EFFECTS OF CLIMATE SMART AGRICULTURE PRACTICES ON HOUSEHOLD LIVELIHOODS IN SOY SUB-COUNTY KENYA

ABSTRACT

Aims: This study sought to analyze the effects of adoption of Climate Smart Agriculture practices on farmers' livelihoods in Soy sub County Kenya.

Study Design: The study adopted a cross-sectional descriptive survey research design, specifically use of household questionnaires, and interviewing key informants were used to come up with both quantitative and qualitative data.

Place and duration of study: the study was conducted in two sites in Soy sub-County Kenya: Soy and Kipsomba ward. The study was conducted in the period October –December 2019

Methodology: Structured household questionnaires (N-196) and interviews with Key informant (N-6) were conducted in two agro-ecological zones. Descriptive statistical analysis was used .while results from key informants were used to collect valuable data that was useful in checking the validity of responses obtained through the use of questionnaires.

Results: The study found that 88.7% of the farming households that had adopted CSA practices led to increased yields, 73.46 % of farming households felt that the adoption led to increased income, 7.65 % felt that it has led to employment creation, 4.08 % felt that the adoption led to control of pest and 0.06 % felt that it led to control of weeds. This is an indication that the adoption of Climate Smart Agriculture practices can be the useful approach for mitigating climate variability effects, building more resilient livelihoods, improving food security and alleviating poverty.

Conclusion: in order to improve on the climate variability adaptation smallholder farmers need to adopt more of CSA practices to turn around the of food insecurity threats. The study concludes that the adoption of Climate Smart Agriculture practices positively and negatively influences the livelihoods of farming households in Soy sub- County

Keywords: Climate Smart, Household Survey, climate variability, food security, livelihoods

1.0 Introduction

Sub-Saharan Africa, including Kenya, and certain regions of Asia are especially vulnerable to food insecurity as a result of climate variability's effects on production and productivity.

Forecasts predict an increase in both the severity and frequency of severe weather occurrences. Farmers on a smaller scale are particularly sensitive to the consequences of climate change since their livelihoods rely on the weather and they face environmental deterioration and socioeconomic concerns already. Adopting climate-smart methods is crucial for small-scale farmers to effectively adapt to climate change.

Agriculture is vulnerable to climate events. For many small-scale farmers, the potential consequences of trying out new technology and production practices may outweigh the benefits (1). (2) found a link between the number of food shortage months and the inability to innovate in farming operations, suggesting a negative association food security in households and innovation in farming. Because of this, many low-income families are unable to save enough money to invest in productive avenues. Stakeholders such as the World Bank, in collaboration with International Center for Tropical Agriculture (CIAT), have begun to establish technical indicators in order to identify diverse strategies and compare them in terms of climate smartness (3). These assess the technical potential of various agricultural techniques in terms of their ability to boost productivity, adapt, and mitigate climate change. Because of the wide range of effects of such tactics on people from various backgrounds, the indicators are weighted and quantified according to national and regional contexts, and may differ significantly from one country to the other. In general, the indicators are scored from 1 (low potential) to 5 (high potential) in each area and assess positive improvements resulting from the application of CSA technologies:

Approaches like agro forestry, zero tillage, and the use of cover crops all improve the amount of carbon stored in the soil, which helps CSA adoption contribute to climate variability adaptation and reduction of greenhouse gases (GHGs) (4). Adopting CSA may have long-term advantages for households, such as higher yields and more resilience to climatic change in agricultural systems(5). There are favorable outcomes at the home and community levels, as well as at the public level, from adopting these strategies for lowering carbon emissions. Adoption of CSA methods has been sluggish, especially in food poor and vulnerable parts of sub-Saharan Africa, but places that have made the transition have shown greater production as a consequence of enhanced soil properties and water retention (6). Agro forestry is a good example of a practice that promotes adaptability by lowering the likelihood of crop failure due to weather, increasing consistency in yields, and enhancing water management. Another way in which agro forestry helps reduce greenhouse gas emissions is via the underground and aboveground storage of carbon (7). Indonesia and Colombia have both successfully implemented agroforestry practices; in Kenya, farmers use the Grevillea Agro Forestry system with shelterbelts (8).

Reduced or zero tillage helps soil retain more water, has a positive effect on soil aeration and structure, and decreases yield variability caused by weather extremes (9). Therefore, zero-tillage strategies strengthen farm systems and enhance farmers' ability to respond to climatic unpredictability. These methods also have the potential to reduce carbon losses associated with ploughing and boost carbon sequestration through residue integration and decreased erosion (10). Despite the benefits of zero-till farming, many farmers who use this method nevertheless plough their fields on a regular basis to increase productivity without reducing the soil's resilience or adaptation. This results in the release of previously sequestered carbon (11). Some countries that have successfully implemented zero or minimal tillage methods are Morocco (where it is used for growing wheat and barley), Ghana (where it is used for growing cotton and other crops) and Kenya (where it is used for growing cereal crops on a small scale through conservation tillage)(12).

In areas where pesticides are too expensive or inaccessible for smallholder farmers, a cover crop might help suppress weed growth. Soil is not stripped naked after harvest, and its fertility is quickly restored with the help of cover crops like leftovers left on the field or better fallows (13). Weeds and pests may be suppressed and managed with the aid of continuous cover crops, making them an invaluable tool for farmers. By implementing these measures, one may better adapt to climate change by lowering erosion, increasing water retention, and decreasing vulnerability to drought. The rate of adoption of cover crops rises in response to rising populations and the need for constant cultivation; yet, in places with a high poverty rate, rising populations have led to cover crops abandonment and significant soil degradation, as well as increased weeds and pests (14).

Reducing food waste and increasing agricultural resilience to climatic unpredictability are two of the many benefits of community supported agriculture (CSA) (15). Since agriculture is the primary source of income, employment and food for many individuals in underdeveloped nations, CSA may help improve the link between agriculture and poverty. Conservation agriculture consists of methods that try to reduce soil disturbance and the amount of exposed soil, such as minimum/zero tillage, mulching and crop rotation(16).

There is significant potential for the application of CSA technologies, either in combination or individually, to mitigate the effects of climatic variability on agriculture. Crop yields may be increased by an average of 7-15% with farm-level adjustments, according to a crop simulation meta-analysis under several climatic scenarios (17). The advantages of adaptation have been shown to alter depending on the technology used and environmental factors like temperature and precipitation (18). Similar evidence from trials conducted on farms demonstrates that CSA technology may boost agricultural yields, boost input usage efficiency, boost net income, and reduce greenhouse gas emissions (19).

Adoption of CSA is not without its difficulties; for example, when mulching is done in semi-arid places, where termites abound, the surface mulch is consumed by the termites, reducing the effectiveness of the CSA (20). Animals that graze on post-harvested fields may disrupt zero/minimal tillage practices by removing residue from the ground, leaving insufficient residue to properly cover the crop. Additionally, the heavy nature of grazing compact the soil, making it harder to grow using zero-tillage techniques (21). Farmers in the African environment see the perceived risk of implementing CSA as a main barrier to adoption, since the methods need stronger managerial skills than the traditional system (22). Tenure security may also have a role in determining the prevalence of these practices, particularly if higher levels of tenure security lead to greater incentives to spend in ways that boost returns and ensure their stability over the long term (23).

Agriculture is considered to be "climate-smart" when farmers are in a position to adapt and sustainably mitigate climate risk and contribute to increasing food security. Climate variability poses serious economic challenges including low yields and high post-harvest losses leading to low income among farmers. Although there have been technological and policy efforts in Kenya by both national and county governments through county integrated development plans to assist farmers to cope with the challenge of climate variability, the effects are yet to be fully realized at the household level. The adoption of Climate-Smart Agriculture practices (CSA) plays a key role in promoting resilience to climate variability, improvement of household income, and increase in agricultural productivity. Study analyzed both negative and positive effects of CSA on farmers' livelihoods and environmental sustainability.

2.0 Materials and Methods

2.1 Study Area

The study area was Soy sub County Uasin Gishu County. The sub-County lies between longitude 35° 8′ and 35° 19′ East and Latitudes 0° 45′ and 0° 56′ North and area of 768.0 square kilometer (Figure 1). The sub County is situated on a plateau falling gently from 2700 meters to about 1,500 meters above sea level. Soy sub County has seven administrative wards namely; Ziwa, Segero Barsombe, Kipsomba, Soy, Kuinet Ka

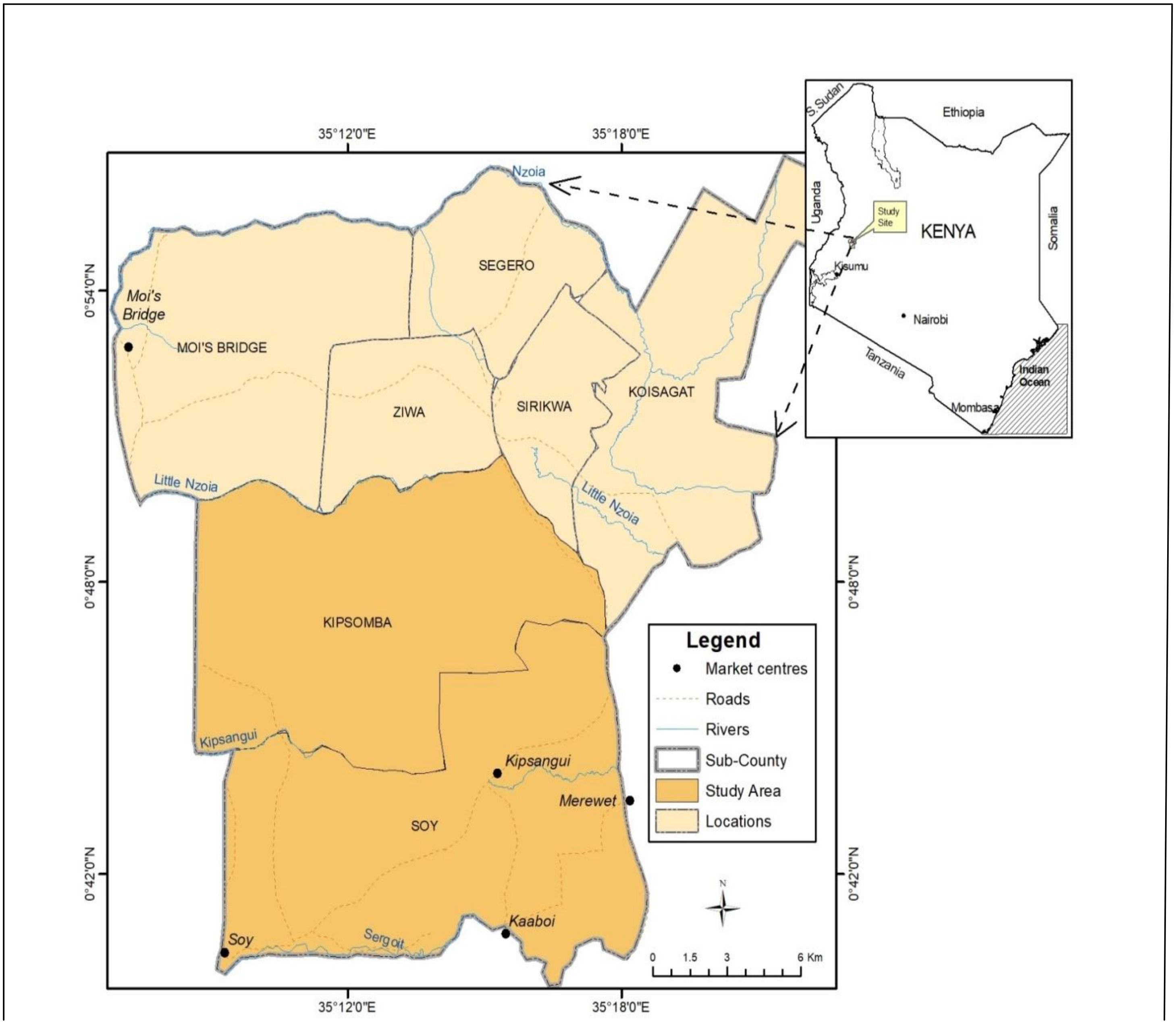

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Figure1.0 A map of Soy sub-County showing the sampled sites

2.2 Climate and Agro-Ecological Zones

The yearly rainfall in the Soy sub-County is between 900 and 1200mm, distributed between two rainy seasons. Annual temperatures in the sub-county range from 8.4 to 27 degrees Celsius, making it a temperate and cold region. March through May and October through December are the rainy seasons, with January and February being the dry seasons. Approximately 218 km^2 of land in Soy is underwater, swamps, and rocks.

2.3 Sampling Procedures and Sample size

The proportionate sampling approach prescribed by Kothari's (24) formula for a finite population was used to estimate the sample size;

n= $z^2.p.q.N/\ e^2(N-1) +\ z^2.P.Q$ ……………………………………………………….. (1)

Where: N = the population size,

n = sample size,

p = the sample proportion (q = 1-p),

Z= the standard variant at a given significance level (α = 0.05) and

e= acceptable error (precision).

Using p=0.5 as the proportion of farmers with off-farm investments ("n" will be the most conservative sample and will give the desired precision).

Z=1.96,

p=0.5 and an acceptable error of 7 % (e).

q= the weighting variable and is computed as 1-P.

The sample will be determined as;

n= $(1.96^2 \times 0.5 \times 0.5 \times 88{,}956) / (0.07^2 \times 88{,}955) + (1.96^2 \times 0.5^2) \approx 196$

Therefore, from the equation, the desired sample size was 196 respondents. These were obtained as 5443/ 8903 x 19 = 119.22 ≈ 119 for Kipsomba ward and 196-119= 77 for Soy ward. The Key informants involved; two crop officers, two National Cereal Board Officers, two Meteorologists, and one Environmental Officer and documentation of the adopted approaches to provide rich qualitative information to support primary data from interviews.

2.4 Data Collection

Questionnaires and a Key Informant Interview were used to gather the primary data for this study. Household questionnaires were administered to selected households targeting household heads in order to obtain primary data on farmer's socio economic characteristics. These questionnaires also help to gather data about climate smart agriculture and climate variability information. The questionnaires helped to gather data on effects of CSA on agricultural production and climate variability information. Besides the questionnaires, Key Informant Interviews were also conducted, with the six Key Informants who were chosen purposely to give insight information on adaptive approaches, agricultural production, rainfall amount, and distribution.

Secondary data was used to complement the survey data. The data included the interventions of the national and county government to improve farmers' livelihoods, rainfall data and information on climate variation.

3.0 Results and Discussion

3.1 Effects of Adoption of Climate Smart Agricultural practices in Soy sub County

In order to analyze the effects of CSA on farming households in Soy sub –County descriptive statistics was used to analyze the data collected using farming household survey and the results presented in Table 1 . The result shown show that, 88.7% of the respondents indicated that with adoption of CSA practices there were positive effects as evidenced by the increased yields. Seventy-three percent (73%) of the farming households indicated that adoption of CSA leads to increased income, 96 % of the farming households opined that the adoption of CSA can control pest in farms, 99.93% also that the adoption of CSA control weeds in the farms. This finding suggests that CSAs are a viable strategy for enhancing rural communities' food security and decreasing poverty. The results concurs with the study by.(25), who concluded that the factors such as the home head's education, labor size, and the implementation of CSA all had a substantial impact on household income.

Table 1: Data collected using farming household survey

Benefits of CSA	**Number of respondents (%)**
Increased yields	88.77
Increased income	73.46
Employment creation	7.65

Able to control pests	4.08	
Able to control weeds	0.06	
Totals		100

According to the study findings the soil management practices for CSA include; minimum tillage, agro-forestry practices, and crop rotation through compost, crop residues, and green manure. The practices also prevent the leaching of nutrients by erosion and better retention of soil moisture. Agro forestry leads to reduced soil and water erosion, increased yields of food, fodder, and fuel; however adoption of agro forestry worries farmers in that the introduction of some trees on farms can affect the growth of crops.

It was determined via this research that enhanced yields, higher farm revenue, and more food availability are the key advantages of CSA activities. It also suggests that farm families may play an important role in adapting to climate change. This suggests that CSA is a viable strategy for reducing climate change's negative effects, fortifying communities against natural disasters, increasing food security, and decreasing poverty. Most of the interviewees said that improved soil organic matter quality due to CSA adoption was the single most significant benefit of the practice.

4.0 Conclusions and Recommendations

The adoption of CSA practices positively and negatively influence the livelihoods of farming households in Soy sub-County, the main achievements of the adoption of CSA is the increase of farm yields, yield stability due to the soil being well-drained, and having raised farm income due to reduced farming activity, for instance, minimum tillage where farmers can avoid the normal ploughing of land and just go for direct planting or plant after harrowing their land. However, the adoption of some CSA practices such as agro forestry had a negative effect where the planting of trees affect some of the growth of crops on the farm. Farmers need to progress in ways that will lead them to strengthen the adaptability of farming communities and their livelihoods. This can be achieved by implementing beneficial climate-resilient and low carbon emission agricultural operations on farmers' land and by adopting a holistic vision of agricultural growth that directly links farmers to policies and programs that will provide them with suitable incentives to adopt new practices. Although Kenya's potential in CSA is high, it has yet to be fully exploited. Context-specific approaches can only be devised and implemented with the coordinated effort of numerous players, making the promotion of CSA practices a complex and multi-actor endeavor. There are CSA-like activities in the country's traditional agriculture as well as research-oriented methodologies and programs, but promoting CSA practices needs coordinated activity from various actors to enable for context-specific ways to be devised and implemented.

In order to generate CSA research-based evidences and uptake and up scaling CSA practices as best practices in Soy sub–County, Uasin Gishu County, Kenya, the study suggests that the

Ministry of Agriculture consult with the County government to carry out an extensive analysis of Climate Smart Agriculture policies, programs, and institutional arrangements in the areas.

COMPETING INTEREST

I Declare that no competing interest exist

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