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Adapting to climate variability and change: Insights from smallholders in Kenya

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Policy Brief

SUMMARY

Food security is one of the pillars under the Government's Big Four Agenda and it is also a key theme in the forthcoming Kenya's Agriculture Sector Transformation and Growth Strategy (ASTGS). Climate change has had a significant impact on rain-fed agricultural production in developing countries. Smallholder farmers are the most vulnerable, and currently must make production decisions in a high risk and uncertain environment with regard to rainfall and temperature. This policy brief uses data from a household survey and focus group discussions as well as climate information from the Kenya Meteorological department to answer two questions: (i) what adaptation strategies do smallholder farmers use?; and, (ii) what are the barriers to adaptation to climate change? Results show that adoption of adaptation strategies was low despite a high percentage of farmers indicating that they had observed changes in temperature and rainfall in the last 10 years. Most farmers used crop management practices such as changing crop varieties, planting trees and application of soil and water conservation measures. A few farmers adopted irrigation or varied planting dates to ensure that critical stages of plant growth did not coincide with very harsh weather conditions. Barriers to the uptake of adaptation strategies were lack of finances and knowledge as well as inconsistent policies. Hence, effective adaptation will require: a multi-faceted collaborative approach, with different stakeholders playing key roles in providing support services; incentives for appropriate financial products for smallholders; revamping of extension services; and, consistent policies as well as a holistic approach towards farmer support.

Background

Food security is one of the pillars under the Government's Big Four Agenda and is also a key theme in the forthcoming Kenya's Agriculture Sector Transformation and Growth Strategy (ASTGS). The need for increased and dependable food supply in Kenya cannot be overemphasized, given the growth in its population. However, agricultural production has not increased in tandem with population growth. Low agricultural production and erratic food availability could be attributed to factors such as climate variability and change, rain-dependent farming, low productivity, high input costs, low adoption of technology, conversion of agricultural land into other uses, post-harvest losses, low value addition, and pests and diseases, among others.

Climate variability and change pose one of the most important environmental threats to nations, communities and livelihoods. This is in terms of soil erosion, landslides, warming and drying, prolonged droughts and intense flooding. Given that majority of the rural population in Kenya depends on agriculture for income, adaptation is vital in enhancing the resilience of the sector to climate change, protecting the livelihoods of poor households and ensuring their food security. Several studies have shown that without adaptation, climate variability and change would be detrimental to agricultural productivity and net incomes, but with adaptation, vulnerability would be significantly reduced (e.g., Seo and Mendelsohn, 2008; Di Falco et al., 2012). This is because the degree to which an agricultural system is affected depends on its adaptive capacity (Ochieng et al., 2016). Hence, it is important to understand farmers' adaptation measures and barriers to uptake of these measures.

Table 1:Farm-level adaptation strategies in Kenya (percent of respondents)

	Adaptations by zone		Adaptations by perception on rainfall		Adaptations by perception on temperature		
Adaptation strategies	**High potential**	**Low potential**	**Increase**	**Decrease**	**Increase**	**Decrease**	**Total**
Changing crop varieties	21.8	18.5	20.3	25.1	27.2	17.6	19.6
Planting trees	6.4	13.6	10.3	18.0	18.0	10.5	11.3
Water harvesting	1.7	2.5	2.6	3.2	2.9	4.6	2.2
Soil and water conservation measures	16.4	10.7	17.5	13.2	20.0	12.4	12.5
Irrigation	5.2	5.5	1.2	12.8	8.1	2.0	5.4
Change timing of planting	0.5	1.8	1.0	1.4	2.2	0.0	1.4
Crop diversification	0.7	0.8	1.8	0.0	0.2	0.0	0.8
Better land preparation	0.2	0.0	0.0	0.0	0.2	0.0	0.1
Proper harvesting time	0.0	0.1	0.2	0.0	0.0	0.7	0.1
Bought more land	0.0	0.1	0.2	0.0	0.0	0.0	0.1
Not adapting	68.3	62.2	39.3	45.3	87.4	51.9	64.2
No. of observations	887	422	503	438	456	153	1,309

Previous research has demonstrated ways in which policymakers can support adaptation efforts through provision of institutional services such as credit, training, market information, farm inputs and extension services (Kabubo-Mariara, 2008; Gbetibouo, 2009; Tambo and Abdoulaye, 2013). Thus, understanding adaptation strategies that smallholders undertake in their farming practices will provide insights into the necessary interventions to ensure adequate adaptation on farms and at county and national government levels in Kenya.

This study seeks to answer the following questions: (i) what adaptation strategies do smallholder farmers use; and, (ii) what are the barriers to adaptation to climate change?

Data and Methods

This study employed three main data sources: (1) a survey of 1,309 households across eight agro-regional zones in rural Kenya; (2) focus group discussions (FGDs) conducted between July and August 2011 in various sub-locations within the eight agro-regional zones; and; (3) climate data from the Kenya Meteorological Department. These data sources were supplemented with information from annual assessments of cost of production (COP) by Tegemeo among producers of major staples.

Results

Farm households' adaptation to climate change

As climate changes, crop production strategies need to change also. The farm-level adaptation strategies used by farmers in response to changing climatic conditions are presented in Table 1. More than 60% of the farmers were not using any adaptation strategy. This is despite about 50 and 80 percent of them indicating that they had observed changes in temperature and rainfall, respectively, in the last 10 years. Majority of farmers without adaptation strategies were in high potential zones (68%) and those who noticed an increase in temperature (87%).

Farmers who perceived changes in rainfall adapted to climate change more readily than those who perceived changes in temperature. This may be because changes in rainfall are more noticeable, have greater and more long-lasting devastating effects, and there are more options to deal with rainfall variations compared to temperature changes.

Most farmers used crop management practices such as changing crop varieties, planting trees and application of soil and water conservation measures. A few farmers adopted irrigation or varied planting dates to ensure that critical stages of plant growth did not coincide with very harsh weather conditions. Changing crop varieties is widely used by farmers as an adaptation measure. This is in line with reports from the FGDs that since the 1990s, varieties grown have changed; some have been abandoned (especially in the lowlands), while others have been introduced.

This strategy may be predominantly used as an adaptation measure because farmers are familiar with the practice, and extension messages often encourage the adoption of drought tolerant varieties. Strategies such as irrigation and water conservation measures are useful in lengthening the growing period of crops and ensuring moisture at critical stages of crop growth, even during extreme climate conditions.

Crop diversification, better land preparation, proper timing of harvesting and purchasing more land are strategies that registered low adoption by farmers. A strategy like crop diversification gives better insurance by reducing the downside risk of crop failure resulting from poor weather conditions, and it helps in expanding income sources and conserving natural resources. It also reduces susceptibility to climatic variability such as frequent floods or prolonged droughts, which might result in crop failure. To reap optimal benefits, these adaptation strategies should not be adopted in isolation but in a complementary manner.

Uptake of the various adaptation strategies

was higher among households that were male-headed, larger and close to extension services, and that had more land and access to credit, electricity, fertilizer subsidy and relief support. Agro-ecological zones also influenced adoption of various practices. Farmers in high potential zone were more likely to plant trees, use water harvesting techniques and change planting time, while those in the lowlands adopted soil and water conservation techniques. This indicates the importance of regional characteristics and peculiarities concerning adaptation to climate change.

Barriers to adaptation to climate change

Farmers face considerable barriers in adapting to climate variability and change. Results from household level data indicated that 64% of farmers did not adjust their farming practices in response to perceived climate change and variability (Table 1). Across all agro-ecological zones, the key constraints to farmer adaptation were lack of finances (52%) and knowledge and information on appropriate adaptation measures (41%) (Table 2). Similarly, from the FGDs, farmers indicated that although they noticed changes in rainfall and temperature in the last ten years, their adaptive capacity was limited by these two constraints.

Smallholder farmers require important information related to climate change forecasting, early warnings, adaptation options and other agricultural production activities. These would include appropriate use and bundling of fertilizer and seed, water conservation techniques and soil health management pratices, and climate smart production practices, technologies and innovations. However, results show that farmers have limited ability in accessing the necessary resources and technologies for adapting to the extreme effects of climate change and variability. This lack of information may explain the limited number of adaptation strategies used by the farmers.

To deal more effectively with the challenge of climate change and ensure sustainability of production systems, farmers need reliable and up to date information on issues identified above. This will ensure sustainable soil and land management and hence improved productivity. Interviews with farmers during COP studies have consistently pointed out the need to revamp extension services to enable farmers access up to date information on

Table 2 Constraints to adoption of adaptation strategies in Kenya (percent)

Barriers	High potential zone	Low potential zone	All zones
Inadequate finances	53.8	48.0	51.9
Labour shortage	2.2	2.1	2.1
Lack of knowledge/ information	41.2	41.4	41.3
No need to do anything	2.4	0.2	1.7
No. of observations	208	470	678

farm management practices, pests and disease control, advisories based on weather forecasts and adoption of efficient technologies such as mechanization.

Nevertheless, smallholders may fail to adapt, even when provided with adequate information, because they are resource constrained and lack credit facilities and other inputs, leaving them unable to meet the cost of adaptation measures (Kandlinkar and Risbey, 2000). From the survey, only 27% of farmers accessed credit, mainly from informal sources, further confirming that a lack of sufficient funds to implement adaptation strategies is a major problem.

These findings are in line with those of Shackleton et al. (2015), who extensively documented the barriers to adaptation in Africa. They noted that some barriers are specific to the employment of particular adaptation options (e.g., shortage of land is more of a constraint to soil and water conservation than changing crop variety) whereas others, such as a lack of finances and credit inhibits almost any adaptation response within the farming sector.

Findings from annual COP indicate that policy disconnect or inconsitent policy signals may also hinder effective adaptation. For instance, National and County governments have been running parallel fertilizer subsidy programs. While a subsidy helps to relax a credit constraint, enhancing access to and use of acidifying chemical fertilizer will continue to raise soil pH and compromise soil fertility if not used in combination with other soil amendments like lime.

Recommendations

Results show that adoption of strategies to deal with challenges of climate change is low and that uptake is mainly constrained by lack of finances and knowledge and information as well as inconsistent policies. In order for farmers to achieve long-term benefits from the adaptation responses to climate change, it is important to address potential constraints that they face in adopting relevant practices and technologies.

First, effective adaptation will require a multi-faceted collaborative approach, with many stakeholders playing key roles in providing support services in terms of education, extension, credit and meteorological information. This implies that collaborative generation of knowledge and innovation to address the challenges of climate variability and change could be useful, since it will include farmers in the process.

Second, there is need to provide financial incentives to enhance farmers' capacities or increase their access to loans to support investments in adaptation practices and technologies. This can be achieved by working with financial institutions to develop financial products that reflect the needs and realities of smallholders to enable them take advantage of adaptation measures including those with high initial costs.

Third, it is imperative that extension services are revamped in order to play a bigger role in adaptation and resilience building. This will provide timely weather advisories and information on critical and adequate farm management practices and technologies. In most cases, farmers are receiving information through cell phones, radio, television and internet but this is not adequate to completely replace public extension services. Extension is a devolved function and counties need to allocate sufficient funds and staff for extension.

Fourth, it is important to have consistent policies and a holistic approach towards farmer support. Provision of the right fertilizers should be accompanied by other productivity enhancing inputs such as lime and organic matter to ensure improved and sustainable production for food security and climate-resilient livelihoods.

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