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

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Abstract of Research Achievements and Impacts
Common beans provide a strategic opportunity to meet Millennium Development Goal targets, but many problems confront producers, marketers and consumers in Africa. Through the Center for Sustainable Rural Livelihoods program in Uganda, food security and market readiness have increased from 9% to 77% in three years among 800 farm households which produce an increasing variety of crops. In this project, the collaborating institutions in Uganda and Rwanda have three strategic aims to enhance nutritional value and marketability of common beans: to improve harvested bean quality and yields, enhance nutritional value and appeal of beans through appropriate handling and processing, and to increase marketing and consumption of beans and bean products. Under the first strategic objective (improving harvested bean quality and yields), PRA guides/tools for understanding knowledge, attitudes, and practices (KAPs) have been developed for key informant interviews and focus group discussions with community-based groups; participatory rural appraisals were conducted; KAPs were documented and analyzed; production and quality constraints have been identified; certified seeds of bean varieties are being established; agricultural research locations were visited by the US team; farmer cooperators have been selected and been mobilized to participate in research and training. For the second strategic objective (enhancing nutritional value and appeal of beans through appropriate handling and processing), accomplishments include assessment of KAPs, prioritization of post-harvest losses, and identification of initial recipes of some of the bean products. Collaborative work for the third strategic objective (to increase marketing and consumption of beans and bean products) actions has involved engaging local stakeholders in identification of producers’ marketing constraints; rural consumer demand and preferences for beans have been characterized; qualities of beans corresponding to farmers’ preferences determined, and nutrition awareness levels of benefits of bean consumption have been determined. For the fourth strategic objective (collaboration), increasing capacity, and effectiveness and sustainability of the universities have been effected. Accomplishments to date include defining the roles of key partners, formalizing partnerships, initiating training of 3 M.S. students at MAK and 2 Ph.D. students at ISU, and active multi-institutional collaboration in all aspects.

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 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 remains 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) using a sustainable livelihoods approach has increased food security and market readiness from 9% to 77% among 800+ farm households in the past 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% sell some in 2007. The SL approach livelihood 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 yield improving technologies result in beans (Aim 1) with better nutritive value or processing characteristics (Aim 2) is an important under-researched issue in this region. Improved linkages to emerging markets is also essential (Aim 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 (bean stem maggots, aphids, storage 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 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 April 1, 2008 - September 30, 2009

Objective 1: To Improve Harvested Bean Quality and Yields.

Approaches and Methods:
Objective 1a: Determine and Prioritize Key Production Constraints of Six Priority Bean Varieties

Approaches and Methods

- Conduct participatory rural appraisals (PRA) to determine current local knowledge, attitudes and practices related to planting, weeding, soil fertility/nutrient management, and mitigation/control strategies for diseases and pests in four varieties of common bean in Kamuli district, Uganda, and two common bean varieties in Nyagatare district, Rwanda
- Prioritize constraints to increased production
- Prioritize constraints to improved quality

Benchmarks

Apr. – Sept. 2008

- Participatory rural appraisal guides/tools developed
- Participatory rural appraisal conducted
- Production constraints prioritized
- Quality constraints prioritized


- Knowledge, attitudes and practices documented
- KAPs analyzed and report written

Objective 1b. Improve Quality and Yields of Beans through Evaluation of Better Production Practices

Approaches and Methods

- Evaluate yield and quality of the beans (NABE 6 [white dry bean, small seeded] and K 131 [carrioca dry bean] and K 132 and NABE 4 [red mottled beans] in Kamuli and Luweero districts in Uganda, and RWR 1668 and RWR 2245 in Nyagatare district in Rwanda)
- Evaluate practical management strategies to increase and stabilize seed yield and seed quality in participatory field research
- Carry out on farm demonstrations for farmers on better agronomic practices
Benchmarks

Apr. – Sept. 2008
- Availability of certified seeds for red and mottled bean varieties established
- Locations and farmer cooperators selected for research and demonstration
- Site and location visited by US team

- Recommended irrigation and fertigation practices for profitable yields defined
- Field sampling and laboratory procedures to quantify bean quality established
- Trials planted, managed and harvested
- Seed samples submitted for analysis
- Yields under standard production practices from first crop season quantified and analyzed
- Crop production and soil management strategies evaluated
- Harvested bean quality for each demonstration site and experimental treatment quantified

Apr. – Sept. 2009
- Yield and quality of beans harvested from second crop season quantified and analyzed
- Impacts on bean quality from improved harvest and storage techniques documented

Objective 1c: Strengthen Farmers’ Collective Capabilities to Learn and Share Innovative Practices

Approaches and Methods: Promote adoption of recommended practices to increase yield of quality beans through RDE and farmer training, and facilitating access to superior varieties and priority inputs

Benchmarks

Apr. – Sept. 2008
Selected farmers mobilized to participate in training in better management and evaluation of research process and outputs

- Farmer and extension training manuals developed for use by trainers (researchers and extension agents)
- Farmer knowledge on participatory research methodologies/designs enhanced for better trial implementation

Apr. – Sept. 2009
Recommended research results incorporated in RDE training procedures and promotion protocols

Results, Achievements and Outputs of Research:
Objective 1a: Determine and Prioritize Key Production Constraints of Six Priority Bean Varieties
- PRA guides/tools for knowledge, attitudes, and practices (KAPs) developed
  - Key Informant Interviews
    - General information (sub-county, parish, village)
    - Livelihood (education, farm size and land tenure status, top five crops, bean production and marketing, income, crop husbandry activities and challenges, and animals reared)
    - Bean production (reason for bean growth, varieties, pests and diseases)
    - Harvesting (bean maturity, drying process, challenges)
Storage (how, where, pests, pest control, and other causes of storage loss)
Processing (production/consumption rates, different bean processes, challenges,
Consumption patterns (production, eating habits, shelf life, and price)
Marketing (allocations, location, value addition activities, transportation, income use)

Focus Group Discussion (FGD) with community-based groups involved in growing, utilization and marketing of beans

Group 1: Bean production (why, which varieties, input methods, values, barriers, opportunities, trends, extension information sources, credit availability/accessibility)
Group 2: Bean utilization and value-addition (who consumes, how often, preparations, varieties consumed, desired attributes, barriers, opportunities, and products made)
Group 3: Bean marketing (who makes decisions, who markets, arrangements, prices, community inquiry, variety successes, desirable attributes, barriers and opportunities)

- Participatory rural appraisals conducted, data collected and analyzed
- Local agronomic knowledge, attitudes and practices documented, analyzed and report written
- Production constraints and some solutions identified (listed in order of importance)
  - Constraints: unreliable or erratic weather conditions, small land holdings, limited access to seeds, pests and diseases, lack of capital to allow for commercialization of beans, declining soil fertility due to bad eco-management, poor storage facilities, poor drying facilities which result in losses in quality and quantity in storage, and poor post-harvest handling methods
  - Solutions: crop rotation, early and randomized planting, use of organic pesticides, providing subsidized inputs
- Quality constraints prioritized
  - Lack of methods to monitor humidity for safe and longer storage
  - Poor storage facilities leave beans vulnerable to pests, diseases, and contamination
  - Most farmers lack the knowledge and capacity to properly handle pests and diseases both in the field and in storage, resulting in heavy losses in quality and quantity

Objective 1b: Improve Quality and Yields of Beans through Evaluation of Better Production Practices
- Certified seeds of bean varieties established
  - Varieties most commonly grown and with characteristics suitable for the project include K 131, K 132, NABE 4, NABE 6
  - K 131 is a carioca type bean (Kazibwe), very resilient to harsh environmental conditions and performs relatively well under extreme environments. This variety is deemed good for food security and can be a potential for flour-based recipe development. However, farmers in most places do not appreciate its color and small
seed size, and they claim it hardens when stored even for a short time period - therefore requiring more time and fuel for cooking.

- K 132 (Nambele Onuwanvu) and NABE 4 (Nambele) are red mottled beans popularly grown in most parts of Uganda including Kamuli (10% and 22% of farmers growing K 132 and NABE 4, respectively). They are preferred for their large seed size, desired marker qualities, short cooking time compared to K 131 and shorter maturity period.
- NABE 6 (Obudandali Obweru) is small seeded, white in color, matures early and has good markets in urban areas.
- In addition to the above 4 varieties selected for on-farm trials in Kamuli, NABE 2 (Obudandali Obudugavu) is black, small seeded; and several other land races are also grown by farmers in the area.
- NaCCRI is planting 20 kg of K 131, 40 kg of K 132, 8 kg of NABE 2, 30 kg of NABE 4, and 15 kg of NABE 6, respectively. The harvest from this season’s multiplication efforts will be used for field trials in Kamuli during the first growing season of 2009.

- Livestock were identified as an important component in rural household livelihoods
  - Cattle (49%), goats (45%), pigs (39%), and chicken (34%)

- Locations and farmer cooperators selected
  - Uganda, Kamuli District (total of 85 respondents)
    - Butansi (sub-county): 21 in Naluwoli parish and 29 in Butansi parish
    - Bugulumbya (sub-county): 16 in Nawanende parish, 17 in Kasambira parish
    - 1 District Agricultural Officer (DAO) and 1 production officer
  - Rwanda, Nyagatare District (total of 32 respondents)
    - In Rwanda, research made use of an interpreter with knowledge of local farming situations, two members from CITT (Center for Innovation and Technology Transfer), and one from ISAR (Institut des Sciences Agronomiques du Rwanda)
      - one economically flourishing village
      - one poverty stricken village

- Site and locations visited by US team
  - ISU team visit in June 2008 included visits to locations in Uganda, various meetings with VEDCO, NaCCRI and MAK
  - Kamuli district was identified as the appropriate site for full project implementation; for the first phase of research, it was determined to be unnecessary to conduct field research in a second district (Mukono was also visited) as was originally anticipated.

**Objective 1c: Strengthen Farmers’ Collective Capabilities to Learn and Share Innovative Practices**

- Selected farmers mobilized to participate in training in better management and evaluation of research process and outputs
  - VEDCO and NaCRRI training took place from September 23-28, 2008 and emphasized research methodologies to prepare farmers for the coming season involvement in experimentation.

- Existing farmer and extension training manuals are being reviewed; they will be revised and supplemented for future use by trainers (researchers and extension agents) when working with farmers during the first growing season of 2009 (March – May).
Objective 2: To Enhance Nutritional Value and Appeal of Beans through Appropriate Handling and Processing

Approaches and Methods:
Objective 2a: Establish the Key Causes of Post-Harvest Losses of Beans

Approaches and Methods
- Conduct participatory rural appraisals of current knowledge, attitudes and practices (KAPs) related to pre- and post-harvest handling
- Establish the basis and magnitude of post-harvest losses associated with different stages of post-harvest handling and storage (harvesting times, threshing method, drying, storage and packaging)
- Correlate knowledge, attitudes and practices with post-harvest losses, based on both the primary information obtained during the survey and the results of laboratory analyses

Benchmarks
Apr. – Sept. 2008
- MS and PhD students admitted
- Participatory rural appraisals conducted
- Knowledge, attitudes and practices assessed

- Post-harvest losses prioritized
- Post-harvest management innovations promoted via training

Apr. – Sept. 2009
Post-harvest management innovation adoption evaluated

Objective 2b: Evaluate Impacts of Improved Post-Harvest Practices on Post-Harvest Losses in Study Sites

Approaches and Methods
- Promote adoption of recommended pre- and post-harvest handling practices that address the identified major causes to minimize post-harvest yield and quality losses
- Assess the effect of the above practices on post-harvest losses by comparing between two groups of bean farmers: one group using the recommended practices and the other group not

Benchmarks
Pre- and post-harvest losses reductions documented and analyzed

Apr. – Sept. 2009
Further loss reductions documented and analyzed

Objective 2c: Develop Protocols for Bean Products with Enhanced Nutritional and Organoleptic Properties

Objective 2c-1: Determine Digestibility and Utilization, Amino Acid Quality and Iron Bio-Availability
Approaches and Methods

- Determine nutritional and physico-chemical properties of bean varieties, and influences of agronomic and post-harvest handling practices on those properties
- Investigate the effect of pre-treatment of beans (malting, pre-soaking, roasting) on nutritional value of products.

Benchmarks

Apr. – Sept. 2008
Initial recipes identified and disseminated

- Nutritional and physico-chemical analysis initiated
- Analysis of benefits for nutritionally vulnerable people initiated

Apr. – Sept. 2009
Best processing techniques to enhance protein and carbohydrate digestibility determined

Objective 2c-2: Develop Nutrient-Dense Bean Flour and Value-Added Recipes Utilizing Developed Bean Flour

Approaches and Methods

- Develop a semi-processed bean flour using the response surface methodology using preferred bean varieties from Uganda and/or Rwanda
- Develop recipes for nutritious, value-added products, using the developed bean flour
- Determine the acceptability and shelf-life of the developed products
- Promote the recipes for uptake in communities
- Demonstrate flour preparation for participating farmers to take it up as an enterprise

Benchmarks

- Bean flour development initiated
- Protocol for semi-processed bean flour initiated

Apr. – Sept. 2009
- Acceptability data for developed products generated and analyzed
- Processing protocols for adoption by bean processors refined and promoted

Results, Achievements and Outputs of Research:

Objective 2a: Establish the Key Causes of Post-Harvest Losses of Beans

- KAPs assessed
  - Poor drying and storage facilities were identified as factors that leave beans vulnerable to pests, diseases, and contamination, resulting in losses in quality and quantity

Objective 2b: Evaluate Impacts of Improved Post-Harvest Practices on Post-Harvest Losses in Study Sites

This objective will be addressed through project activities during the next year.
Objective 2c: Develop Protocols for Bean Products with Enhanced Nutritional and Organoleptic Properties

2c-1: Determine Digestibility and Utilization, Amino Acid Quality and Iron Bio-Availability

This objective will be addressed through project activities during the next year.

2c-2: Develop Nutrient-Dense Bean Flour and Value-Added Recipes Utilizing Developed Bean Flour

This objective will be addressed through project activities during the next year.

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

Approaches and Methods:
Objective 3a: Identify Solutions to Production and Marketing Constraints Faced by Producers of Beans

Approaches and Methods
- Conduct baseline surveys of producers to generate information on production and marketing constraints, and terms of trade between farm and non-farm sectors
- Analyze value chain components and linkages to identify strengths and weaknesses
- Identify barriers and challenges farmers face in accessing emerging markets
- Initiate and facilitate farmers’ interaction with small, medium and large scale wholesale and retail enterprises to promote distribution and purchase of beans and value-added bean products
- Train farmers and farm groups to more successfully market beans
- Identify ways to improve packaging methods, packaging materials and storage conditions

Benchmarks
Apr. – Sept. 2008
- Local stakeholders and partners identified to address adoption constraints
- Producers’ marketing constraints identified

- Value chain analysis initiated
- Priorities for education and training activities developed

Apr. – Sept. 2009
Farmers trained and facilitated to improve their marketing of beans

Objective 3b: Characterize Consumer Demand and Preferences for Beans and Agro-Processed Products

Approaches and Methods: Participatory appraisals and baseline surveys of producers and consumers to determine knowledge, attitudes and practices regarding processing and human consumption of beans
Benchmarks

Apr. – Sept. 2008
Qualities of beans corresponding to farmers’ preferences determined

Consumer demand and preferences for beans characterized

Apr. – Sept. 2009
Consumer demand and preferences for bean products characterized

Objective 3c: Increase Consumer Awareness of Benefits of Consuming Beans and Value-Added Products and their Access to New Products

Approaches and Methods

- Train community members on the benefits of consuming beans
- Demonstrate value addition in beans and preparation of bean recipes to community members

Benchmarks

Apr. – Sept. 2008
Nutrition awareness levels of benefits of bean consumption determined

- Product improvement strategies identified
- Strategies and practices identified to promote consumer awareness and purchase

Apr. – Sept. 2009
- Farmers trained on benefits of bean consumption
- Community members trained on value addition and preparation of various bean recipes
- Follow-up on community trainings conducted

Results, Achievements and Outputs of Research:
Objective 3a: Identify Solutions to Production and Marketing Constraints Faced by Producers of Beans

- Local stakeholders and partners identified to address adoption constraints
  - Includes: input suppliers (sell seeds and other farming inputs to farmers including pesticides and fertilizers), producers (involved in the whole process of bean production from acquisition of the inputs to management of the crop to harvest, storage and sale of the outputs), wholesalers (very important and control the price setting mechanism in the trade [fix prices], collect produce from producers, transfer produce from one location to another, distribute grains to retailers), retailers (final point where grains reach and are accessible by the consumers), consumers (consumption of final product), and NGO’s (VEDCO and extension agents (adversary services)

- Producers' marketing constraints identified (listed in order of importance)
  - Includes: subsistence nature of bean production that hinders commercialization, low prices from traders, lack of available credit, lack of market information, poor regulatory policies in bean marketing sector, poor market structures, and lack of diversified bean products
Opportunities for value addition of beans: source of information on value addition (VEDCO), availability of near market (schools, hospitals and shops), availability of electric power in our area, collective value addition (formed groups), and chances of establishing links between farmers and market (VEDCO)

Opportunities for increased bean production
- Long experience in bean production and VEDCO trainings expected, provides the local community with a reliable resource base for the development of this industry, availability of seed and existence of two growing seasons a year and considerable favorable climatic conditions conducive for bean production, and existing local huge consumption market in institutions, world food programme and other relief agencies

Objective 3b: Characterize Consumer Demand and Preferences for Beans and Agro-Processed Products

- Rural consumer demand and preferences for beans characterized (in order of importance)
  - Good taste/flavor, early maturity period, easy to cook, high yield, market availability, and tolerance to drought and heavy rains

- Initial recipes identified
  - ‘Recipes’ used by farm household in Kamuli district were identified by the PRA’s
  - Recipes have only been developed by NaCRRRI thus far from their past participation in the development of simple bean-based recipes and collaborations with other countries and institutes

- Qualities of beans corresponding to farmers’ preferences determined (in order of importance)
  - Marketability, resistance to weather conditions, high yields, taste, storage and ability to retain quality, and growth habit (bush type is preferred because of extra labor required for staking the climbing types)

Objective 3c: Increase Consumer Awareness of Benefits of Consuming Beans and Value-Added Products and their Access to New Products

This objective will be addressed through project activities during the next year.

Explanation for Changes
Not applicable

Networking and Linkages 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

**Leveraged Funds**

Name of PI receiving leveraged funds: Mark Westgate
Description of leveraged Project: Partial support for Ph.D. student from Uganda in Agronomy
Dollar Amount: $46,089
Funding Source: ISU

Name of PI receiving leveraged funds: Robert Mazur
Description of leveraged Project: Partial support for Ph.D. student from Uganda in Food Science & Human Nutrition
Dollar Amount: $46,089
Funding Source: ISU

**List of Scholarly Activities and Accomplishments**
Not applicable

**Contribution of Project to Target USAID Performance Indicators**
No information provided

**Contribution to Gender Equity Goal**

- 62 of 87 participating farmers in the field experiments are women.
- Among the team of research scientists and professional practitioners, there are 7 women and 5 men.
- Among students receiving training and engaging in research, there are 2 women and 4 men.

**Progress Report on Activities Funded Through Supplemental Funds**

Funds are in the process of being transferred to Makerere University and the Kigali Institute of Science and Technology.

**Tables/Figures Cited in the Report**
Not applicable

**Literature Cited**
Not applicable
Capacity Building Activities: P1-ISU-1

**Degree Training:**

**Student #1**
First and Other Given Names: Cyrille  
Last Name: Syanobe  
Citizenship: Rwanda  
Gender: Male  
Degree: M.S.  
Discipline: Food Science & Technology  
Host Country Institution to Benefit from Training: Makerere University  
Training Location:  
Supervising CRSP PI: Mazur, Robert  
Start Date: 08/08  
Project Completion Date: 08/10  
Training Status: Active  
Type of CRSP Support (full, partial or indirect): Partial (Category 2b)

**Student #2**
First and Other Given Names: Gerald  
Last Name: Sebuwufu  
Citizenship: Uganda  
Gender: Male  
Degree: Ph.D.  
Discipline: Agronomy  
Host Country Institution to Benefit from Training: National Crop Resources Research Institute  
Training Location: Iowa State University  
Supervising CRSP PI: Westgate, Mark  
Start Date: 08/08  
Project Completion Date: 05/12  
Training Status: Active  
Type of CRSP Support (full, partial or indirect): Partial (Category 2b)
**Student #3**
First and Other Given Names: Geoffrey Arijole
Last Name: Nyakuni
Citizenship: Uganda
Gender: Male
Degree: Ph.D.
Discipline: Food Science & Human Nutrition
Host Country Institution to Benefit from Training: Makerere University, Uganda
Training Location: Iowa State University
Supervising CRSP PI: Hendrich, Suzanne
Start Date: 08/08
Project Completion Date: 05/12
Training Status: Discontinued
Type of CRSP Support (full, partial or indirect): Partial (Category 2b)

**Student #4**
First and Other Given Names: Aisha Nakitto
Last Name: Musaazi
Citizenship: Uganda
Gender: Female
Degree: M.S.
Discipline: Food Science & Technology
Host Country Institution to Benefit from Training: Makerere University
Training Location: Makerere University
Supervising CRSP PI: Nakimbugwe, Dorothy
Start Date: 08/08
Project Completion Date: 06/09
Training Status: Active
Type of CRSP Support (full, partial or indirect): Partial (Category 2b)
Student #5

First and Other Given Names: Simon
Last Name: Okiror
Citizenship: Uganda
Gender: Male
Degree: M.S.
Discipline: Agricultural Economics/Agribusiness

Host Country Institution to Benefit from Training: Makerere University
Training Location: Makerere University
Supervising CRSP PI: Kiiza, Barnabas
Start Date: 08/08
Project Completion Date: 06/09
Training Status: Active
Type of CRSP Support (full, partial or indirect): Partial (Category 2b)
**Project Title:** Enhancing Nutritional Value and Marketability of Beans through Research and Strengthening Key Value Chain Stakeholders in Uganda and Rwanda

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<tr>
<th>Objective</th>
<th>Improve Bean Quality and Yields</th>
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<td><strong>PRA tools for KAP study developed</strong></td>
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<td><strong>PRA conducted and data collected</strong></td>
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<td><strong>Local agronomic KAPs documented</strong></td>
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<td><strong>KAPs analyzed and reported</strong></td>
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<td><strong>Site and location visited by US team</strong></td>
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<td><strong>Irrigation/irrigation practices defined</strong></td>
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<td><strong>Farmers mobilized for training</strong></td>
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<td><strong>Extension training manuals developed</strong></td>
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<th>Benchmark Indicators by Objectives</th>
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**Objective 2:** Enhance the Nutritional Value and Appeal of Beans

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<th>Objective 3</th>
<th>Increase Marketing and Consumption of Beans and Bean Products</th>
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<tr>
<td><strong>PRA conducted &amp; KAPs assessed</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Post-harvest losses prioritized</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Post-harvest mgmt. innovations promoted</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Innovation adoption documented</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Loss reductions documented &amp; analyzed</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Recipes identified and disseminated</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Nutr./physico-chem. analysis started</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Analyzing benefits for vulnerable people</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Best processing techniques determined</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Bean flour development initiated</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Bean flour product protocols developed</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Product acceptance data generated/analyzed</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Processing protocols refined &amp; promoted</strong></td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective 4</th>
<th>Increase Capacity, Effectiveness &amp; Sustainability of Ag. Research Instit.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Partnerships developed/formalized</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Training 3 MS @ MU, initiated, ongoing</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Training 2 PhD @ ISU initiated, ongoing</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Research collaborat. (Univ., MARO, NGO)</strong></td>
<td>x</td>
</tr>
<tr>
<td><strong>Research dev., partnerships consolidated, inter-organizational learning fostered</strong></td>
<td>x</td>
</tr>
</tbody>
</table>

**Name of the PI reporting on benchmarks by institution:**

- Robert Mazur
- Dorothy Nakimbuwe
- Michael Ugen
- Henry Musoke
- Hilda Vaseentukaadari

**Name of the U.S. Lead PI submitting this Report to the MO:**

- Robert Mazur

**Signature:**

- Hilda Vaseentukaadari

**Date:** 20th Sept 2008

* Please provide an explanation for not achieving the benchmark indicators on a separate sheet.
Dry Grain Pulses CRSP  
Research, Training and Outreach Workplans  
(April 1, 2008 – September 30, 2009)  

PERFORMANCE INDICATORS/TARGETS  
for Foreign Assistance Framework and the Initiative to End Hunger in Africa (IEHA)

<table>
<thead>
<tr>
<th>Project Title:</th>
<th>Enhancing Nutritional Value and Marketability of Beans through Research and Strengthening Key Value Chain Stakeholders in Uganda and Rwanda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead U.S. PI and University:</td>
<td>Robert E. Mazur, Iowa State University</td>
</tr>
<tr>
<td>Host Country(s):</td>
<td>Uganda, Rwanda</td>
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<table>
<thead>
<tr>
<th>Output Indicators</th>
<th>2008 Target</th>
<th>2008 Actual</th>
<th>2009 Target</th>
<th>2009 Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree Training: Number of individuals who are receiving (or have received) degree training</td>
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<td></td>
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<tr>
<td>Number of women</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
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<tr>
<td>Number of men</td>
<td>4</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Short-term Training: Number of individuals who are receiving (or have received) short-term training</td>
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<tr>
<td>Number of women</td>
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<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Number of men</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Technologies and Policies</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of technologies and management practices under research</td>
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<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Number of technologies and management practices under field testing</td>
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<td>5</td>
<td></td>
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<tr>
<td>Number of technologies and management practices made available for transfer</td>
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<td>3</td>
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<tr>
<td>Number of policy studies undertaken</td>
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<tr>
<td>72</td>
<td></td>
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<td></td>
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<tr>
<td>Number of rural households benefiting directly</td>
<td>60</td>
<td>72</td>
<td>120</td>
<td></td>
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<tr>
<td>Number of agricultural firms/enterprises benefiting</td>
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<td>0</td>
<td>2</td>
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<tr>
<td>Number of producer and/or community-based organizations receiving technical assistance</td>
<td>4</td>
<td>12</td>
<td>16</td>
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<tr>
<td>Number of women organizations receiving technical assistance</td>
<td>4</td>
<td>10</td>
<td>16</td>
<td></td>
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<tr>
<td>Number of HC partner organizations/institutions benefiting</td>
<td>4</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Developmental outcomes:</td>
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<td></td>
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<tr>
<td>Number of additional hectares under improved technologies or management practices</td>
<td>4</td>
<td>0</td>
<td>30</td>
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</table>