

**IOWA STATE UNIVERSITY SUPPLEMENTAL BUDGET**

**Fund-acct: 404-21-32**

Type: UNIVERSITIES

previous account: 404-21-32

Fed Type:

Check ? YES NO

Sponsor: MICHIGAN STATE UNIVERSITY

Amount: \$ \_\_\_\_\_

Title: Enhancing Nutritional Value and Marketability of Beans Through Research and Strengthening

Prime Contractor: USAID-U.S. agency FOR INTERNATIONAL DEVELOPMENT

SBSP: ARRA: N BSL3:

Contract Period: 4/1/2008 to 9/28/2012

E Verify: N Bio Farm: N

Lead PI: Mazur, Robert

ISU ID#: 541822442

Full/Allowable: Y

Department: Sociology-LAS

Research Location: Uganda & Rwanda

Admin D//C/E: Sociology-LAS

RRC Administering Unit: LAS

Purpose: RESEARCH

Award Type: CONTRACT

**BUDGET**

Salaries/Hourly: \$25,546  
 Payroll Benefits: \$3,054  
 Equipment:  
 Travel - Domestic:  
 Travel - Foreign: \$31,339  
 Student Tuition: \$6,691

PI	Conflict	Name	ISUID	ACCT#	Incentive
1	N	Mazur, Robert	541822442	490-	15
2	N	Westgate, Mark	903620718	490-	0
3	N	Jensen, Helen	025483709	490-	0
4	N	Hendrich, Suzanne	069025965	490-	0
5	N	Reddy, Manju	022673723	490-	0
6	N	Murphy, Patricia	700844116	490-	0

**Supplies/Materials**

Ag and Vet Supplies:  
 Lab/Research Supplies:  
 Other Supplies: \$5,254

**Subcontracts**

Subject to IDC:  
 NOT Subject to IDC: \$119,440

**Participant Support Cost**

Stipends:  
 Travel:  
 Subsistence:  
 Other:

**Other Direct Costs**

Telecom Charges:  
 Computer Usage:  
 Printing/Copying:  
 Honoraria/Services:  
 Postage:  
 Other: \$250

**RRC Distribution**

Unit	RRC 45%	If changes needed:		Date
		New RRC %	Signature	
AES/C	5.01 %	%	_____	/ /
HS	1.74 %	%	_____	/ /
LAS	38.25 %	%	_____	/ /

TOTAL DIRECT COSTS: \$191,574  
 Indirect Costs: \$17,015  
 TOTAL ALL COSTS: \$208,589

OSPA Approval: \_\_\_\_\_  
 SPA Approval: \_\_\_\_\_

**This section is for Sponsored Programs Accounting use ONLY**

Rate(%): 26 % Base: \$66,443 Code \_\_\_\_\_ IDC Budget \_\_\_\_\_  
 Rate(%): % Base: Code \_\_\_\_\_ IDC Budget \_\_\_\_\_

Resp Code: \_\_\_\_\_

Prime Contractor: USAID-U.S. agency FOR INTERNATIONAL DEVELOPEME

Contract #:

CFDA: \_\_\_\_\_

Reimbursement Type  C

Account Type: \_\_\_ Admin \_\_\_ Sub of: \_\_\_\_\_

Bill: \_\_\_\_\_

Eligible for Incentive: YES (see above) NO

Proposal Number: 10-1833

Record ID: 108154

Updated By: tra

11/1/2011

**AMENDMENT NO. 5**  
**To**  
**Subagreement No. 61-2950**  
**Between**  
**Michigan State University**  
**And**  
**Iowa State University**

THIS AMENDMENT is entered into between Michigan State University (MSU) and Iowa State University (LEAD INSTITUTION) and

WHEREAS, MSU and LEAD INSTITUTION entered into a Subagreement on 21 April 2008, and

WHEREAS, the parties now desire to modify said Subagreement,

NOW THEREFORE, the parties mutually agree that said Subagreement shall be and is amended as follows:

**I. INTRODUCTION (Section C)**

Append the following items:

**Appendix C:** Append the *Project Workplan* with the attached approved **Phase II FY 2012 Workplan**. Attached to FY 12 Workplan are "FY12 Semi-Annual Indicators of Progress" and "FY 12 Performance Indicators" forms for the **PII-ISU-1** project in the Dry Grain Pulses CRSP.

**Appendix D:** Append the attached Sub-project, **Phase II Budget** for the period 10/1/11 to 9/28/12.

**II. STATEMENT OF WORK**

Append the following to the first paragraph:

The LEAD INSTITUTION shall also perform the activities and services described in the detailed project workplan and the "TMAC" recommendations and its amendments, submitted to the Dry Grain Pulses CRSP Management Office (MO) (for the period of October 1, 2011 - September 28, 2012) and incorporated and appended hereto as Appendix C.

**IV – AMOUNT OF SUBAGREEMENT**

Delete "The total estimated amount of the Subagreement shall not exceed Six Hundred Ninety Eight Thousand One Hundred Forty Seven US Dollars (US \$698,147.00).

Replace with "The total estimated amount of the Subagreement shall not exceed Nine Hundred Six Thousand Seven Hundred Thirty Six US Dollars (US \$906,736.00). MSU obligates Nine Hundred Six Thousand Seven Hundred Thirty Six US Dollars (US \$906,736.00) as full funding of the total estimated amount as set forth above per the budget listed as Appendix D."

Said amount consists of:

<b>OBLIGATION THRU AMENDMENT 1 &amp; 2</b>	
FY08-09 18-month project budget (4/1/08-9/30/09)	\$319,530.00
FY09 Supplemental Institutional Capacity Building budget	\$47,182.00
<b>AMENDMENT NO. 3 OBLIGATION INCREASE:</b>	
FY10 12-month project budget (10/1/09-9/30/10)	\$130,470.00
FY10 Supplemental Institutional Capacity Building budget	\$13,371.00
<b>AMENDMENT NO. 4 OBLIGATION INCREASE:</b>	
FY11 12-month project budget (10/1/10-9/30/11)	\$187,594.00
<b>AMENDMENT NO. 5 OBLIGATION INCREASE:</b>	
FY12 12-month project budget (10/1/11- 9/28/12)	\$188,589.00
FY 12 Supplemental Institutional Capacity Building budget	\$20,000.00
<b>TOTAL OBLIGATION</b>	<b>\$906,736.00</b>

Delete: "Because this Subagreement is incrementally funded, funds obligated hereunder are only anticipated to be sufficient for project expenditures through approximately September 30, 2011.

Replace with: "Because this Subagreement is incrementally funded, funds obligated hereunder are only anticipated to be sufficient for project expenditures on or before September 28, 2012."

Except as specifically herein amended, all terms and conditions of the above-numbered Subagreement, as heretofore amended, remain unchanged and in full force and effect.

Signatures of Authorized Individuals

**Michigan State University**

By *Diane Cox*  
Printed Name Diane Cox  
Title Sponsored Programs Manager  
Date 25 Oct 2011

**Iowa State University**  
(Grantee)

By *Tammy Polaski*  
Printed Name Tammy Polaski  
Associate Director  
Office of Sponsored Programs Administration  
Iowa State University  
Date 10/28/11

**PII ISU-1**

**Enhancing Nutritional Value and Marketability of Beans through Research and Strengthening Key Value Chain Stakeholders in Uganda and Rwanda**

**Lead U.S. Principal Investigator and University**

Robert Mazur – Iowa State University (ISU)

**Collaborating Host Country and U.S. PIs and Institutions**

Dorothy Nakimbugwe, Makerere, Uganda	Michael Ugen, NaCRRI, Uganda
Henry Kizito Musoke, VEDCO, Uganda	Hilda Vasanthakaalam, KIST, Rwanda
Suzanne Hendrich, ISU, U.S.	Helen Jensen, ISU, U.S.
Patricia Murphy, ISU, U.S.	Manju Reddy, ISU, U.S.
Mark Westgate, ISU, U.S.	Agnes Nakimuli, VEDCO, Uganda
Gabriel Elepu, Makerere, Uganda	Paul Kibwika, Makerere, Uganda
Michael Otim, NaCRRI, Uganda	

**Project Problem Statement and Justification**

Agriculture in East Africa is characterized by women and men working in small scale, rainfed production, averaging 2 hectares per household (FAO 2006). Erratic bimodal rainfall patterns in recent years further challenge cropping results (ARB 2007). Farmers have very limited access to extension, training, inputs (quality seeds, fertilizers, etc.), improved agronomic practices, new technologies, and credit (KDA 2004; Nkonya et al. 2004). Producers are not well linked with profitable markets, especially to emerging sectors of domestic and regional markets (Ehui & Pender 2005). Private traders operate on a small scale with limited investment capability. Availability and use of processed products at present remain very modest. As a result of low production levels, hunger is widespread (WFP 2006) and the vast majority of the rural population lives in absolute poverty (KDA 2004).

Our recent efforts to introduce new agronomic practices and technologies demonstrate encouraging progress (Butler & Mazur 2007). Ongoing collaboration since 2004 of Iowa State University (ISU), Makerere University (MAK), and Volunteer Efforts for Development Concerns (VEDCO) in Uganda's Kamuli District (Mazur et al. 2006; VEDCO 2006; Sseguya, Mazur & Masinde 2009) using a sustainable livelihoods approach has increased food security and market readiness from 9% to 77% among 800+ farm households in 2½ years (Sseguya 2007). The main crops grown in Kamuli district are maize, beans, sweet potatoes, cassava, bananas, rice and coffee (Sseguya & Masinde 2005). Most (90%) of participating households produce beans, but only 20% sold some in 2007. The SL approach focuses on understanding and supporting individual and community capabilities, assets (natural, physical, human, financial, social, cultural and political capital), goals, strategies and activities. Diversification of livelihood opportunities and activities is crucial to sustainability (Ellis 2000). In combination with SL approaches, scientific knowledge, improved technologies, financial assistance, and changes in government policies can have significant positive local impacts (Helmore & Singh 2001). Participatory research methods can generate knowledge that people can apply to improve their individual and collective well-being (Selener 1997).

Beans provide a strategic opportunity to help meet the Millennium Development Goal targets of reducing hunger and poverty. Improved beans production in Uganda and Rwanda offers unique opportunities to address the deteriorating food security situation there and elsewhere in sub-Saharan Africa. The short growth period and two growing seasons offers great opportunities to contribute to rural poverty alleviation - playing an essential role in sustainable livelihoods of small scale farmers and their families, providing food security and income to the most vulnerable group, the women and children. Testing whether various management practices and technologies result in higher bean yield and quality at harvest and after storage (Objective 1), and which varieties, processing methods, and food combinations can increase consumption and nutritional value (Objective 2) are important under-researched issues in this region. Improved farmers's linkages to emerging markets and the food industry are also essential (Objective 3).

*Central problems limiting production of quality beans and higher yields*

- Declining soil fertility and inefficient cropping systems unable to utilize available resources effectively and efficiently
- Limited accessibility and affordability of quality seeds, non-seed inputs and other yield improving technologies
- Effects of drought and other weather related factors compromise productivity and quality
- Diseases (root rot, anthracnose, angular leaf spot, common bacterial blight, viruses, rust, ascochyta blight) and insect pests (aphids, thrips, bean stem maggots, weevils)

*Central problems relating to nutritional value and processing of beans*

Pre- and post-harvest losses for beans are very high throughout the value chain, mostly due to poor harvest and post-harvest practices and poor on-farm storage facilities. Poor pre- and post-harvest handling also results in the majority of beans on the market being characterized by mixed varieties and poor quality with high levels of foreign matter, rotten or shriveled beans, and infestation. The lack of value-added bean products having reduced preparation times makes bean preparation laborious with high fuel requirements; consumers also tire of monotonous flavor. As a result, an increasing number of people are abandoning or reducing their bean consumption despite its documented high nutrient content and health benefits.

The nutrition value of beans is negatively affected by anti-nutrients such as phytates, trypsin inhibitor, lectins, polyphenols, saponins, oligosaccharides and hemagglutinins (Kebede et al., 1995). However, treatments such as de-hulling, soaking, milling, fermentation and germination or malting and cooking enhance the digestibility and nutritional value (Matella 2005; Martín-Cabrejas 2006; Shimelis & Rakshit 2007; Nergiz & Gökgöz 2007; Cevdet & Gökgöz 2007).

*Central problems inhibiting increased marketing of beans and derived food products*

Prospects of marketing increased quantities of beans and new agro-processed bean products within the Ugandan and regional markets requires carefully examining production and marketing constraints (increased farm productivity, producer incentives, and access to better markets). Equally important is examining prospects for increasing demand for beans and agro-processed products (understanding consumers' tastes and preferences, increased consumer awareness of benefits of consuming beans and other value-added products, increasing consumer choices of value-added products, etc.).

## Planned Project Activities for October 1, 2011 - September 28, 2012

### **Objective 1:** To Improve Harvested Bean Yield and Quality

#### **Collaborators**

*National Crops Resources Research Institute* (Kampala, Uganda)

Michael Ugen, Bean Programme, m.ugen@naro-ug.org, michaelugen@yahoo.com

Michael Otim, Entomology Department, otim\_michael@yahoo.com

*Volunteer Efforts for Development Concerns* (Kampala, Uganda)

Henry Kizito Musoke, Executive Director, henrykizito@vedco.or.ug

Agnes Nakimuli, Eastern Region Program, anakimuli@yahoo.com

*Iowa State University* (Ames, Iowa)

Mark Westgate, Department of Agronomy, westgate@iastate.edu

Gerald Sebuwufu, Department of Agronomy, sebuwufu@iastate.edu

*Makerere University* (MAK-Kampala, Uganda)

Dorothy Nakimbugwe, Dept. of Food Science & Technology, dnakimbugwe@agric.mak.ac.ug, dnakimbugwe@gmail.com

#### **Rationale**

Results of Phase 1 research activities prompted several adjustments in research and development activities planned for Phase 2.

On-farm field trials revealed significant local variation in soil conditions that resulted in large genotype x environment interactions for the priority varieties evaluated. Although management techniques and farmer interest contributed to some extent, variation was largely due to variation in soil conditions and fertility. Bean production remained well below genetic potential and, in some cases, unresponsive to supplemental Nitrogen fertilizer. All soils in the test sites were depleted in phosphorous. Objective 1a will test the hypothesis that incorporating a small amount of inorganic phosphorous into the soil prior to planting will generate a profitable return on seed and N-fertilizer investment. Results of this objective will be compared to those of related studies to enhance Biological Nitrogen Fixation, in which phosphorous levels will be monitored as critical for profitable plant response.

Phase I results also confirmed the large potential for yield loss due to insect infestations during seed development. While chemical methods of insect control are available, their high cost and lack of information on effective and timely application renders chemical insecticides a luxury for most small-landholder farmers. Use of biological control agents, however, could prove to be an affordable and effective alternative. We will enlist the expertise of entomologists at Uganda's National Crops Resources Research Institute and elsewhere (University of Illinois, ICIPE) to identify and test biological control methods for two major insect pests in common beans - aphids

and thrips. Controlled field trials will be conducted to determine specificity and effectiveness against these damaging pests.

Phase I analysis of farmer production levels and market requirements for consistent production levels and product quality required significant changes in seed management to effect a successful transition from household-based bean production to market-oriented production. A major priority is to establish a system for community-based production of quality seed. This will require establishment of farmer groups or associations committed to large-scale bean production, establishment and management of seed quality standards for all participating farmers to adopt, and development of bulk seed storage methods suitable for long-term (3-6 months) storage without loss of product quality. We will use proven participatory methods to engage farmers in this process and establish protocols for seed production, harvesting, and storage. We hypothesize that membership in an active farmer group and market forces will have a major impact on the success and sustainability of the production groups.

Numerous factors are known to affect the duration of seed quality in storage. Phase I studies on typical storage techniques revealed the need to improve bean post-harvest handling and storage to prevent post-harvest losses and avoid excessive time expenditure involved in re-sunning. Re-sunning is commonly used to limit damage to stored seeds caused by infesting bruchid larvae. While the actual control mechanism is not known, the movement of the seed is thought to be the controlling factor. If correct, periodically moving the seed could limit adult damage, but would have little impact on eggs or larvae. We will test to confirm a well-known technique of asphyxiation using air-tight bagging to eliminate living insects from the storage container. The triple bagging technique has numerous advantages including flexible storage volume, re-usable containers, and manageable volume of individual bags (50-100 kg) for transport. This flexible storage approach will be evaluated as a means to meet the emerging need for bulk storage on farm or at community collection sites as determined most appropriate and effective for collective marketing and increased farmer access to emerging markets.

These Phase II activities for Objective 1 build on the great potential for promoting improved practices and disseminating technologies in Kamuli, in other districts in Uganda, and in Rwanda that have similar yield and seed quality limitations. Key activities for Objective 1 include:

- Data on variety performance, fertility response, and pest/disease management will be analyzed.
- Exchange visits will be made to established seed production programs (e.g., Namulonge and western Uganda) to facilitate learning and sharing of practices and technologies.
- Drying and storage techniques will be evaluated in multiple periods to determine their effectiveness in keeping out/killing pests and maintaining seed germination viability.
- Bio-control strategies will be tested for two priority biotic pests.
- Refinements in practices and technologies (land preparation, soil nutrient management, pest and disease control, harvest and storage) will be evaluated, documented, and incorporated into materials for dissemination.

## Approaches and Methods

### **Obj. 1a. Improve Yield and Quality through Evaluation of Better Production and Management Practices**

1. Evaluate additional bean varieties with selected agronomic/nutritional traits under farmers' cropping system conditions (farmer selected and promising new NaCRRRI varieties, high seed ferritin genotypes, early maturation, good yield, disease resistance). New varieties will be tested under conditions of monocropping and intercropping (with maize).
2. Evaluate practical methods to enhance nutrient management - organic fertilizers (adding compost and green manure to currently evaluated farm yard manure), adding phosphorous and nitrogen.
3. Evaluate appropriate biological and cultural/agronomic methods to control pests/diseases (intercropping, crop rotation, and possibly later trap cropping).
4. Promote adoption and use of key management practices and technologies.

#### **Benchmarks**

##### **Oct. 2011 – Mar. 2012**

- Variety performance, fertility response, and biological and agronomic/cultural controls analyzed

##### **Apr. – Sept. 2012**

- Assessment by farmers/farmer groups of new variety acceptability completed
- Report to bean breeders on variety performance and farmer acceptance completed

### **Obj. 1b. Support Community-Based Seed Production (CBSP) by Farmers Groups/Associations**

1. Refine CBSP systems initiated in 2010 based on farmer group/stakeholder input
2. Document lessons learned in development of community based seed production systems
3. Scale up CBSP systems to other farmer groups in Kamuli District and explore approaches for doing so more widely

#### **Benchmarks**

##### **Oct. 2011 – Mar. 2012**

- Strategies for profitability and sustainability of seed production assessed
- Extension guide for CBSP of beans finalized

##### **Apr. – Sept. 2012**

- Achievements and lessons learned from the CBSP documented and shared
- Assess impact of CBSP on seed systems within Kamuli district
- Successful strategies for seed production business promoted



**Obj. 1c. Evaluate Adoption of Improved Post-Harvest Handling and Storage Methods**

1. Evaluate parameters of 'solarization' method (bean seed size, seed coat thickness, color, length of time exposed, heat accumulated by time of day, etc.), to achieve optimal moisture content and viability of bean seeds.
2. Train farmers in improved drying methods ('solarization') to achieve optimal moisture content and viability of bean seeds, and identify and address barriers to farmers' adoption.
3. Train farmers in improved threshing practices, identify and address barriers to farmers' adoption.
4. Train farmers in improved storage methods ('triple bagging' and 200 liter re-sealable plastic drums), and identify and address barriers to farmers' adoption.
5. Train farmers in management of bulking facilities (technical, organizational, and financial aspects)
6. Assess adoption of drying, threshing, and storage techniques through interviews and focus group discussions.

**Benchmarks**

**Oct. 2011 – Mar. 2012**

- Extension materials for drying, threshing, and storage finalized
- Barriers to adoption of storage techniques identified and addressed
- Follow up training on solarization and new storage techniques carried out

**Apr. – Sept. 2012**

- Farmers' long-term adoption of new drying, threshing, and storage techniques assessed

**Obj. 1d. Strengthen Learning and Sharing of Innovative Practices**

1. Share and disseminate information through farmer field days at research/demonstration sites, and develop materials and methods to promote improved management practices and technologies.
2. Review training materials by project farmers and RDEs / CNHWs, adapt, and translate
3. Develop materials for new farmer groups to utilize in adopting and utilizing new management practices and technologies (germination, moisture content, etc.)
4. Explore approaches to disseminate and promote management practices and technologies in other districts, and quantify the resource requirements.

**Benchmarks**

**Oct. 2011 – Mar. 2012**

- Training of trainers in bean production initiated
- Training modules (production, drying, storage and bulking management) compiled into a

comprehensive document and published

Apr. – Sept. 2012

- Final training of all trainers conducted – including farmers from other districts for scaling up and scaling out
- Two farmer field days held (one in each sub-county)
- Project findings shared with stakeholders through workshop and publications
- Status of bean production, constraints faced and resources needed for scaling up determined

**Target Outputs and Developmental Outcomes**

We will document and publicize the contributions of production factors to increased yield, reduced lost due to pests and diseases, and improved quality after drying and storage, as well as successful strategies for profitable and sustainable community-based seed production. Farmers' indigenous knowledge combined with emerging research results and 'lessons learned' will be incorporated into revised training procedures and materials, and promotion protocols for use in VEDCO operations and NaCRRRI demonstration projects in other areas of Uganda. The project will facilitate access to improved drying and storage techniques, and farmers' central roles in field days conducted for the public (farmers, farmer groups and associations, NGOs, researchers). We anticipate that dissemination of these technologies, management practices, and CBSP programs will benefit more than 2,000 VEDCO-assisted farmers and other farmers in Kamuli. Project researchers will actively explore the bases for dissemination of improved technologies and practices to other districts in Uganda and in Rwanda.

**Objective 2:** To Enhance Nutritional Value and Appeal of Beans through Appropriate Handling and Processing.

**Collaborators**

*Makerere University (MAK-Kampala, Uganda)*

Dorothy Nakimbugwe, Dept. of Food Science & Technology, dnakimbugwe@agric.mak.ac.ug, dngabo@yahoo.co.uk

John Muyonga, Dept. of Food Science & Technology, muyongaj@agric.mak.ac.ug, hmuyonga@yahoo.com

*Iowa State University (ISU-Ames, Iowa)*

Suzanne Hendrich, Department of Food Science & Human Nutrition, shendric@iastate.edu

Patricia Murphy, Department of Food Science & Human Nutrition, pmurphy@iastate.edu

Manju Reddy, Department of Food Science & Human Nutrition, mbreddy@iastate.edu

Martin Mutambuka, Department of Food Science & Human Nutrition, mcmartin@iastate.edu

*Kigali Institute of Science and Technology (KIST-Kigali, Rwanda)*

Hilda Vasanthakalam, Dept. of Food Science & Technology, hildajeya@hotmail.com, h.vasanthak@kist.ac.rw

*Center for International Tropical Agriculture Research (CIAT-Africa)*

Martha Nyagaya, Nutrition Programme – Harvest Plus, m.nyagaya@cgiar.org

## **Rationale**

Phase 1 results indicate the need to promote increased bean consumption among farming communities and urban consumers to realize the nutritional and health benefits and address prevalent diet and nutritional imbalances, as well as the need to reduce cooking time and monotony in the diet. Doing so involves four core elements. The first is understanding and communicating consumer preferences regarding culinary properties and sensory characteristics of existing and improved bean varieties to national bean breeding programs and the private business sector. This leads to the second element - engaging the private business sector in value addition and commercialization of bean products to open up new markets for bean producers. Third, to enhance children's daily nutrient intake through increased consumption of beans and bean products, our emphasis will be on products that are practical, useful in school settings, and acceptable to students. Thus, institutional buyers such as schools, hospitals, and humanitarian agencies have been identified as potential markets for beans and bean products. Finally, complementary use of produce from home gardens to increase dietary iron content and bioavailability constitutes an important, new component of the project's next phase.

While beans have the potential to positively contribute to the nutritional and health status of both farming and urban communities, a number of constraints to consumption remain, including long cooking times, monotony of cooking methods and limited dietary complementation. During phase I, pre-processing methods that reduce cooking times to about 15 minutes, using a pre-processed bean flour were developed. Recipes utilizing the fast-cooking bean flour will be developed in a planned participatory, community based competition and field day later in 2010. We hypothesize that availability of acceptable alternative ways of consuming beans will result in increased bean consumption. The central hypothesis regarding farmers' adoption, adaptation and sustainable (continuous) use is that a coordinated strategy of technological innovation to facilitate ease of utilization of bean foods for weaning and snacks and ongoing evidence of nutritional and economic benefits of beans are likely to create sustainable increased use of bean-based foods within communities.

To further enhance the nutritional benefits from beans, there is also need to evaluate the role of complementary foods on the nutritional and healthful contribution of beans, as well as promoting this knowledge and encouraging consumption of meal combinations that maximize balanced nutrient intake and enhance bioavailability. Key complementary foods commonly grown and consumed in Kamuli District (the study area in Uganda) have been identified as green vegetables, especially amaranth and citrus fruits. They are envisaged to enhance protein quality and mineral bioavailability of beans. This objective will seek to evaluate adoption and nutritional/health impact of practices aimed at maximizing nutritional contribution of beans, especially for nutritionally vulnerable populations. It is hypothesized that dietary complementation of beans with fruits and vegetables will improve the nutritional benefits to vulnerable individuals.

Phase I results indicate that new high yielding bean varieties were not necessarily of optimal nutrition, consumer acceptability and processability into high quality value added products. This

clearly indicated a disparity between breeding for agronomic hardiness versus end user requirements. Thus, Phase II of this project will aim to bridge the gap between the breeder and the consumer by clearly defining consumers' sensory, culinary and processing requirements and informing national breeding programs. It is hypothesized that interfacing with bean breeders and providing critical information on expectations of end users (consumers and processors) will lead to development of sustainable and consumer acceptable varieties; and with potential for niche markets as high quality value added products.

Besides utilization by communities, the project will also partner with the private business sector to promote adoption of value addition to beans as a way of increasing consumption and creating market outlets. Bean varieties that are high yielding and stress resistant but have low consumer acceptability and are prone to being hard-to-cook were selected for value addition and product development in phase I. In phase II, processing protocols developed in phase I will be refined and up-scaled through the Technology Business Incubator (TBI) model, as a vehicle to promote technology transfer to the private sector. TBIs are effective frameworks for fostering industrial uptake of new technologies by providing 'seed' entrepreneurs with a supportive environment to help establish and develop their projects (Lalkaka 1996). It is hypothesized that by providing services (product refinement/optimization, marketing, access to funding/loans) on a 'one-stop-center' basis and enabling overhead costs to be reduced by sharing facilities, the TBI model will significantly improve the survival and growth prospects of bean processing enterprises in their early stages of development. Suitable private sector partners will be identified and linked to farmer organizations for maximum trickle down effect of value addition returns. We will also test three additional hypotheses: (1) processing of beans significantly improves its acceptability and market potential; (2) promotion of bean processing can lead to increased beans consumption; and (3) there is no significant difference between the organoleptic property of bean based products made from hard-to-cook bean varieties and the varieties less prone to that phenomenon.

Initial publication outlets for this research include the Journal of Agricultural and Food Chemistry, and the Journal of Food Science.

### **Approaches and Methods**

#### **Obj. 2a. Address Nutritional and Health Problems among Vulnerable Individuals through Increased Consumption of Beans, Bean Products, and Complementary Foods**

1. Document prevalence of diet-related health problems, both over and under-nutrition among vulnerable groups, which can be addressed through increased bean consumption.
2. Document consumer levels and trends of buying and using beans.
3. Identify accessible and affordable complementary foods (grain and vegetable amaranth, citrus, mango, etc.) to increase nutritional benefits of consuming beans.
4. Train rural populations (Rwanda, then Uganda) to utilize simple 'cold extrusion' technology (using hand-operated presses) at community level with processed (sprouted, fermented) beans and maize.
5. Determine acceptability and nutritional benefits (based on anthropometry and morbidity) from consuming bean based products by the nutritionally vulnerable, including bean based

weaning foods and extruded snack products.

6. Develop and implement appropriate extension information education and communication (IEC) approaches (nutrition, processing of bean based products) for rural community nutrition and health workers to accelerate and multiply positive rural development impacts.

**Benchmarks**

Oct. 2011 – Mar. 2012

- Studies on acceptability and nutritional benefits (anthropometry) of bean based weaning foods initiated in Uganda and Rwanda.
- IEC materials translated into local languages

Apr. – Sept. 2012

- Results of weaning food feeding trials analyzed
- Data from acceptability and nutritional benefits studies analyzed
- Extension information, education, and communication approaches for popularization of bean products finalized
- Community-based dissemination field days held in Uganda and Rwanda

**Obj. 2b. Analyze Culinary Properties, Sensory Characteristics, and Consumer Acceptability of Improved Varieties of Beans**

1. Identify desirable culinary properties and sensory characteristics of beans in different regions
2. Analyze culinary properties of improved bean varieties in Uganda (NaCRRI) and Rwanda (ISAR)
3. Analyze sensory characteristics (color, texture, taste, flavor, etc.) and consumer acceptability of improved bean varieties in Uganda (NaCRRI) and in Rwanda (ISAR)
4. Liaise with national bean breeding programs to match consumer requirements with culinary and sensory characteristics of new varieties

**Benchmarks**

Oct. 2011 – Mar. 2012

- Culinary traits and sensory characteristics of improved bean varieties documented
- Communicate culinary traits and sensory characteristics results to national breeding programs

Apr. – Sept. 2012

- Strategy to promote current and improved varieties developed with national breeding programs
- Strategy to promote improved bean varieties initiated

**Obj. 2c. Incorporate Insights from Analysis of Private Food Processing Industry regarding Development and Commercialization of Bean-based Products**

1. Identify approaches and methods that enable farmers' associations to establish and strengthen links with the private food processing industry in Uganda, taking lessons from experiences in the U.S.
2. Engage private sector actors in developing protocols for value-added bean products (including utilizing the semi-processed bean flour).
3. Develop and evaluate marketing strategies regarding consumers' nutritional awareness and utilization, and work with private sector processors, distributors and retailers to promote bean products for purchase.
4. Support commercialization of bean products through technology and business incubation in the Makerere University, Department of Food Science, Technology and Business Incubation Centre.

**Benchmarks**

**Oct. 2011 – Mar. 2012**

- Infrastructure to support commercialization of bean products at Makerere University developed
- Developed protocols for value-added bean products up-scaled in partnership with private sector
- Marketing strategies for processed bean products developed and evaluated

**Apr. – Sept. 2012**

- Process to document Industrial adoption and market performance of bean based value added products initiated
- Process to evaluate impact of industrial adoption of value added bean products on farmers' livelihoods initiated

**Target Outputs and Developmental Outcomes**

Documentation and analysis of culinary properties and sensory characteristics of current and new bean varieties will be of great value to national bean breeding programs. We will document and publicize nutritional analysis of harvested beans and effects of processing methods, including the rural-based cold extrusion method. Our initial feeding trials will be evaluated in terms of participation and dietary impact, and the results published. In rural communities, we will conduct follow-up training and evaluation regarding adoption of promoted food preparation practices and use of complementary foods. Information on shelf-stability and consumer acceptability of the developed bean flour-based products and extruded products will be of interest to processors and retailers. Private sector processors will gain from the bean processing protocols that will be finalized and disseminated. Rural farmers will gain through project activities which will enable farmers' associations to establish and strengthen links with the private food processing industry.

**Objective 3:** To Identify Solutions for Constraints to Increased Marketing & Consumption.

**Collaborators**

*Makerere University* (MAK - Kampala, Uganda)

Paul Kibwika, Dept. of Agricultural Economics & Agribusiness, pkibwika@agric.mak.ac.ug

Gabriel Elepu, Dept. of Agricultural Economics & Agribusiness, elepu@agric.mak.ac.ug

*Volunteer Efforts for Development Concerns* (VEDCO - Kampala, Uganda)

Agnes Nakimuli, Eastern Region Program, anakimuli@yahoo.com

*Iowa State University* (ISU - Ames, Iowa)

Helen Jensen, Department of Economics, hhjensen@iastate.edu

Robert Mazur, Department of Sociology, rmazur@iastate.edu

**Rationale**

Although there has been an increase in bean market participation among households, bean production has tended to be for domestic consumption rather than for commercial purposes (currently 42%). Improved crop management practices and technologies stimulate market participation, as they effectively increase the quantity available for sale. Basic value addition activities such as proper drying, sorting, grading, storage, the absence damage or insect infestation, help improve quality and price. When farmers achieve higher prices, they increase marketing. The local village markets have been important concentration/assembly and dispersion points for beans, and where market prices become formalized. Still, most (79%) farmers who sell beans do so at farm gate rather than directly in markets. Transactions costs, costs associated with gathering information, travel, making sales or purchases, can impede the development of markets and marketing activities. Market participation by smallholder farmers is affected by transaction costs, especially distance and access to useful market information. Since households headed by women tend to market smaller quantities of beans, there is value in increasing program and policy support for women to participate in marketing. Our results to date suggest the value of increasing access to market information systems that are reliable and timely, improving transportation networks for marketing, strengthening farmer groups, and establishing associations that can effectively engage in collective marketing with various types of buyers, including industry.

To foster successful collective marketing activities as production increases, our Phase 2 activities focus on strengthening farmer groups and associations, and supporting development of value chain partnerships. These strategies reduce the costs of marketing transactions, including acquisition of market information. It is expected that these efforts will increase the number of farmers engaged in commercialization of beans, increase the quantity of beans sold, and increase the income and associated livelihoods benefits that small scale farmers derive from production and sale of beans. We expect that farmers participating in this project, as well as other VEDCO assisted farmers, will play important leadership roles in emerging associations.

**Approaches and Methods**

Obj. 3a. Assess capabilities and needs of farmer groups and associations

1. Assess institutional status of existing farmer groups and associations
2. Design strategies to build strong farmers' marketing associations

**Benchmarks**

Oct. 2011 – Mar. 2012

- n/a

Apr. – Sept. 2011

- n/a

Obj. 3b. Strengthen Farmers' Successful Engagement in Value Chain Development

1. Convene periodic value chain platform meetings
2. Establish product portfolio appropriate for target markets
3. Improve market information systems
4. Training farmers' associations in agri-business management skills

**Benchmarks**

Oct. 2011 – Mar. 2012

- Farmers trained in developing business plans, pricing, packaging and record keeping
- Market information system enhancements initiated

Apr. – Sept. 2012

- Progress of farmer groups in collective marketing evaluated
- Comprehensive business plans developed
- Strategic value chain partnerships established

**Target Outputs and Developmental Outcomes**

Farmers will benefit significantly from improved market information systems, establishing small scale bulking centers, processing and extrusion as value addition income earning activities, and increased capabilities to engage with value chain actors regarding production, bulking, price negotiation, and targeting production. Consumer awareness and interest in bean products is expected to increase among households, students, and others. The private business sector will benefit by through product development, commercialization, and access to new markets.



**Objective 4: Capacity Building**

To Increase the Capacity, Effectiveness and Sustainability of Agriculture Research Institutions that Serve the Bean Sector in Uganda and Rwanda

**Collaborators**

*Makerere University (MAK - Kampala, Uganda)*

Dorothy Nakimbugwe, Dept. of Food Science & Technology,  
dnakimbugwe@agric.mak.ac.ug, dnakimbugwe@gmail.com

John Muyonga, Dept. of Food Science & Technology, muyongaj@agric.mak.ac.ug

Paul Kibwika, Dept. of Agricultural Economics & Agribusiness, pkibwika@agric.mak.ac.ug

Gabriel Elepu, Dept. of Agricultural Economics & Agribusiness, elepu@agric.mak.ac.ug

*National Crops Resources Research Institute (NaCRRI - Kampala, Uganda)*

Michael Ugen, Beans Programme, m.ugen@naro-ug.org, michaelugen@yahoo.com

Michael Otim, Entomology Department, otim\_michael@yahoo.com

*Kigali Institute of Science and Technology (KIST-Kigali, Rwanda)*

Hilda Vasanthakaalam, Dept. of Food Science & Technology, hildajeya@hotmail.com,  
h.vasanthak@kist.ac.rw

*Iowa State University (ISU - Ames, Iowa)*

Robert Mazur, Center for Sustainable Rural Livelihoods, Iowa State University, rmazur@iastate.edu

Mark Westgate, Department of Agronomy, westgate@iastate.edu

Suzanne Hendrich, Department of Food Science & Human Nutrition, shendric@iastate.edu

Patricia Murphy, Department of Food Science & Human Nutrition, pmurphy@iastate.edu

Manju Reddy, Department of Food Science & Human Nutrition, mbreddy@iastate.edu

Helen Jensen, Department of Economics, hhjensen@iastate.edu

**Approaches and Methods**

- Engage students in learning appropriate theories and methods in discipline and multidisciplinary format, and applying them in their research activities
- Integrate students into research projects and research program development
- Guide development of students' research proposals and supervise their research

**Benchmarks**

Oct. 2011 – Mar. 2012

- Training M.S. students (Food Science & Technology, and Agricultural Economics and Agribusiness) at Makerere University on-going
- Training M.S. student in Food Science & Technology from Rwanda on-going
- Training Ph.D. students (Food Science & Human Nutrition, and Agronomy) at Iowa State University on-going

Apr. – Sept. 2012

- Training M.S. students at Makerere University completed
- Training Ph.D. at Iowa State University completed
- Inter-organizational learning fostered
- Preliminary results disseminated (conferences, publications, websites)

**Degree Training**

*Trainee #1*

First and Other Given Names: Gerald

Last Name: Sebuwufu

Citizenship: Ugandan

Gender: Male

Degree Program for training: Ph.D.

Program Areas or Discipline: Agronomy

Host Country Institution to Benefit from Training: National Crops Resources Research Institute, Uganda

University to provide training: Iowa State University

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

Supervising CRSP PI: Mark Westgate

Start Date: August 2008

Projected Completion Date: August 2012

Type of CRSP Support (full, partial or indirect): Partial

If providing Indirect Support, identify source(s) of leveraged funds: Iowa State University

Amount Budgeted in Workplan, if providing full or partial support: \$47,298

Direct cost: \$39,106

Indirect cost: \$8,192

U.S. or HC Institution to receive CRSP funding for training activity: Iowa State University

*Trainee #2*

First and Other Given Names: Martin

Last Name: Mutambuka

Citizenship: Ugandan

Gender: Male

Degree Program for training: Ph.D.

Program Areas or Discipline: Food Science and Human Nutrition

Host Country Institution to Benefit from Training: Makerere University, Uganda

University to provide training: Iowa State University

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

Supervising CRSP PI: Suzanne Hendrich

Start Date: January 2009

Projected Completion Date: May 2012

Type of CRSP Support (full, partial or indirect): Partial

If providing Indirect Support, identify source(s) of leveraged funds: Iowa State University

Amount Budgeted in Workplan, if providing full or partial support: \$43,114

Direct cost: \$35,563

APPENDIX C Phase II FY 2012 Workplan

Indirect cost: - \$7,551

U.S. or HC Institution to receive CRSP funding for training activity: Iowa State University

*Trainee #3*

First and Other Given Names: TBD

Last Name: TBD

Citizenship: TBD

Gender: TBD

Degree Program for training: Ph.D.

Program Areas or Discipline: Sociology or Economics

Host Country Institution to Benefit from Training: Makerere University, Uganda

University to provide training: Iowa State University

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

Supervising CRSP PI: Robert Mazur

Start Date: August 2011

Projected Completion Date: August 2012

Type of CRSP Support (full, partial or indirect): Partial

If providing Indirect Support, identify source(s) of leveraged funds: Iowa State University

Amount Budgeted in Workplan, if providing full or partial support: \$26,491

Direct cost: \$22,012

Indirect cost: \$4,479

U.S. or HC Institution to receive CRSP funding for training activity: Iowa State University

*Trainee #4*

First and Other Given Names: Marie Rose

Last Name: Kambabazi

Citizenship: Rwanda

Gender: Female

Degree: M.Sc.

Discipline: Food Science & Technology

Host Country Institution to Benefit from Training: Kigali Institute of Science and Technology - Rwanda

University to provide training: Makerere University

Supervising CRSP PI: Dorothy Nakimbugwe

Start Date: August 2010

Project Completion Date: August 2012

Training Status: Active

Type of CRSP Support (full, partial or indirect): Partial (Category 2b)

*Trainee #5*

First and given names: Catherine Tamale

Last name: Ndagire

Citizenship: Ugandan

Gender: Female

Degree program for training: M.Sc.

Program areas / Discipline: Food Science & Technology

Host Country Institution to benefit from training: Makerere University, Uganda

University to provide training: Makerere University

Supervising CRSP PI: Dorothy Nakimbugwe

Start date: August 2009

## APPENDIX C Phase II FY 2012 Workplan

Project completion date: May 2011  
Type of CRSP Support (full, partial or indirect): Partial

### *Trainee #6*

First and given names: George  
Last name: Jjagwe  
Citizenship: Ugandan  
Gender: Male  
Degree program for training: M.Sc.  
Program areas / Discipline: Ag. Economics & Agribusiness *or* Ag. Extension & Education  
Host Country Institution to benefit from training: Makerere University, Uganda  
University to provide training: Makerere University  
Supervising CRSP PI: Dorothy Nakimbugwe  
Start date: August 2009  
Project completion date: August 2011  
Type of CRSP Support (full, partial or indirect): Partial

### **Contribution of Project to Target USAID Performance Indicators**

- Six scientists will undergo degree training (two female, three male) during this budget cycle at Makerere University (three M.S.) and Iowa State University (three Ph.D.).
- We expect 67 farmers (56 female, 11 male) to participate in advanced training regarding production, harvesting, and post-harvest methods in Uganda.
- Important technologies and management practices that are under research or field testing are:
  - Protocols for matching bean varieties with agro-ecological regions and growing conditions (soil nutrients, amendments, and moisture) for optimum physiology (plant growth and development) and yield (seed number, size, and nutrient composition)
  - Post-harvest handling and storage training techniques being adapted and further development, incorporating results of project research
  - Protocols for producing bean flour, extruded bean snack and extruded instant bean flour
  - Recipes utilizing bean flour
  - Protocols for bean flour-based products
  - Improved market information system
  - Marketing plans for farmers and farmer organizations
- We expect these approaches to be at or near readiness for transfer for use by Host Country farmers or researchers during this phase of the project. We plan to demonstrate and disseminate these management practices and technologies to wider audiences.
- We expect that 67 households will benefit directly from our training and support program. The train-of-trainer approach utilized will ultimately benefit many more farm households.
- Two agricultural enterprises will benefit from the increased volume of product marketed and available for processing.
- We expect that all six participating producer organizations, two marketing associations, and an additional six producer organizations will receive useful and actionable technical assistance. All of these organizations have a significant or majority of women members.
- We expect that four Host Country partner organizations/institutions will benefit from these activities (two universities, one NARO, and one NGO).
- We anticipate that an additional 15 acres will be cultivated using improved technologies by during this phase of the project.

### **Target Outputs**

- Reports regarding recommended practices for crop production, and both pre- and post-harvest management procedures to improve quality of harvested beans and increase yields
- Training manuals (for VEDCO's Rural Development Extensionists, farm group members, etc.)
- Stronger links between farmers groups and associations to diverse types of buyers, including the food processing industry
- Reports of superior processing methods to protect protein and carbohydrate digestibility
- Recipes for widespread use, including for nutritionally vulnerable people
- Protocol for bean flour processing promoted for commercialization
- New value-added bean products designed for identified consumer markets

### **Engagement of USAID Field Missions**

USAID agricultural initiatives in Africa seek to build economies, establish and enhance partnerships, and harness science and technology to meet the needs of the vulnerable and impoverished. This project will help USAID meet its goals for improved well-being in Uganda and Rwanda through agricultural activities designed to promote best practices, develop and market nutritious bean-based value-added products, and successfully link farmers and producers to markets. We will meet periodically with Mission staff devoted to realization of their agriculture-related strategic objectives (SO 617-007 Economic Growth, Agriculture and Trade in Uganda) and SO 696-007 (Economic Growth, Agriculture and Trade) in Rwanda. We will also invite them to project-sponsored activities and share results of our research-development activities.

### **Networking Activities with Stakeholders**

To realize project objectives and actively promote institutionalization of positive impacts of research project finds and impacts, we will effectively engage diverse key stakeholders throughout the project and in annual workshops:

- Work with farmers, groups and associations to understand local livelihoods, agronomic practices, their previous and current linkages with various types of institutions and service providers (governmental and non-governmental), private sector traders, and transporters
- Interact regularly with various types of institutions and service providers (governmental and non-governmental), private sector traders, transporters, small, medium and large scale processors and distributors etc., to gain and maintain appropriately broad perspectives on key issues in the value chain, benefit from their special expertise, and build consensus and collaborative relationships for high levels of continued success
- Hold periodic planning and review meetings to involve all partners so that challenges and constraints are discussed and strategies to deal with them developed together
- Facilitate broad involvement in research design, data collection instruments and processes, and data analysis
- Share results from various stages of the project to encourage constructive criticism and strengthen usefulness, impact and sustainability of intervention results
- Involve other developmental partners with similar interests for complementarily and dissemination of results to other areas and countries
- Project results will be shared with the research and developments communities in Uganda, Rwanda and the region through workshops and various types of publications

### **Leveraging of CRSP Resources**

- In addition to the direct collaboration between food scientists in Uganda, Rwanda and the U.S. in this project, link work done by NaCRRRI and ISU with ISAR (Institut des Sciences Agronomiques du Rwanda) and MSU through a linkage with the Pulse CRSP project directed by James D. Kelly
- Iowa State University is contributing to partial support for two Ph.D. students from Uganda
- Explore bases for possible collaboration with relevant USAID-funded projects in Uganda and Rwanda, as well as other relevant projects in these countries
- Identify, with Mission staff, the potential for an Associate Award
- Explore possibilities of funding from members of the bean producer and processor industry
- Work to identify agencies that may fund related research, training and outreach and prepare proposals as appropriate

**Dry Grain Pulses CRSP  
Research, Training and Outreach Workplans  
(October 1, 2011 - September 28, 2012)**

**FY 2012 PERFORMANCE INDICATORS  
for Foreign Assistance Framework and the Initiative to End Hunger in Africa (IEHA)**

**Project Title:** Enhancing Nutritional Value and Marketability of Beans through Research and Strengthening Key Value Chain Stakeholders in Uganda and Rwanda

**Lead U.S. PI and University:** Robert Mazur, Iowa State University

**Host Country(s):** Uganda, Rwanda

<b>Output Indicators</b>	<b>2012 Target (Oct. 1, 2011 - Sept. 28, 2012)</b>	<b>2012 Actual</b>
<b>Degree training: Number of individuals enrolled in degree training</b>		
Number of women	2	
Number of men	3	
<b>Short-term training: Number of individuals who received short-term training</b>		
Number of women	56	
Number of men	11	
<b>Technologies and Policies</b>		
Number of technologies and management practices under research	5	
Number of technologies and management practices under field testing	5	
Number of technologies and management practices made available for transfer	15	
Number of policy studies undertaken	0	
<b>Beneficiaries</b>		
Number of rural households benefiting directly	67	
Number of agricultural firms/enterprises benefiting	2	
Number of producer and/or community-based organizations receiving technical assistance	16	
Number of women organizations receiving technical assistance	16	
Number of HC partner organizations/institutions benefiting	4	
<b>Developmental outcomes</b>		
Number of additional hectares under improved technologies or management practices	15	

**Dry Grain Pulses CRSP**  
**Research, Training and Outreach Workplans**  
**(October 1, 2011 -- September 28, 2012)**

**FY 2012 SEMI-ANNUAL INDICATORS OF PROGRESS BY INSTITUTIONS AND TIME PERIOD**

**Project Title:**

***Enhancing Nutritional Value and Marketability of Beans through Research and Strengthening Key Value Chain Stakeholders in Uganda and Rwanda***

	<b>Abbreviated name of institutions</b>									
	<b>Iowa State</b>		<b>Makerere</b>		<b>NaCRRRI</b>		<b>VEDCO</b>		<b>KIST</b>	
	4/1/12	9/28/12	4/1/12	9/28/12	4/1/12	9/28/12	4/1/12	9/28/12	4/1/12	9/28/12
<b>Identify Benchmark Indicators by Objectives</b>										
<b>Objective 1</b>	<b>Improve Bean Yield and Quality</b>									
1a. Analyzed variety perform., fertility respon., agron./cultural controls	X				X					
1a. Assessment by farmers of variety acceptability completed		X				X		X		
1a. Report to breeders on variety performance & farmer acceptability		X				X		X		
1b. Strategies for seed production profitability & sustainability assessed	X				X		X			
1b. Extension guide for CBSP of beans finalized	X				X		X			
1b. Achievements and lessons learned from CBSP shared		X				X		X		
1b. Assess impact of CBSP on seed systems in Kamuli district		X				X		X		
1b. Successful strategies for CBSP profitability & sustainability promoted		X				X		X		
1c. Extension materials for drying, threshing, and storage finalized	X				X		X			
1c. Barriers to adoption of storage techniques identified & addressed	X				X		X			
1c. Follow up training on solarization & new storage techniques					X		X			
1c. Adoption of drying, threshing, and storage techniques assessed		X				X		X		
1d. Training-of-trainers in bean production initiated					X		X			
1d. Training modules compiled into a document and published					X		X			
1d. Final training of all trainers conducted		X				X		X		
1d. Two farmer field days held (one in each sub-county)		X				X		X		
1d. Project findings shared through workshops and publications		X				X		X		
1d. Scaling up constraints and resources needed determined		X				X		X		
<b>Objective 2</b>	<b>Enhance the Nutritional Value and Appeal of Beans</b>									
2a. IEC materials translated into local languages			X				X		X	
2a. Extension info., education, & communic. approaches finalized		X		X				X		X
2a. Community-based dissemination field days held				X				X		X
2b. Culinary traits & sensory char. of improved varieties documented	X		X						X	
2b. Communicate culinary traits & sensory char. to breeders	X		X		X				X	
2b. Strategy developed to promote varieties w/ breeding programs		X		X		X				X
2b. Strategy initiated to promote improved bean varieties with public		X		X		X		X		X
2c. Infrastr. to support commercializ. of products at Makerere developed			X							



APPENDIX C FY 12 Semi-Annual Indicators of Progress

2c. Developed protocols up-scaled with private business sector	X		X						
2c. Marketing strategies for bean products developed and evaluated	X		X						
2c. Process to document industrial adoption & market perform. initiated				X					
2c. Process to eval. impact of indust. adopt. on farmer livelihoods initiated		X		X				X	
<b>Objective 3</b>	<b>Increase Marketing and Consumption of Beans and Bean Products</b>								
3b. Farmers trained in business plans, pricing, packaging, records			X				X		
3b. Market information system enhancements initiated							X		
3b. Progress of farmer groups in collective marketing evaluated		X		X				X	
3b. Comprehensive business plans developed		X						X	
3b. Strategic value chain partnerships established		X		X				X	
<b>Objective 4</b>	<b>Incr. Capacity, Effectiveness &amp; Sustainability of Ag. Research Institut.</b>								
4. Training M.S. students (FTN & Extension-Innov.) at MAK completed				X					
4. Training M.S. student in FST from Rwanda on-going				X					X
4. Training Ph.D. students at Iowa State University completed		X							
4. Inter-organizational learning fostered	X	X	X	X	X	X	X	X	X
4. Results disseminated (conferences, publications, websites)		X		X		X		X	X

<b>Name of the PI responsible for reporting on benchmarks</b>	<b>Robert Mazur</b>	<b>Dorothy Nakimbugwe</b>	<b>Michael Ugen</b>	<b>Henry Kizito Musoke</b>	<b>Hilda Vasanthakaalam</b>
---	---------------------	---------------------------	---------------------	----------------------------	-----------------------------

<b>Signature/Initials:</b>					
----------------------------	--	--	--	--	--

Date: \_\_\_\_\_

**Dry Grain Pulses CRSP  
Research, Training and Outreach Workplans  
(October 1, 20011 - September 28, 2012)**

**FY 2012 PERFORMANCE INDICATORS  
for Feed the Future**

**Project Title:** Enhancing Nutritional Value and Marketability of Beans through Research and Strengthening Key Value Chain Stakeholders in Uganda and Rwanda

**Lead U.S. PI and University:** Robert Mazur, Iowa State University  
**Host Country(s):** Uganda, Rwanda

Output Indicators	2012 Target	2012 Actual
	(October 1, 2011-Sept 28, 2012)	

Degree Training: Number of individuals enrolled in long-term degree training		
Number of women	3	
Number of men	3	

Short-term Training: Number of individuals who received short-term training		
Number of women	300	
Number of men	100	

Technologies and Policies		
Number of technologies and management practices under research	5	
Number of technologies and management practices under field testing	5	
Number of technologies and management practices made available for transfer	10	
Number of policy studies undertaken	1	

Beneficiaries:		
Number of rural households benefiting directly from CRSP interventions - Female Headed households	130	
Number of rural households benefiting directly from CRSP interventions - Male Headed households	720	
Number of agriculture-related firms benefitting from CRSP supported interventions	5	
Number of producer organizations receiving technical assistance	3	
Number of trade and business associations receiving technical assistance	3	
Number of community-based organizations receiving technical assistance	80	
Number of women organizations receiving CRSP technical assistance	80	
Number of public-private partnerships formed as a result of CRSP assistance	2	
Number of HC partner organizations/institutions benefiting	4	

Developmental outcomes:		
Number of additional hectares under improved technologies or management practices as a result of CRSP technical assistance	350	

<b>Dry Grain Pulses CRSP : THIRD PERIOD (FY12)</b>						
Enhancing Nutritional Value and Marketability on Beans through Research and Strengthening Key Value Chain Stakeholders in Uganda and Rwanda						
10/01/11 - 09/28/12						
Institution Name	U.S. Institution	U.S. for Host Country	HC or U.S. Institution (1)	HC or U.S. Institution (2)	HC or U.S. Institution (3)	HC or U.S. Institution (4)
	ISU	0	Makerere U.	NaCRRRI	VEDCO	Kigali Inst.
<b>a. Personnel Cost</b>						
Salaries	\$11,237.00	\$14,309.00	\$16,775.00	\$4,400.00	\$13,200.00	\$4,125.00
Fringe Benefits	\$1,151.00	\$1,903.00				
<b>b. Travel</b>	\$18,989.00	\$12,350.00	\$4,875.00	\$7,810.00	\$2,500.00	\$2,563.00
<b>c. Equipment (\$5000 Plus)</b>	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>d. Supplies</b>	\$5,254.00	\$0.00	\$2,250.00	\$2,000.00	\$11,252.00	\$4,500.00
<b>e. Training</b>						
Degree	\$1,869.00	\$4,822.00	\$8,750.00			
Non-Degree						
<b>f. Other</b>	\$250.00	\$0.00	\$3,500.00	\$900.00	\$250.00	\$750.00
<b>g. Total Direct Cost</b>	<b>\$38,750.00</b>	<b>\$33,384.00</b>	<b>\$36,150.00</b>	<b>\$15,110.00</b>	<b>\$27,202.00</b>	<b>\$11,938.00</b>
<b>h. Indirect Cost</b>	\$9,589.00	\$7,426.00	\$3,615.00	\$1,511.00	\$2,720.00	\$1,194.00
<b>i. Indirect Cost on Subcontracts (First \$25000)</b>						
<b>j. Total Indirect Cost</b>	\$9,589.00	\$7,426.00	\$3,615.00	\$1,511.00	\$2,720.00	\$1,194.00
<b>Total</b>	<b>\$48,339.00</b>	<b>\$40,810.00</b>	<b>\$39,765.00</b>	<b>\$16,621.00</b>	<b>\$29,922.00</b>	<b>\$13,132.00</b>
<b>Grand Total</b>	<b>\$188,589.00</b>					

	Amount	Percentage
Total direct cost budgeted for U.S. institution(s)	\$ 38,750.00	23.84%
Total direct cost budgeted for H.C institution(s)	\$ 123,784.00	76.16%

Cost Share	U.S. Institution	U.S. for Host Country	HC or U.S. Institution (1)	HC or U.S. Institution (2)	HC or U.S. Institution (3)	HC or U.S. Institution (4)	Total
In-kind	\$23,621.00						\$ 23,621.00
Cash							\$ -
<b>Total</b>	<b>\$ 23,621.00</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 23,621.00</b>

Attribution to Capacity Building							
Percentage of effort	91.59%	100.00%	90.87%	83.45%	95.40%	92.14%	93.18%
Amount corresponding to effort	\$44,273.69	\$40,810.00	\$36,134.46	\$13,870.22	\$28,545.59	\$12,099.82	\$175,733.78

U.S Institution PI: Dr. Robert Mazur, Professor of Sociology, Iowa State University