RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

Info Note

Adoption of climate smart technologies in East Africa

Findings from two surveys and participatory exercises with farmers and local experts

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Key messages

- CSTs, including practices, are critical enablers of climate-informed agricultural practices that enhance food security.
- There is a remarkable amount of agrobiodiversity on the study sites and farmers are able to identify an important number of CSTs.
- The uptake of CSTs by farmers in the study sites was found to be very low.
- The capacity of the extension systems should be strengthened to support farmers' knowledge about how, and under which conditions, particular CSTs should be implemented.
- There is a need to create learning alliances and other spaces whereby networks of farmers and technology providers can be initiated and strengthened.

As part of the "Policy Action for Climate Change Adaptation" (PACCA) project this info note summarizes findings of a project activity entitled "Influencing and linking policies and institutions from national to local level for the development and adoption of climate-resilient food systems in East Africa" undertaken by researchers from Bioversity International and Arizona State University. By conducting a network analysis and participatory exercises with district officials and farmers, the study assesses the extent to which farmers are adopting agricultural practices and correlates the findings about the size and "make up" of the networks in which the farmers are embedded.

Climate smart technologies for climate change adaptation

Climate smart technologies (CSTs) and practices contribute to the adaptation of farmers to the effects of climate change. CSTs help farmers address climate change issues such as extreme drought, extreme precipitation, and changes in seasonal timing. To shed some light on the factors influencing the diffusion and uptake of CSTs for adapting the agricultural sector to climate change in Rakai (Uganda) and Lushoto (Tanzania) and to provide an evidentiary basis for identifying policy interventions so that the flow of CSTs can be facilitated, Bioversity International and Arizona State University conducted this study. Among other things, this study identifies crops grown and animals raised by farmers, awareness of government programs associated with new agricultural practices, and weather changes that have been experienced in the study areas to find out the best ways to address climate change-related challenges in agricultural production systems.

This info note is based on surveys designed to gather information on farming practices and technologies and climate change perceptions as well as on participatory exercises conducted with farmers in two study sites located in Rakai and Lushoto in May and October 2014, respectively. Additional data analysis activities were conducted, including descriptive analyses to understand the size of the communication network, the kinds of crops grown and animals raised, the use and maintenance of natural resources, and the awareness of government programs. Such activities also included bivariate correlation to understand the relationship between communication networks and several farm characteristics, analyses by gender to understand the gender differences in network size, in the adoption of farming practices, in the involvement of local organizations, in the access to farming expertise through training workshops and advice by extension officers, in the awareness of rules and regulations that govern the use of natural resources, and in the maintenance of natural resources. However, the results presented in this brief are limited to the areas specified above.

Although the findings presented here are site specific, the authors believe that they have the potential to contribute to the identification of ways to increase farmers' capacity to adopt new practices and technologies in the future as part of their strategies to adapt to climate change.

Crops grown, animals raised, and the adoption of CSTs in Rakai and Lushoto: pre-survey working sessions

In May and October 2014, participatory exercises were conducted in Rakai and Lushoto, respectively. These exercises were designed to learn how farmers perceive climate change, what impact climate change has had on their farming systems and potential adaptation options, what crops are grown and animals are raised on their farms, and what changes they have experienced in the status of the natural resource base. Simultaneously, locally based experts were consulted to identify the CSTs that they thought were the most important in the study sites. Different sections of the survey were analyzed in detail with these experts, putting special emphasis on the sections dedicated to CSTs, traditional weather prediction, and local formal and informal institutions that are working on activities related to agriculture.

- ### Status of natural resources and awareness about CSTs in the study sites

The participatory exercises provided collective evidence from both countries regarding the following concerns the steady erosion of the surrounding forest stands, wetlands and pasture areas on hills, the recent loss of the traditional knowledge regarding natural resources management and the lack of enforcement and implementation of the laws regulating natural resources' conservation and use.

The consultations with the local experts, on the other hand, led to the identification of 39 CSTs in the study sites. For the purpose of the study, the 39 CSTs were grouped into six sub-categories: crop pest and disease, soil fertility, diversity on the farm, water and water use, animal/livestock management, and introduction of improved and traditional crop varieties (Table 1).

Insights from the surveys: agrobiodiversity, weather perceptions, and CST adoption rates

The surveys were administered to 298 farmers and 70 experts between November 2014 and March 2015 in Rakai and to 302 farmers and 85 experts between July and August 2015 in Lushoto.

- ### Existing agrobiodiversity and existing CSTs in the study sites

Survey analyses revealed that the surveyed farmers from Rakai grew about 14 different crops and 75% of them raised animals (mainly cows, ducks, and heifers). In Lushoto, the 10 most common crops grown by the surveyed farmers included, in order of importance, maize, beans, Irish potatoes, cassava, sweet potatoes, avocado, sugarcane, tomatoes, and amaranth. In Lushoto, chickens and cows were the animals most commonly raised, followed by sheep, heifers, calves, and goats. The decreased size of land due to increasing population pressure and the lack of pasture, together with new animal diseases and epidemics, however, were reported as big challenges to the farmers' ability to raise livestock in both countries.

- ### Perceptions of changes in weather patterns

Farmers' perceptions of weather patterns may influence their decisions about adopting or not adopting certain CSTs. For example, 25% of the surveyed farmers from Rakai who responded as having started new farm practices and 12% of those who reported having interrupted the implementation of at least one practice during the previous two years attributed these changes to variations in weather conditions. Similar results were found in Lushoto, where eight out of the nine farmers who reported that they had started using herbicides and pesticides during the previous two years, had done so in response to changes in weather patterns.

Table 1. Climate Smart Technologies (CSTs) existing in the study sites according to local experts

Crop Pest and Disease Management	Soil Fertility Management		Managing Diversity on Farm
Use herbicides and pesticides	Check dams	Mulching	Monocropping
Crop rotation	Grass strips/bands	Composting/residues	Strip cropping
Traps and killing physically	Applying both artificial and organic fertilizer	Artificial fertilizers	Introducing new crops and animals
Intercropping	Minimum tillage	Digging trenches	Intercropping
Planting date	Intercropping	Manure use	Mixed cropping
Biological control	Agroforestry	Fallowing	Crop rotation
Push and pull mechanisms	Contour ploughing	Cover crops	Mixed farming
Planting of natural barriers			
Animal/Livestock Management	**Water and Water Use Management**		**Improved and Traditional Crop Varieties**
Zero grazing	Water harvesting tanks	Planting and maintaining trees along water channel	Introducing improved crop varieties
Introducing improved breeds	Channel irrigation and diversion	Growing water efficient crops	Introducing traditional crop varieties
Introducing local breeds	Catchment ditches	Reservoirs for crops	
	Contour bands	Drip irrigation	
	Micro irrigation		

Survey analyses regarding perceptions of the occurrence of weather changes over the previous five years in the study sites, however, were found to be rather mixed among the participants of both countries. The importance of this finding relies on the fact that this mismatch of farmers' perceptions could indicate not only high levels of uncertainty but also a lack of access to new technologies, practices, and programs to respond to weather changes. Opinions were fairly evenly divided on whether there had been an increase or a decrease in average rainfall and temperatures during the previous five years. According to the analyses of the survey, 60% of the respondents from Rakai reported an increase of precipitation, whereas the remaining 40% reported a decrease. Likewise, 60% of the respondents considered that the temperatures had increased, while 30% reported the opposite. Similarly, in Lushoto, about 40% reported an increase of average temperatures, whereas approximately 30% reported a decrease. Regarding the rainfall patterns, half of the respondents from Lushoto reported that average rainfall had decreased somewhat, around 13% of them thought that it had decreased rather significantly, 22% that it had increased somewhat, and the remaining 12% considered that it had stayed about the same over time.

- **Adoption of CSTs**

Results from the data analyses revealed that very few of the surveyed farmers used the CSTs that were associated with managing crop pests and diseases, soil fertility, on-farm diversity, and water production management techniques.

Higher rates were found for the adoption of CSTs related to crops and livestock. According to the analyses, 19.5% of the interviewed farmers from Lushoto had introduced new crop varieties, and 5% of them had adopted new crops during the previous three years. Adoption rates among the respondents from Rakai were found to be relatively higher: 24% of the interviewed farmers had introduced new varieties, and 23% of them had introduced a new crop over the same time period. In addition, 11% of the interviewed farmers from Rakai had introduced traditional crop varieties during the previous three years. Data from Lushoto indicates that 18.5% of the interviewed farmers had introduced traditional crop varieties during the previous three years. Interestingly, the survey analyses concerning livestock showed that 50% of the respondents from Rakai and 32.8% from Lushoto had introduced local breeds during the three previous years. In addition, 27.1% of the farmers from Lushoto had introduced improved breeds during the same period.

Follow up workshops: potential reasons for low adoption rates of CSTs

Specific reasons for the relatively lower or higher adoption rates of each of the CSTs were given by both farmers and local experts one year later. In October and December 2015, follow-up workshops were conducted in Rakai and Lushoto, respectively, to present to the same farmers and experts from both countries the survey findings and to investigate the relatively lower or higher adoption rates of each of the identified CSTs.

Overall, high associated costs, small land sizes, and a lack of awareness and sufficient knowledge about some of these CSTs were pointed as some of the main factors behind the rates of adoption in both countries. Specific examples included increasingly unpredictable weather patterns and the difficulty in adopting practices such as planting dates. Likewise, widespread lack of awareness about the importance of managing soil fertility, insufficient knowledge about the particular crops that should be combined, and the lack of resources for conducting soil analyses to identify the most appropriate crops for each particular piece of land were identified by both farmers and experts as key issues hindering the adoption of practices related to crop rotation. In addition, the very low adoption rates of CSTs related to water and water use management, despite the scarcity of water in the study areas, was explained by the high costs associated with these kinds of practices, which often surpassed what the farmers could afford. The lack of capacity in the extension systems due to an insufficient number of resources and personnel to conduct demonstrations, to implement field schools for farmers, and to respond sufficiently to farmers' needs was also a general concern among experts and farmers. In both countries, local breeds were considered to be more resistant to pests and diseases, cheaper to maintain, and of a higher value with respect to taste and nutrition. However, introducing improved breeds was associated, especially among the farmers from Lushoto, with an improvement in the farmer's lifestyle due to its increased economic value in the marketplace.

Participatory exercises in Rakai District (Uganda).
Photo credits: Evelyn Clancy (Bioversity International)

Conclusions and policy implications

The insights provided by this study suggest particular aspects that could contribute to developing a more enabling environment for the adoption of CSTs by small-hold farmers and, therefore, to better adapting to climate change in the agricultural sector in Rakai (Uganda) and Lushoto (Tanzania). It is necessary to evaluate the suitability of technologies in the studied area in light of costs, labour shortages, limited farm size, population pressures, and topography. In addition, farmers would benefit from raising their awareness about the benefits to be achieved from certain technologies and practices as well as from training on technology use. The creation of learning alliances and other spaces whereby farmers and local experts can be initiated and strengthened should be promoted so that farmers' networks (farmer to farmer and farmer to technology providers) related to climate and agricultural information and technology access are improved. In the same line, there is a strong need to strengthen extension systems. The study areas would benefit if the implementation of certain practices was conducted, if farmer field schools were improved and more widely established, and if the formation of farmers' groups was encouraged.

Further Reading

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