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The U.S. Government's Global Hunger & Food Security Initiative

Social and Economic Issues in Farmer Decision Making:

Improving Soil Fertility Management and Bean Production in Uganda

Rob Mazur[1], Richard Miiro[2], Eric Abbott[1], Moses Tenywa[2], Ebby Luvaga[1], Onesmus Semalulu[3]

[1] Iowa State University, [2] Makerere University, [3] National Agricultural Research Laboratories, Uganda

Legume Innovation Lab

Feed the Future Innovation Lab for Collaborative Research on Grain Legumes

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Multidisciplinary Research Team

- Robert Mazur (Lead PI), Iowa State Univ., *rmazur@iastate.edu*
- Iowa State U. (A. Lenssen, E. Luvaga, E. Abbott, L. Burras, B. Miller)
  - *Sociology, Cropping Systems, Soils, GIS, Economics, Communications*
- University of Hawai`i (R. Yost)
  - *Tropical Plant & Soil Sciences*
- Michigan State University (J. Bello Brava, B. Pittendrigh)
  - *Communication, Scientific Animations Without Borders (SAWBO)*
- Makerere University, Uganda (M. Tenywa, R. Miiro)
  - *Agricultural Production, Soils, Extension & Innovation Systems*
- National Agric. Research Laboratories Uganda (O. Semalulu)
  - *Soils, Environment & Agro-Meteorology*
- Mozambique Agric. Research Institute (R. Maria, S. Mocumbe)
  - *Soils, Bean Breeding, Socioeconomics, Training and Technology Transfer, Outreach/Extension/Communication*

Project Rationale

- ***Common beans*** serve **important roles** in *cropping systems, food security, nutrition, incomes, and livelihood resilience* – but *low yields*, *pervasive poverty* and *food insecurity*.

- ***'Sustainable intensification'*** of agriculture production *requires* ***improved soil fertility management*** in which ***legumes*** are an **integral part** of cropping systems.

- ***Poor and declining soil fertility*** **is a** ***key constraint to increased common bean productivity*****; there is limited adoption/use of improved production practices.**

- **Addressing soil-related constraints requires understanding farmers' current practices and** ***enhancing their capabilities in diagnosing and finding solutions*** **to yield constraints.**

Soils and Crop Research

- Analyses of Chemical and Physical Properties
  - texture, pH, organic matter, available nutrients, aluminum
- Nutrient Omission Study (for bean growth)
  - N, P, K, Ca, Mg, Zn, Fe, B
- Lime Requirement Study (for bean growth)
  - Low pH, Ca and Mg availability, and Al toxicity

- On-Farm Studies to Identify Constraints & Solutions
  - Soil type and site-specific management options/strategies
- Community-Based Field Trials and Demonstrations → Current Use of Improved Mgmt. Practices/Tech.: (survey 101F, 55M)
  - Early field preparation (92%); improved varieties (98%); plant spacing (60%); banded application of chicken manure (67%), DAP (34%) & Urea (47%) (amounts specific to soil type); timely weeding; economic analysis of benefits and costs

Social and Economic Constraints in Decision Making

- *Livelihood Resources* for Production and Marketing
  - Natural (land, water)
  - Physical (tools/equipment, infrastructure)
  - Financial (income, savings, credit)
  - Human (labor, education, skills)
  - Social (groups, networks)

- *Information Sources* and *Extension Services*
- *Awareness, Availability, Accessibility,* and *Affordability*
- *Market* Development and Access

Livelihood Resources & Input Use

- Households with more ***adult family laborers*** more commonly purchase land and apply manure.
- Those with more ***land*** more commonly use manure, fertilizer and pesticides.
- Households ***hiring labor*** more commonly use manure, fertilizer, pesticides and herbicides to intensify efforts and achieve higher yields.
- Those who use ***inorganic fertilizers*** have non-agricultural income, savings, and access credit.
- Households with ***savings*** more commonly apply manure and pesticides. Those who access ***credit*** apply manure, pesticides and herbicides.

Liv. Res. & Input Use (at baseline 2014)

- **Purchased Inputs (+) with Economic Ability**:
  - Manure (11%) + Acres, Hire Labor, Savings, Credit
  - Fertilizer (35%) + Acres, Group, Hired Labor, Livestock, Sell Beans, Non-Ag. Income, Savings, Credit, Borrow
  - Pesticide (33%) + Acres, Hire Labor, Non-Agric. Income, Savings, Credit Access
  - Herbicide (20%) + Group, Sell Bean, Hire Labor, Credit
- Titling of More Secure and Better Quality Soils
- *Manure & Fertilizer* used on *More* Secure Land; *Pesticides/Herbicides* used on *Less* Secure Land

Broadening Awareness and Adoption

- ***Combining local farmer knowledge systems,*** *experimentation and innovation* with ***laboratory analyses*** of soil-related constraints
- ***Creating*** a 'community of practice' (***a continuous learning environment***) - researchers and farmers asking questions, seeking answers, making sense of each other's experiences and knowledge)
- ***Groups and social networks*** playing key roles in experimentation and adoption of new management practices and technologies, involving ***changes in beliefs, knowledge, and behavior***
- Identifying most effective and efficient approaches to ***promote multidirectional information flows*** among all key stakeholders
- Providing complementary ***training*** and follow-up ***support***

Multi-stakeholder Innovation Platforms

- Farmers (900+), seed producer, agro-input dealers, microfinance organization, traders, extension agents in two districts
- District Agriculture Officers
- District Production Officers
- Resident District Commissioners
- Local Government Authorities

- IPs significantly enhance awareness, availability, and access to needed inputs, services, markets.
- Currently developing a 3-year strategic plan

Field Trials, Demonstrations and Community Field Days

- Field Trials and Demonstration plots
  - Participatory trainings to diagnose soil nutrient deficiencies and other production constraints
  - Field trials to determine local solutions specific to soil type
  - Two rainy seasons/year (started 2015)

- Community Field Days (each season)
  - Observations and comparisons promote social learning
  - Stimulates widespread adoption of improved management practices and technologies

Farmer Learning and Values

- All recommended soil and bean crop management practices and technologies
- On-site soil testing with quick results and fertilizer guidelines
- “Fertility of all soil types can and should be improved”
- Increased access to knowledge, services and inputs derived from interacting with the array of value chain stakeholders:
  - Experiencing a ‘mindset shift’
  - Planning for the full crop cycle (incl. record keeping, profit assessment)
  - Developing a business orientation (“my garden is my office”)
  - Searching for new information (“all ways of learning”)
  - Educating/training others (“I have seen the light”)
  - Conveying pride in their transformative achievements (“I have advanced from being a grain and seed buyer to now being a grain and seed seller”)

Farmer Learning, Values and Outcomes

- "Active participation and interaction in the IP facilitates experiential collective learning and core knowledge development of *all* members."
- "Members develop horizontal and vertical social linkages and networks which help them to identify 'true' partners needed to increase production, 'know the market' and coordinate joint decision making and actions."
- Farmers have improved ***household food security***, ***mobilized collectively for loans*** to increase productivity, ***increased savings***, ***open bank accounts***, ***purchased durable goods***, and used profits from coffee to invest in ***more intensive and expanded bean production***.

Information Flows / Dissemination

- Farmer-to-farmer within own groups hosting field trials
- Farmer-to-farmer beyond own groups on field days
- Progressive farmers requested to train farmer groups in other communities
- Vertically within the Innovation Platform (bottom-up and top-down)
- Horizontally among members and groups in the IP
- Printed materials conveying recommended practices
- Animated videos in local languages on cell phones
- Live Radio Broadcast (in *Luganda*) from field day site

Soils Mapping

- Farmers create an indigenous soil map for their village (6 hours)
- Soil sampling on strategic grid (measuring color & pH) (12-24h)
- Create digital terrain-based soil map (3h)
- Co-create block diagram of soil-landscape relationships (2h)
- Create attribute table of local soils' properties by associating measured data with comparable landscape locations (6h)
- Create soil suitability tables: (a) for various cropping systems and (b) risks of erosion, soil organic matter loss, etc. (2h)
- Create tables of fertilizer and lime recommendations (2h)
- Synthesis report and printing (6h)
- Meet with farmers to discuss results and way forward (6h)

Local Soil Assessment Capacity

- Review village & GIS soil resource maps and block diagrams to aid decision making *for farmers without soil testing*
- Strengthen indigenous soil classification:
  - Review history of land use and management
  - Incorporate laboratory soil test results
  - Hierarchicalization (sub-categories and indicators)

- Training 20 farmers to use test kits for rapid field soil assessment, with 4 to operate as paid service providers
- Training 30 extension agents to appreciate farmers' soil knowledge, use village soil maps, block diagrams, and interpret soil test results
- District leaders integrating soil testing in local gov't plan

Comments? Questions? Thanks!

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