditional extension method (i.e. live demonstration) to deliver the same information. In treatment A, extension agents left in the village (i.e. made available) a number of sets of plastic bags that farmers could buy and use for triple bagging. In contrast, in treatment B they did not leave plastic bags in the village; instead, they only provided to the participants information on where to buy these plastic bags.

The combination of these two sets of treatments resulted in four groups of treatment villages labeled 1A, 1B, 2A and 2B. Twelve villages across two provinces were randomly assigned to each of these four treatment groups (using randomized cluster experiment design). The experiment was divided into two phases. In the first phase, extension agents implemented the treatments after the cowpea crop was harvested (November 2012). Within each village, farmers were invited to attend a training session where the two postharvest technologies were disseminated as per the treatment group a village was randomly assigned. Prior to the session, 20 attendees were randomly selected to collect baseline data on their prior knowledge about the storage techniques and exposure to the two technologies. In the second phase, a follow-up impact evaluation survey was conducted six to eight weeks after the training for a subset of 12 farmers per village (total sample size = 576 farmers). These farmers were randomly selected from the list of 20 farmers who attended the training session and had completed the pretreatment knowledge module.

Preliminary Results

The pre- and posttreatment data were used to estimate the treatment effect related to adoption of postharvest technologies promoted in the pilot project. Table 1 provides the mean outcomes of the two treatments and comparison of these groups. Just comparing the mean outcome, indicate that the extension method was significantly more effective in inducing adoption of the two postharvest technologies. However, after taking into account the confounding factors that can potentially influence the adoption of these technologies by farmers (e.g., their age, education, gender, distance to market, roads and extension office, area and production of cowpea, price of cowpea grain, amount of cowpea grain available to store, whether they own a cell phone with video capability, prior training on postharvest technologies, prior awareness of these methods, etc.), and the effectiveness of the training they received (e.g., which trainer provided the training, number of participants in the training program, time spent by the trainer per trainee, etc.), the difference between the advantage of the traditional extension method was diminished at least for the triple bag technology (Table 2). However, in the case of solar technology, the traditional method was effective in inducing 22–27 percent more adoption than the video-based method (Table 2).

The overall mixed results do indicate potential role of cell phone based videos in promoting agricultural technologies. The high level of understanding and comprehension reported by the farmers who saw the videos, and the low cost of using this method indicate that integrating this method of transferring scientific information to farmers through cell phones with the traditional extension method can be a cost-effective method of scaling out new technologies based on farmers' own knowledge sharing networks.

IV. Major Achievements

We would like to highlight the following emerging messages from the seed assessment study in Central America and the effectiveness of different extension models to disseminate science based technologies in Burkina Faso as technical advances resulting from project activities in FY 13–14.

Main messages from the seed system assessments that have important implications for the Legume Innovation Lab research and dissemination strategy are:

1. Flexibility in payment method and proximity/presence of seed production/distribution closer to the community are identified as features of sustainable seed systems. Future seed system development efforts should integrate these features.
2. Despite favorable quality rating, the average yield and seed to grain ratio reported by farmers were not very impressive…Integrating seed distribution efforts with technical support (or vice versa) may be a better strategy to realize the full potential of the quality seeds in farmers' fields
3. There is willingness to pay for quality seed with a premium over the grain price; but the amount farmers are willing to pay is highly correlated (not a surprise) with the economic status of bean farmers. Thus meeting the seed needs of the farmers across the spectrum

based on 100 percent cost-recovery principle and private sector led model will not be a viable option for legume crops in many developing countries

4. Scaling up efforts must be based on a two- (or multi) pronged approach of subsidies and cost recovery (where possible)
5. Models based on seed production closer to the end users (i.e., community-based systems) may have better chance of recovering the cost of QDS production in the form of in-kind payment

Main messages emerging from the effectiveness study in Burkina Faso on using animated videos for disseminating postharvest technologies

1. This study has shown that the effectiveness of using the ICT (video and cellphone) based method in inducing adoption may be context specific and depend on the type of technology being promoted and prior exposure of the technology by the farmers. For a technology that was already adopted by many farmers and for which farmers had received prior training from other projects, simply using the video-based method can be as effective as the traditional method in inducing re-adoption or first time adoption of that technology as was evident in the case of triple bag technology adoption outcomes. However, for a less popular technology or a technology for which farmers had relatively less experience/exposure, the traditional method of live demonstration was more effective in inducing behavior change (i.e., adoption) among farmers. This was evident from the significantly more (though still a low absolute number of farmers) adoption of the solar method by farmers trained using the traditional extension method versus those trained using the video on cell phone method.
2. The high level of understanding and comprehension reported by the farmers who saw the videos, and the low cost of using this method indicate that integrating this method of transferring scientific information to farmers through animated videos (on cell phones or other medium) with the traditional extension method can be a cost-effective method of scaling out new technologies by using farmers' own knowledge sharing networks. The question remains on finding cost effective business models of incorporating the information and communication technology methods for delivering knowledge and information to a large number of farmers (i.e., scaling up)

V. Research Capacity Strengthening

Unlike other Legume Innovation Lab projects, this project does not have a country-specific collaborating HC institution. We serve as the crosscutting project that works towards building the institutional capacity and human resources in the area of impact assessment across all the projects of the Legume Innovation Lab. In FY 13–14, following activities were implemented towards this broader goal of capacity strengthening in the area of monitoring and impact evaluation:

1. Presentations and interactions with other Legume Innovation Lab research project teams: As part of the advisory role to the Management Office, the project team and project collaborator, Dr. Byron Reyes, helped develop the tools for impact pathway analysis and

the performance monitoring indicators guideline. We also conducted educational sessions at project planning meetings during summer 2013 to build capacity across the Legume Innovation Lab in developing and using impact pathways, understanding the concepts related to theories of change, and in systematically collecting credible data for reporting on FTF performance indicators. The discussion and exchange of information/ideas during this process has helped increase awareness among the Legume Lab researchers on the importance of doing research with the goal of achieving developmental outcomes. We believe this has helped contribute to enhancing the impact culture within the host country partner organizations.

2. All the research activities conducted under objectives one and two described above involve host country PIs/collaborators in the planning and conduct of field data collection. Through this collaboration we have been able to expose HC researchers to the methodologies of data collection in a scientific and rigorous manner, design of instruments, sampling methods, data entry and data analysis.
3. Conducted two short courses on impact assessment in the LAC region. Having worked in developing countries for several years, one of the challenges we have faced is the absence of trained personnel to conduct impact assessment of Legume Lab projects and agricultural projects in general. Faculty at national universities and research centers often lack the theoretical and practical experience to conduct sound and rigorous social science research and impact assessment. This motivated the planning and implementation of these training courses, in collaboration with CIAT researchers, to help build local capacity in research centers and universities in the LAC region.

The two short-term training courses were implemented in FY 14 with a focus on novel methods to assess impact of agricultural projects. Originally the plan was to conduct this training activity during the PCCMCA meeting. But this plan was modified and instead conducted at CIAT and Zamorano because the allowable time at the PCCMCA meeting was not adequate (too short) to deliver the content of this training program. This course focused on teaching theoretical concepts and demonstrating practical applications of these concepts, including the use of statistical software. Researchers and economists from national research centers and universities (e.g. DICTA, FHIA, INTA, INIAP, Zamorano, CURLA, UNA, UNAN) were invited to attend. This course was be led by Legume Innovation Lab Collaborator fluent in the local language and economists from CIAT. The duration of the course varied between four and four-and-a-half days. This was a joint activity in collaboration with local partners. Additional details are provided in Section VI.

Supplemental funds from the Legume Innovation Lab's Strengthening Host Country Institutional Capacity grants were used to partially cover the cost of the workshop in Honduras. CIAT contributed funding for the workshop organized in Colombia and local NARS and other partners covered the cost of supporting the participants.

VI. Human Resource and Institution Capacity Development

Short-Term Training

Short-Term Training 1

1. **Purpose/description of training activity:** Conduct educational sessions at project planning meetings on constructing impact pathways and collecting/reporting performance indicators data
2. **Type of training:** Introduction to the concepts, tools and methods related to impact pathways and FTF performance indicators
3. **Country benefiting:** All Legume Lab program host countries
4. **Location and dates of training:** Various (Puerto Rico, Quito, Lusaka, Maputo, Accra, Dakar); May–June 2013
5. **Participants/Beneficiaries of Training Activity**: U.S. and HC PIs of the Legume Innovation Lab program
6. **Numbers receiving training (by gender):** 60 (45 male, 15 female)
7. **Institution providing training or mechanism (and PI/Collaborator responsible for this training activity):** M. Maredia and B. Reyes, Michigan State University

Short-Term Training 2

1. **Purpose/description of training activity:** Introduction to novel methods to assess impact of agricultural projects and practical applications (training course 1)
2. **Type of training:** Conducted a 4 day intensive training on current theory to assess impact and practical applications of this theory. The training also included basic use of statistical software (i.e. STATA) for data manipulation and analysis.
3. **Country benefiting:** Guatemala and countries from South America
4. **Location and dates of training:** Colombia (CIAT), April 2014
5. **Participants/Beneficiaries of Training Activity:** Economists and researchers from National Research Centers, Universities and International Research Centers.
6. **Numbers of Beneficiaries:** Colombia: 22 (7 female)
7. **Institution providing training or mechanism (and PI/Collaborator responsible for this training activity):** B. Reyes, Michigan State University and CIAT economists

Short-Term Training 3

1. **Purpose/description of training activity:** Introduction to novel methods to assess impact of agricultural projects and practical applications (training course 2)
2. **Type of training:** Conducted a 4.5 day intensive training on current theory to assess impact and practical applications of this theory. The training also included basic use of statistical software (i.e. STATA) for data manipulation and analysis.
3. **Country benefiting:** All host counties in Central America region
4. **Location and dates of training:** Honduras (Zamorano), September 2014.

5. **Participants/Beneficiaries of Training Activity:** Economists and researchers from National Research Centers, Universities and International Research Centers. The beneficiaries also included staff from collaborating Legume Lab projects from Honduras and Guatemala
6. **Numbers of Beneficiaries:** Honduras: 16 (3 female).
7. **Institution providing training or mechanism (and PI/Collaborator responsible for this training activity):** B. Reyes, Michigan State University and CIAT economists

Degree Training

Trainee

1. **First and Other Given Names:** David
2. **Last Name:** DeYoung
3. **Citizenship:** USA
4. **Gender:** Male
5. **Training Institution:** Michigan State University
6. **Supervising Legume Innovation Lab PI:** Mywish Maredia
7. **Degree Program for Training:** M.S.
8. **Program Areas or Discipline:** Agricultural Economics
9. **If Enrolled at a U.S. University, will Trainee Be a Participant Trainee as Defined by USAID?** No
10. **Host Country Institution to Benefit from Training:** None
11. **Thesis Title/Research Area:** Assessment of Technical Inefficiencies of the Community Seed Banks Using Stochastic Frontier Analysis
12. **Start Date:** Fall 2011
13. **Projected Completion Date:** Spring 2015
14. **Training Status (Active, Completed, Pending, Discontinued, or Delayed):** Delayed
15. **Type of CRSP Support (Full, Partial or Indirect) for Training Activity:** Partial

VII. Achievement of Gender Equity Goals

This project is designed to assess how the technologies and knowledge generated by the Legume Innovation Lab (and its predecessor CRSP) benefit both men and women farmers, entrepreneurs and consumers. Thus, where applicable, gender equity is used as one of the metrics in evaluating the impact of Legume Innovation Lab research. Survey instruments are designed to collect gender disaggregated data on beneficiaries. Where applicable, results of analyses based on primary data are reported by gender to assess the impact on women farmers and other potential beneficiaries of legume research.

VIII. Explanation for Changes

The following outputs targeted to be achieved by the end of FY 2014 have been delayed:

1. One M.S. thesis paper: David DeYoung, a master's student in AFRE department at MSU was Partially supported by the Legume Innovation Lab project with the plan of completing his thesis paper based on the data collected on community seed bank model in Nicaragua. This has not been completed as of fiscal year end 13–14. The project PI and collaborators continue to provide advice and support to ensure that this output is delivered in the near future. The student has indicated that the thesis will be submitted during the first half of FY 15.
2. Two manuscripts for journal submission: We had set a target of two manuscripts for journal submission. To date only one manuscript is completed and submitted to a journal. Towards the second manuscript, the analysis is complete and we are in the process of writing up the results. The paper should be completed and submitted to a journal before the end of 2014.
3. Impact Briefs: We had planned to develop two Impact briefs in FY 2014. One of these was to be based on the thesis paper and the second on the field experiment paper targeted for the refereed journal. Since these two outputs have not been fully achieved, we were not able to complete the two briefs. But we plan to do this soon after the outputs (thesis paper and the RCT based journal article) are achieved.

IX. Self-Evaluation and Lessons Learned

Challenges

Our project is a collaborative project cutting across all the other projects funded by the Legume Innovation Lab. We depend on the support and collaboration of the lead U.S. and HC PIs in implementing our workplan. As such delays in the start-up of activities in some host countries (i.e., Benin under SO1-B1 and in Guatemala under SO1-A1) also impacted our workplan for objective 1. In the case of the Benin study, the lack of French language skills on our part was also a challenge in engaging with the HC collaborator in planning this activity and contributing to this study as we had planned.

Failures

Although, there are no failures in doing research, we do consider the delays in implementing the workplan or incomplete activities reported in this Annual Report as a failure on our part to properly manage time and available resources to meet the outputs set for this first 18 months.

Successes/Strengths

The support and collaboration we have received from other project teams during the planning meeting and subsequently at the global meeting is a strength of this program and a great recipe for success towards achieving the objectives of this crosscutting project.

X. Scholarly Accomplishments

Publications and Manuscripts

Maredia, Mywish, Shankar, Bhavani, Kelley, Timothy, Stevenson, James. 2014. Impact Assessment of Agricultural Research, Institutional Innovation, and Technology Adoption: Introduction to the Special Section. *Food Policy* 44 214–217

Reyes, Byron A., Maredia, Mywish, Ba, Malick, Clementine, Dabire, Pittendrigh, Barry. 2013. "Economic Impacts of Biocontrol Research to Manage Field Insect Pests of Cowpea in Burkina Faso: Baseline Survey Report." Department of Agricultural, Food and Resource Economics Staff Paper 13-04. East Lansing, Michigan: December.

Reyes, Byron A., Maredia, Mywish, Bernsten, Richard H., Rosas, Juan Carlos. 2014. Have investments in bean breeding research generated economic benefits to farmers? The case of five Latin American countries. *Agricultural Economics* (Submitted)

Impact Briefs

Magen, Benjamin, Crawford, Eric W., Maredia, Mywish. 2013. “Impact Economique des investissements du CRSP sur le développement et la diffusion des variétés améliorées de niébé: Nouvelle évidence du Sénégal” *Impact Assessment Research Brief 4.* Michigan State University: Dry Grain Pulses CRSP (French translation).

Presentations and Poster Papers

Magen, Benjamin, Crawford, Eric W., Maredia, Mywish. 2013. "Economic Impact of Research Investment in the Development and Dissemination of Improved Cowpea Varietal Technology." Poster paper presented at the Agricultural and Applied Economics Association Annual Meeting, Washington, D.C., August.

Maredia, M., Reyes, B. A., DeYoung, D. 2014. "An assessment of the Bean Seed Distribution Models Implemented under the Bean Technology Dissemination Project: Results of key informant interviews and surveys conducted in Guatemala, Honduras and Nicaragua.” Final Regional Project Workshop of the BTD Project, Guatemala City, March 20.

Maredia, M., Bernsten, R. H.. 2014. "Monitoring, Evaluation and Impact Assessment of Agricultural Research for Development: Overview, Challenges and Best Practices.” Presentation to the Research Management Team of the Indonesian Agency for Agricultural Research and Development (AARD), MSU, East Lansing, MI, August 18.

Maredia, M., Reyes, B. A., Ba, M., Pittendrigh, B., Bello-Bravo, J. 2014. "Can Animated Educational Materials Induce Learning And Adoption Among Low-Literate Farmers? A Field Experiment on the Dissemination of Cowpea Grain Storage Technologies in Burkina Faso.” Seminar Presentation Given to the Faculty and Students at Sokoine University of Agriculture, Tanzania, June 25.

Maredia, M. and Donovan, C. 2014. "Scaling Up in Agriculture and Nutrition: Concepts and Models.” Legume Innovation Lab Global Meeting, Athens, Greece, May 16.

Reyes, B. A. and Maredia, M. 2014. "Characteristics of a sustainable seed system: Application of the principles of sustainability to two models used in Central America.” Innovations in Sustainable Seed Systems for Grain Legumes, May 14.

XI. Progress in Implementing Impact Pathway Action Plan

For this project we have identified two project outputs to be achieved over the life of the project that will contribute towards developing and impact oriented research program that features: 1) Greater awareness among researchers of the importance of achieving developmental outcomes; and 2) Better design of research programs that incorporate strategies and partnerships to transfer research outputs into outcomes and impacts; and 3) Continued and increased support for investments in agricultural research in general, and on legume crops in particular. Towards the impact pathway of achieving this vision of success, the following was achieved as of the end of FY 2014 for each output:

1. Output 1: Development of impact pathway analytical tools and guidelines:
    a. Transfer of analytical tools to project PIs and research teams: Completed as planned
    b. Input and feedback to research teams on their impact pathway: Completed as planned
    c. Monitor the progress towards projected outputs and strategies to achieving the vision of success as laid down in the impact pathways: Ongoing
2. Output 2: Evidence based assessments of potential and realized impacts of investments in agricultural research:
    a. Publication of results of the assessments in technical reports and peer reviewed venues: Three technical reports and one manuscript for peer reviewed venue have been completed. Annexes

XII. Annexes

Annex 1. Tables, Figures, and Photos Cited in the Report

Table 1: Mean outcomes of adoption related variables for the two treatment groups included in the randomized field experiment, Burkina Faso, 2012–2013

		Treatment groups		
	Average across all observations	2. Farmers trained using traditional method	1. Farmers trained using video-based method	
Number of observations (farmers)	569	283	286	T-test
Triple bag technology related outcomes				
Percentage of HHs that used triple bag technology posttraining	40%	42%	39%	
Change in adoption of triple bag from 2011 to 2012	23%	26%	20%	*
Percentage of HHs reporting using the triple bag method first time posttraining (as % of adopters)	9%	11%	6%	**
Percentage of adopters who reported correct knowledge of using triple bag technology posttraining	99%	99%	99%	
Average number of triple bags HH purchased in 2012, posttraining	0.95	0.96	0.93	
quantity of cowpea grain stored using triple bag method in 2012	102.00	104.00	99.40	
Percentage of HHs reporting not using any storage technology in 2012	28%	27%	30%	
Percentage of HHs that did not use triple bag technology posttraining	60%	59%	62%	
Percentage of farmers not adopting triple bag method because the grain was already stored pretraining or was sold soon after harvest	41%	39%	43%	
Percentage of farmers not adopting triple bag method because they didn't know how to use this method	3.5%	4.6%	2.5%	
Solar technology related outcomes				
Percentage of HHs that used solar technology posttraining	0.122	0.144	0.0986	
Change in adoption of solar method from 2011 to 2012	0.0947	0.119	0.069	**

		Treatment groups	
	Average across all observations	2. Farmers trained using traditional method	1. Farmers trained using video-based method
Percentage of HHs reporting using the solar method first time posttraining (as % of adopters)	0.103	0.127	0.0801 *
Percentage of HHs that did not use solar technology posttraining	0.878	0.856	0.9014
Percentage of farmers not adopting solarization method because the grain was already stored pretraining	0.406	0.4185	0.3944
Percentage of farmers not adopting solar method because they didn't know how to use this method	0.17	0.169	0.171

T-test: * indicates significant difference at 10% level, ** at 5%, and *** at 1%. If not noted, the differences in the mean value between treatment one and two are not statistically significant.

Table 2. Average treatment effect of the animated videos on cell phone compared with the traditional extension method of training farmers on the two postharvest technologies in Burkina Faso: Results of the Linear Probability Model Regressions

	Three types of adoption outcomes		
	Adopted a given technology posttraining	Change in Adoption from 2011 to 2012	First time adoption
Triple Bag Technology Adoption Outcome			
Treatment 1 (Video-based method=1)	0.001	-0.02	-0.078
Std. Error	(0.079)	(0.106)	(0.174)
R-square	0.554	0.5324	0.752
N	320	238	108
Solar Technology Adoption Outcome			
Treatment 1 (Video-based method=1)	-0.222	-0.273	0.265
Std. Error	(0.065) ***	(0.059) ***	(0.075) ***
R-square	0.516	0.505	0.481
N	325	316	308

T-test: * indicates significant difference at 10% level, ** at 5%, and *** at 1%. If not noted, the differences in the mean value between treatment one and two are not statistically significant.

XIII. Milestones

Project Title: SO$.1 Impact Assessment	*Abbreviated name of institutions*								
	MSU			other			other		
	Target	Achieved		Target	Achieved		Target	Achieved	
Milestones by Objectives	**10/1/14**	**Y**	**N***	**10/1/14**	**Y**	**N***	**10/1/14**	**Y**	**N***
	(Tick mark the time period for achieving identified milestones by institution)								
Objective 1: Technical assistance for baseline data collection									
1.1 Identify opportunities for collecting baseline data through partnership with other project teams									
1.2 Complete the report on baseline survey (biological control study in Burkina Faso)									
1.3 Develop survey instruments and research design for baseline data collection in Guatemala									
1.4 Develop survey instruments and research design for baseline data collection in Benin									
Objective 2: Ex ante and ex-post impact assessment									
2.1 Complete French versions of Impact Briefs # 3 and 4									
2.2 Complete the report on the RCT study in Burkina Faso									
2.3 Complete a report based on available secondary data analysis									
2.4 Complete one thesis research paper on seed system issues	**x**		**x**						
2.5 Complete two manuscripts for publication in refereed journal	**x**	**1.5**							
2.6 Complete 2 Impact Briefs	**x**		**x**						
Objective 3: Capacity building									
3.1 Conduct educational sessions at project planning meetings on constructing impact pathways and collecting/reporting on performance indicators data									
3.2 Design and conduct short courses on impact assessment	**x**	**x**							

XIV. Performance Indicators

Project Name: SO4-1 Impact Assessment

Institution 1 Name (one sheet per institition): Michigan State University

Submitted September 30, 2014

*** Please include any comments/explanations/data sources in the last column.*

Indic. numbe	Output Indicators	FY 13 Target (only April 1, 2013 - September 30, 2013)	FY 13 Revised	FY 13 Actual	FY 14 Target (October 1, 2013 - September 30, 2014)	FY 14 Revised	FY 14 Actual	FY 15 Target (October 1, 2014 - September 30, 2015)	FY 15 Revised	FY 15 Actual
1	4.5.2(6) Degree Training: Number of individuals who have received degree tr	0	0	0	0	0	0	0	0	0
	Number of women									
	Number of men									
2	4.5.2(7) Short-term Training: Number of individuals who have received short-term training									
	Total number	60	0	50	45	50	38	20	0	0
	Number of women	**15**		10	7	10	10	5		
	Number of men	**45**		40	38	40	28	15		
	Numbers by Type of individual									
	Producers									
	People in government	**60**		**42**	45	50	17	12		
	People in private sector firms									
	People in civil society			8			21	3		
3	4.5.2(13) Beneficiaries: (numbers of households)									
	New/Continuing (total)	0	0	0	0	0	0	0	0	0
	New									
	Continuing									
	Gendered Household Type									
	Adult Female no Adult Male (FNM)									
	Adult Male no Adult Female (MNF)									
	Male and Female Adults (M&F)									
	Child No Adults (CNA)									

Performance Indicator, continued

4	4.5.2(11) Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance									
	Type of organization									
	Private enterprises (for profit)									
	Producers organizations									
	Water users associations									
	Women's groups									
	Trade and business associations									
	Community-based organizations (CBOs)									
	New/Continuing (total)	0	0	0	0	0	0	0	0	0
	New									
	Continuing									
5	4.5.2(12) Number of public-private partnerships formed as a result of CRSP assistance									
	Number by type of partnership (total)	0	0	0	0	0	0	0	0	0
	Agricultural production									
	Agricultural post harvest transformation									
	Nutrition									
	Multi-focus									
	Other									
6	4.5.2(2) Developmental outcomes:									
	Number of additional hectares under improved technologies or management practices									
	Number under specific technology types (total)	0	0	0	0	0	0	0	0	0
	crop genetics									
	animal genetics									
	pest management									
	disease management									
	soil-related									
	irrigation									
	water management									
	post-harvest handling and storage									
	processing									
	climate mitigation or adaptation									
	fishing gear/technique									
	other									
	total w/one or more improved technology									
	New/Continuing hectares									
	New									
	Continuing									
	Sex of person managing hectare									
	Male									
	Female									
	Association-applied									

Performance Indicator, continued

7	4.5.2(39) Number of new technologies or management practices in one of the following phases of development: (Phase I/II/III)	0	0	0	0	0	0	0	0	0
	Phase 1: Number of new technologies or management practices under research as a result of USG assistance									
	Phase 2: Number of new technologies or management practices under field testing as a result of USG assistance									
	Phase 3: Number of new technologies or management practices made available for transfer as a result of USG assistance									
8	4.5.1(24) Numbers of Policies/Regulations/Administrative Procedures in each of the following stages of development as a result of USG assistance in each case: (Stage 1/2/3/4/5)									
	Sector (total)	0	0	0	0	0	0	0	0	0
	Inputs									
	Outputs									
	Macroeconomic									
	Agricultural sector-wide									
	Research, extension, information, and other public service									
	Food security/vulnerable									
	Climate change adaptation or natural resource management (NRM) (ag-related)									
	Stages of development									
	Stage 1 of 5: Number of policies / regulations / administrative procedures analyzed									
	Stage 2 of 5: Number of policies / regulations / administrative procedures drafted and presented for public/stakeholder consultation									
	Stage 3 of 5 : Number of policies / regulations / administrative procedures presented for legislation/decree									
	Stage 4 of 5 Number of policies / regulations / administrative procedures prepared with USG assistance passed/approved									
	Stage 5 of 5: Number of policies / regulations / administrative procedures passed for which implementation has begun									
	Notes:									
	These indicators are developed under the Feed the Future Monitoring System. Please provide 'total' numbers and also disaggregate where applicable. Just providing 'totals' will not be approved.									
	This table corresponds to the Feed the Future Performance Indicators data collection sheet under the FTFMS system. Where an indicator does not apply to the type of work done under the project, leave it blank.									
	Please follow the indications in the Legume Innovation Lab Indicators Handbook that will be provided to you by the Management Office. Contact Mywish Maredia (maredia@anr.msu.edu) for further information.									
	There is additional guidance on the USAID website http://feedthefuture.gov/sites/default/files/resource/files/ftf_handbookindicators_apr2012.pdf									