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

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Dry Grain Pulses CRSP Global PI Meeting
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Problem and Rationale

Common beans are most important legume crop (5th most important crop in Uganda, 2nd in Rwanda)

Farmers own & cultivate 1-4 acres; half rent 1-2 acres

Most grow ¼-½ acres beans; only 1/6 harvest ≥ 50 kg

Variable soil fertility, and erratic bimodal rainfall

Limited access training and inputs for improved agronomic practices, quality seed, technologies to improve yields and reduce post-harvest losses

Limited access to credit, market information, links to domestic and regional markets

Most farmers sell 1-2 crops; only 5% sell collectively
Research & Development Objectives

- Improve bean yield and quality of grain/seed
- Enhance nutritional value and appeal through improved post-harvest handling & processing
- Identify and promote solutions for constraints to increased marketing and consumption
- Increase capacity, effectiveness, sustainability of agricultural research institutions and rural development orgs. in Uganda and Rwanda
R&D Context and Method

- Sustainable Livelihoods training and support program, 2004+
  - Small scale farm HHs (n=800)
  - Food/Nutrition Security, Marketing
  - Training of Trainers approach

- Farmer Managed Experiments
  - 6 groups (58 of 67 are women)
  - Production & Post-Harvest Mgmt.

- Collaborative training & research
  - NaCRRI, MAK, VEDCO, ISU, KIST
  - Prepare materials, analyze data
On-Farm Participatory Research

- *Four improved varieties* resistant to some diseases with high potential yield (1.5-2t/ha); *one local variety*

- Randomized complete block design, two replicates, 5m x 5m plots

- Two growing seasons/year, early 2009 to mid-2012

- *Trials are farmer managed* with technical guidance

- Pests and diseases *not* controlled in overall design
K131 yields > local (Kanyebwa), but far below potential

*Manure* (10t/ha) and *Phosphorus* (60kg/ha) → to significant yield increases, *still < 50% of potential yields*

On station ↑ P to 180 kg/ha, did *not* significantly increase yield

*Low plant populations at harvest* (3-4 plants/m²); rec. = 20/m²

Need to *assess seed quality* (germination, early season vigor, seed borne pathogens) for farmer saved and certified seed

Investigating effects of *higher rates and repeated application of phosphorus* in a pure bean stand & in a bean maize intercrop

Data are means for two seasons (for each variety, means with the same letters are not significantly different at p=0.10)
Training and Applied Research

- Training and applied research with farmers:
  - Site selection, row and plant spacing
  - Timely weeding
  - Cultural and chemical control of bean fly
  - Harvesting, drying on tarpaulins, threshing
  - Moisture testing
  - Sorting and seed selection
  - Anaerobic storage (jerrycans, triple bags)

- Interactive discussion and demonstrations

- Group and own-farm implementation
Maintaining Bean Quality

- **Bruchid damage eliminated** through anaerobic triple-bagged storage (4 mo.) (vs. $950\%$ in control samples)

- **Viability/germination** declines in triple-bagged samples 2.7x less than in control

- Beans (grain, seed) at high prices
  - Market demand in South Sudan & Kenya
  - 2nd Season excess rain diminished production
  - Holding - speculation of prolonged drought (thus, need for reliable storage)
Exposure visits to NaCRRI and successful marketing and seed producing groups

Conducting field days at research and demonstration sites for other farmers

Training materials (posters, flyers, PowerPoint slides, video clips) refined and translated into local languages

Promoting adoption of improved storage methods and technologies for marketing

Providing initial training and two varieties of improved bean seeds to 550 farmers

Additional training sessions in progress
Six project groups trained in business planning and management, and in group dynamics

Project groups currently produce and market *Quality Seed* for *scaling up production for local needs*

Ensures *timely local availability of seed*

*Local gov’t certify quality seed ➔ tradable elsewhere*

*Multiplying*: 15+ acres of K132 and NABE4

Members cultivate expanded fields of beans on own plots – *sell* to VEDCO, boarding schools, farmers

Learn about seed dressing and packing machines

When producing larger quantities, they *can supply bean grain to processing industry*
Increasing Marketing Effectiveness

- **Training and supporting 51 farmer groups** (most members are women)
- Improving *understanding of market* price variation (among traders, markets, seasons)
- Enhancing ability to minimize grain losses
- *Business planning*, record keeping, analysis
- *Negotiation skills* to obtain increased prices
- Coordination of *collective marketing*
- Tons purchased from project core farmers for scaling up to other farmers and communities
Marketing Activities & Outcomes

- Obtain price info. from VEDCO extension workers (76%), fellow farmers (63%), radio (14%)
- Farmers in Kamuli talk to 1-5 buyers, sell to 1-2
- *Sell as group*: 81% of CRSP farmers vs. 10% others
- *Buyers are increasingly strict* (check grain quality, size, foreign material, pests)
- *Strategies to increase income*: produce quality grain, clean and sort, store well and wait for good prices
- *Aware of better markets, yet not adequately linked*
Farmers’ capabilities enhanced:

- Human capital - technical knowledge, experience
- Social capital - group vision, operations, connections with other groups and organizations

Value chain stakeholder forum in Kamuli, 2010+

- 15 organizations (farmer marketing groups and associations, government agencies, non-governmental organizations, private sector traders, transporters, distributors, and processors)

Stakeholders value forum (Feb. 2012) and networks

- Information sharing and market linkages
- Interest in trained farmers’ producing new varieties of beans for other districts/regions (even if not preferred locally), linking agronomic traits & consumer preferences
Enhancing Nutritional Value & Use

- **Optimizing bean processing to maximize digestibility, iron bioavailability and consumer appeal:**
  - Soaking, sprouting, cooking
  - Extrusion cooking

- **Creating value-added bean-based food products:**
  - Composite flours for soup, cooking and baking
  - Weaning porridge (84-97% EER & 115 RDA protein, 2-3y)
  - Evaluated nutritional, functional & culinary/sensory properties
Cold press blended flour dough with metal hand operated extruder, frying in cooking oil

Teaching farmers to prepare products, meals
- Participatory preparation and demonstration
- Nutrition and preparation materials translated
- Income earning activity for rural women
- Local gov’t request to train health counselors

Enhancing Nutritional Value & Use
Enhance private sector collaboration vis. their criteria and processes to develop new products

Nutreal Ltd. works with Makerere University’s Food Technology and Business Incubation Centre

- Multi-use composite flour selling in 18 Kampala supermarkets
- Key market for farmers’ beans as production increases
- Flour use by rural populations demonstrated and highly acceptable (e.g., porridge, sauce, soups, snacks)

In Rwanda:

- Africare and World Vision planning to use in soup & meals for children (KIST to assess effect on nutritional status 6m-3y)
- Entrepreneur (small town) exploring collaboration with KIST

Feedback from research and communities to bean breeder networks on newly released varieties (growing characteristics, culinary and sensory attributes, etc.)
Research Capacity Strengthening

- **2 Ph.D. students** trained at ISU
  - Abiotic stress tolerance - limited water supply and high temperature during grain filling
  - Iron bioavailability modeled in cooked and extruded flours

- **5 M.S. students** trained at Makerere University
  - Market participation and value chain development
  - Quick-cooking bean flour & weaning foods

- **1 M.S. student** research (leveraged) at ISU
  - Effectiveness of media and materials in farmer training

- **11 B.S. students** at KIST and 5 at Makerere
  - Nutrition vis. pre-processing
  - Causes and extent of post-harvest losses
  - Anaerobic storage

*Active & growing research and development collaboration*
SRL Program has expanded to 1200 households; improved bean varieties now being provided to 850 HHs

Could establish community-based bean processing facilities

VEDCO assists 25,000+ HHs; interest from Rwanda

Training materials (print and video) translated & tested

Link research activities backward and forward to rural development support work of NGOs

Upscaled implementation of weaning & complementary foods

Dissemination of research results
  - Local publications for NGOs, gov’t
  - Scholarly publications for int’l audience

Engage regional research networks

Feed the Future, CRP 3.5, HarvestPlus