

Farmer Decision Making Strategies for Improved Soil Fertility Management in Maize–Bean Production Systems (S02.1)

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Abstract

Poor and declining soil fertility is the primary constraint to common bean productivity among smallholder farmers in Africa, affecting cropping systems, food security, nutrition, incomes, and livelihoods.

Adoption of improved crop management practices, particularly regarding soil fertility, has been modest.

Our *central premise* is that addressing soil-related constraints requires understanding farmers' current practices and enhancing their capabilities in diagnosing and finding solutions to yield constraints.

Problem Statement/Justification

Smallholder farmers in Africa—women and men—manage complex, multifunctional maize–bean cropping systems in diverse landscapes and agroecosystems. Common beans serve multiple important roles in their cropping systems, food security, nutrition, incomes, and livelihood resilience. They register low yields and experience pervasive poverty and food insecurity. Low productivity is due to poor soil fertility, limited access to improved seed varieties, excess water during plant growth, insects, and diseases. Typical yields of 200 to 500 kg ha⁻¹ are significantly less than the 2000 kg ha⁻¹ often obtained in researcher-managed fields. Poor and declining soil fertility is considered the primary constraint to common bean productivity, responsible for 30 percent of the yield gap. Grain legume research programs identify and develop improved technologies and management practices that can substantially increase yields. However, adoption of improved crop management practices, particularly for soil fertility, has been modest for beans.

This research project is based on two premises: 1. sustainable intensification of agriculture production requires improved soil fertility management in which legumes are an integral part of cropping systems and 2. addressing soil-related constraints requires not simply increasing access to fertilizers or use of other soil amendments, but—fundamentally—enhancing smallholder farmers' capabilities in diagnosing and finding solutions to important yield constraints.

Project activities are taking place in key bean production regions in two important Feed the Future (FTF) focus countries: Uganda, where maize and beans are promoted through FTF projects in 62 districts, and Mozambique, where Feed the Future priority provinces are Nampula and Zambézia; beans are a priority crop). Increasing bean productivity can help reduce poverty and improve nutrition. In Uganda, beans are

the most important legume crop, and fifth crop overall. In Mozambique, beans are a cash crop for 35 percent of producing households; the country is the largest informal exporter of maize and beans in southern Africa (50 percent share of regional exports in both). Poor soil fertility has been identified as a major factor in reduced bean yields, and both countries have weak extension systems and rural institutions, so that access to crop technologies, inputs, and credit is limited primarily to informal systems.

Objectives

1. Characterize farmers' motivations, current knowledge and practices, problem diagnoses and solutions, and livelihood and risk management strategies.
2. Develop and refine models about farmers' decision making.
3. Develop and validate appropriate diagnostic and decision support aids.
4. Develop and assess the effectiveness of innovative approaches for dissemination of information and decision support aids, training, and follow-up technical support.
5. Enhance institutional research capacity relative to grain legumes.

Research Approach and Methods

This project seeks to develop tools (methods and procedures) that will enable smallholder farmers with varying levels of education to better diagnose soil-related production constraints and make improved site-specific crop system management decisions that contribute to higher productivity (including grain legumes) in the short-term as well as improvements in soil fertility in the long-term. It will also assess the effectiveness of innovative communication approaches and technologies to engage farmers with diverse characteristics and other key stakeholders in widespread dissemination and adoption of diagnostic and decision support aids in different agroecological contexts. Core research activities are:

- Participatory rural appraisal and baseline surveys for activity planning, taking into account critical social, economic, and cultural factors that impact decision making and the adoption of new strategies and technologies, and for monitoring changes over time
- Farmer innovator and scientific analyses of soil-related constraints
- Participatory, on-farm studies using identified possible solutions
- Participatory, gender equitable development and validation of diagnostic and decision support aids
- Development and pilot-testing of innovative sociotechnical approaches for communication, dissemination, and scaling up

Anticipated Achievements and Outputs

- Characterization of smallholder bean farmers' agricultural motivations, current knowledge and practices, problem diagnoses, and livelihood and risk management strategies (by 2015)
- Models of farmer decision-making strategies that reflect influences of social, cultural, economic, institutional, and contextual factors developed and refined (by 2016)
- Innovative diagnostic aids using observable characteristics that enable farmers to make site-specific management decisions developed and validated (by 2016)
- Process for identifying alternative strategies and management practices for improving cropping system productivity and soil fertility developed (by 2017)
- Effective and efficient methods and media for information dissemination to intermediate and end users developed and assessed (by 2017)
- Capacity building through applied, research-based training conducted (2013 onwards)
- Research results published in peer-reviewed literature and other key outlets (2015 onwards)

Projected Developmental Outcomes

Improved management capabilities will have four important short- and long-term benefits:

1. Empowering farmers (especially women) to take an active role in identifying problems and solutions in bean production
2. Improving household income through the sale of increased bean production
3. Providing higher volume of beans for traders along the value chain within the country and in cross-border trade
4. Ensuring greater availability of nutritious beans and less dramatic seasonal price fluctuations for net consumers (other rural households and urban consumers).

The project will contribute directly to achieving four of the six Feed the Future focal areas: inclusive agriculture sector growth, gender integration, climate-smart development, and research and capacity building.

Contributions to Institutional Capacity Building

This multidisciplinary research project enables soil scientists and social scientists in Uganda and Mozambique to strengthen their skills in key areas, including systems approaches to crop and soil fertility improvement that take into account social, cultural, economic, institutional, and contextual factors that shape farmers' decision making. Development and application of diagnostic and decision support aids, combined with research on communication for dissemination/scaling up impact, will be useful in many future research projects in these countries. Interinstitutional training activities include short-term training at Iowa State and Hawai'i for technical staff and junior and senior researchers; long-term training at Makerere University (two master's students in soil science and one in extension and innovation studies), Iowa State University (master's student in sustainable agriculture and sociology, and (master's student in communication) and the University of Hawai'i (one PhD student in tropical plant and soil sciences).