

Understanding and Guiding Farmer Decision-Making Strategies

Poor soil fertility and crop management practices have left thousands of smallholder bean farmers in Uganda and Mozambique struggling to grow even 10 to 25 percent of their potential crop yield. A Legume Innovation Lab project on *Farmer Decision Making Strategies for Improved Soil Fertility Management in Maize–Bean Production Systems* at Iowa State University, in collaboration with Makerere University and the National Agricultural Research Laboratories in Uganda and the Institute of Agriculture Research of Mozambique, however, is combining soil and social science to bring hope to these farmers—farmers like Angélica A. in the story below—for improved, sustainable crop yields.

Angélica A., a farmer and widow with six children in the Gurué District of Mozambique, farms three fields with maize, beans, rice, pigeon pea, cassava, and sorghum totaling five hectares; her main sources of income are beans and rice. Five hectares is a large farm in Mozambique and should provide her with up to 10,000 kg. of beans—but it doesn't. Angélica's yields are so low that she lacks sufficient seed to plant one of her fields this year. In addition low crop yields, bruchid damage during storage forces her to sell her beans soon after harvest, when market prices are lowest. Unable to save her own seed, she must pay twice as much to buy seed for each planting season as her selling price after the previous harvest.



Farmers and researchers in Mozambique take soil samples to measure soil fertility

In addition to these challenges, Angélica hesitates to adopt new farming methods, including planting in lines—as advocated by an extension service—because she believes it a waste of land. She basically plants whatever seed she can afford—which often isn't much—and then, apart from some manual weeding, leaves the crops alone to grow amidst weeds and insects pests. Through her frustration, she readily acknowledges that she has no one to ask about farming methods. Tradition dictates that men should farm the land, but she's a widow with deceased parents, leaving her isolated in an area where farmers rarely talk to one another.

A key goal of the project is to develop science-based methods to address soil problems in fields that will help smallholder farmers like Angélica—along with social science-based methods to help low literate

farmers understand and implement crop management practices that improve—and then maintain and even strengthen—their soil.

To identify limiting soil nutrients, the project team analyzed the physical and chemical properties of the predominant soil types for growing beans in study communities in Uganda and Mozambique. The results



Researchers in Uganda conduct a Nutrient Omission Study

of these analyses led to nutrient-controlled greenhouse studies that revealed the effects of specific macro- and micronutrients on bean plant growth and development. Field trials using these macro- and micronutrients to understand the soil-specific nutrient and crop management practices necessary to increase bean crop productivity in farmer fields are currently under way. Positive results are expected to provide practical information on how to improve soil fertility through crop management that even low-literacy farmers can readily adopt.

But knowing the means to address crop management and soil fertility problems is just the beginning of the project’s work toward long-term solutions. The multidisciplinary research team recognizes that while improved soil fertility management is integral to sustainably increasing crop yields, addressing soil-related constraints does not simply involve developing a basket of solutions and then telling smallholders farmers what to do.

“Increasing adoption of improved crop management practices requires, fundamentally, a thorough understanding of farmers’ current and farming approaches: what they understand about farm management and soil fertility, how they practice farm management, and what they are able and willing to risk in changing their management decisions, even if someone tells them it’s for the better,” says Dr. Robert Mazur, professor, Iowa State University and Legume Innovation Lab Project Lead PI.



Two field researchers in Uganda evaluate bean plants during a field trial

By working with farmers and learning the critical social, economic, and cultural factors that impact crop

management decisions, particularly regarding the adoption of new strategies and technologies, the team is following a globally collaborative approach that acknowledges the value of combining local farmers' knowledge with state-of-the-art scientific information adapted to meet smallholder farmers "on their own turf," recognizing that smallholder farmers intimately understand their land and its challenges and can contribute meaningfully to the solution.

Toward that end, the team has interviewed hundreds of smallholder farmers to learn their farming practices: field selection and preparation, crop and variety selection, planting methods and spacing, input use, intercropping and rotation patterns, gender-based division of labor, problem identification and management practices, market sales, storage practices, food consumption patterns, and the uses of income earned through farming and other activities.

The types of information that researchers have gathered from farmers like Angélica provide insights not only about their farming practices but also about how they learn and what helps them be open to learning new farming concepts.

These interviews and discussions have revealed that engaging farmers in processes that create a continuous community-learning environment will enable them to make more informed actions that they can truly believe in. Instead of the traditional extension fixation on individual adoption rates that reflect compliance with externally created technologies and criteria, the team will work with farmers in a way that honors their previous practices while empowering them to adopt improved, sustainable agricultural development practices.

The team is strengthening or forming farmer-led learning groups that will be supported in field experiments to test and demonstrate the impact of variations in farmer- and scientist-recommended management practices and technologies for bean production. These leaders will help develop community cohesion among isolated farmers and provide them with opportunities to learn together, share their thoughts and assessments, trust and respect one another, and collectively transform their beliefs and knowledge, and encourage one another to make changes.

The team, working with these farmer innovators and early adopters, will then identify creative ways to engage those farmers not yet making changes or embracing innovations. The local farmers will know their community even better by that time, and their contributions and understanding of the value of these improved crop management practices will help engage their fellow farmers.

The project's success lies in the team's understanding how to increase soil fertility through scientifically-informed crop management practices that can be integrated into existing cropping systems and their commitment to engaging core groups of farmers, women and men, in developing and testing innovative communications approaches and technologies for learning and sharing information about new options for sustainable improvement. While the team's work is still in its early stages, their accomplishments in the field and their connection to farmers' groups is already showing signs that improved crop yields will be part of the near and long-term future for smallholder farmers in Uganda and Mozambique.