Mitigation Measures Adopted by Small Scale Maize Farmers to The Effects of Rainfall Variability on Maize Production

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Abstract- ***Small-scale maize farmers often face challenges due to rainfall variability, which can impact maize production. To mitigate the effects of such variability, farmers adopt various measures to enhance resilience and improve overall productivity. It is on this premise that this study sought to establish the intervention strategies among the small-scale farmers in Endebess Sub County between 2008-2018. The study was based on 330 maize farmers in wards namely; Chepchoina, Matumbei and Endebess. Primary data was obtained from randomly selected farmers through questionnaires, while secondary data on rainfalls and maize production yields was collected from Kitale Meteorological Departments and Endebess Sub-County Ministry of Agriculture offices respectively between 2008-2018. The data collected was analyzed using Statistical Package for Social Sciences version 22 and Precipitations Concentration Index (PCI) values. The finding found that there was a positive relationship between rainfall variability and maize yields. The County government should put measures and policies that are aimed at protecting the forest cover. Forests help reduce the amount of carbon gas in the atmosphere, which is the main cause of climate change that normally led to rainfall variability effects. The related problems of rainfall anomalies are food insecurity, reduction of yield and increase of pest and diseases.***

Indexed Terms- ***Intervention Measure, Maize Production***

I. INTRODUCTION

Human adaptation to a greater extent determines the consequences of climate changes that reduce agricultural productivity impacts (IPCC, 2001), adaptation capacity, as per Parry et al. (2007), is the system's capability to accommodate and address climate change. Changes as well as changeability, allowing for mitigation of potential negative impacts and the exploitation of opportunities that may arise, as well as the capacity to tolerate the consequences. Adaptation, as defined by the Intergovernmental Panel on Climate Change (IPCC) and the Food and Agriculture Organization (FAO) in 2008, involves adjustments in natural or human systems in reaction to real or anticipated climatical influences or repercussions. Some strategies for adaptation to address rainfall changeability are drawn by Low (2005), Orindi and Murray (2005), Selvaraju Subbiah, Juegun (2006) and Majule et al., (2009), include crop diversification changes, changing planting season calendar, planting short duration crops, soil conservation and enterprises diversification. However, more specifically the dry spell periods require the maize farmers to adopt measures such as altering cropping systems, mixed cropping, planting resistant species or changing the crop yield types.

The second measure should concentrate on crop management practices designed to prevent critical growth stages from coinciding with harsh climatic conditions, especially during mid-seasons. Management practices for coping with dry spells can be adopted, such as adjusting the growing period length plus modifying harvesting as well as planting schedules, as suggested by Orindi, Eriksen, et al. (2005). The uses of irrigation method have the potential to improve the agricultural production through the supply of water during dry spell period and lengthening the growing seasons (Baethgen et al., 2003). Various studies have been conducted by (UNDP, 2010).

According to Idrisa et al. (2010), who examined the Influence of farmers' socioeconomic and technological attributes on the adoption of soybean technology in Southern Borno State, it is recommended that suitable modern technologies, such

as soil conservation techniques, should be promoted for adoption by small-scale farmers. These measures can serve as a key strategy in addressing global warming. These adaptations can be implemented in any country as providing more water, re-uses of water and changing crop varieties.

Therefore, there is need to have long term measures, government, NGO and other donors should provide funds on research institutions to develop the resistant crop variety and early maturity varieties e.g., H512, H624, Katumani maize varieties (http://kenyaseedcompany 2018) and on the other hand, educated farmers to improve their agricultural practices. Despite numerous studies having been done on embracing of rain changeability in developing countries within the Sub-Saharan region, findings from Nhemenchena et al. (2007) imply that ongoing climate variations are projected to decrease crop yields in several global regions.

Huho et al. (2012) delved deeper, concentrating on arid and semi-arid parts, as well as medium-potential zones. Their findings suggest that practices should be made accessible to farmers, as they offer Numerous advantages concerning productivity, adaptability, and mitigation. However, these findings studies do not focus into a whole community or maize farmers in the specific measures to be adopted in the high potential Agro-ecological zones and how they responded to consequences of rainfall variability. However, there is urgent need for researchers and agricultural practitioners to focus on high potential zones and specific measures to be adopted small holder farmers to rainfall variability and the specific adaptations. This is because the farmers in Sub-Saharan Africa tend to incline the traditional method system (UNEP, 2009). So, it is imperative to comprehend the unfolding events in small scale farmers in Endebess Sub County which is considered as high potential Agro-ecological zone in Trans-Nzoia County, which is regarded as the food basket of Kenya, this is because maize performance depend on the climate factor.

II. MATERIALS AND METHODS

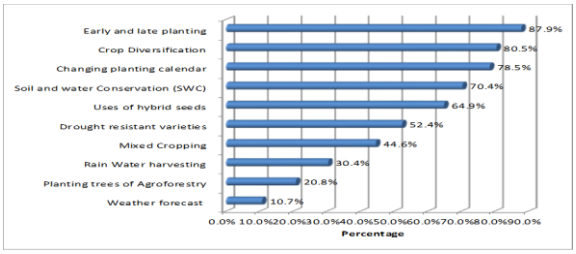
The study adopted descriptive and correlative research design using both qualitative and quantitative approaches. The target population was Endebess Sub-County had 2000 farmers registered in the Sub-County (Sub County Agriculture office by 2018). Small scale maize farmers were preferred more so because they major in the maize crop production. A sample of 330 was selected from the study population for data collection purposes. The study administered questionnaires to collect information from maize farmers in the ground field. The study obtained secondary data on maize yields, rainfall amounts from the Ministry of Agriculture office at Endebess Sub-County, Kitale Meteorological Departments in respective offices between 2008 and 2018. Other data included the shape of study, site extracted from the County Map of Trans Nzoia were used. Validity of instrument was determined by circulating the research tool to the supervisor and other experts in the field of research to evaluate the item objectivity of the questionnaires that were used inthe study. The study used test-retest method to determine reliability of the instrument. The analysis of data utilized both descriptive and inferential statistics and results presented in the form of a table percentages, charts and graphs.

III. FINDINGS OF THE STUDY

Farming Coping Strategies to Rainfall variability

The third goal of the study was to examine the measures adopted by small scale maize farmers to mitigate the effects of rainfall variability on maize productions in rain-fed agricultural productivity. The inter-annual rainfall variations imply that farmers had to adopt wide range of adaptation strategies, both long -term and short- term strategies, to reduce climatic shocks due to the consequences of climate changes that affect maize crop productions among the farmers. To achieve the goal of the study, the researcher requested the respondents to indicate their different strategies applied in farming activities to cope with rainfall uncertainties. The respondents listed down the measures used in farming as follows: - crop diversification, early and late planting, changing the planting calendar, rain water harvesting, soil and water conservation measures (SWC), planting of trees (Afforestation and Agroforestry) uses of hybrid seeds, drought resistant varieties, mixed cropping and weather forecast. The adaptation measures were in relation to the effects of rainfall variability such as dry spells, low rainfalls/ increased rainfalls (floods),

erratic rains and droughts as indicated in the Figure 4.15.



Source: Field Data 2022

Figure 1: Maize farming coping strategies to rainfalls variability

From the Figure 4.15, shows an overwhelming majority of farmers who adopted early and late planting as a response to rainfall anomalies, representing 87.9% of the total respondents who were interviewed. A close range followed by crop diversification 80.5% and changing planting calendar as 78.5%). This finding shows that coping measures done at farm level enable farmer to get prepared to access the adequate income so as to deal with climate effects (extremes) agree with the Ricardian theory of Climate change adaptation where farmers were to adjust the responses and minimize the profit from rainfall variability. Farmers are able to avoid the fake start of crop germinating which occur early in the season. This measure ensures that crop do not suffer the moisture crisis in rooting zone and in the crucial stages of development. Other coping measures adopted by farmers were, Soil and Water Conservation (SWC) and use of hybrid seeds, as represented by 64.9% and 70.4% of the total respondents respectively. The management practices included, proper timing, farming activities, burying of residue crops to increase soil fertility and burning of cropping residues to release nutrients in the soil, to increasing the organic matters.

According to Lema and Majule (2009), who studied the determinants of adaptations of farmers to climate variability in Manyoni farm in Tanzania? Their findings indicated that management practices were very crucial and consistent in line with the results as indicated. However, others practices were; the use of drought resistant varieties 52.4%) and mixed cropping 44.6% and rain water harvesting 30.4% and the least popular measures were, planting of trees of agroforestry and weather forecast in the respective order of 20.8% and 10.7%. These arguments are in line with Eriksen et al., (2005) and, Adger (2006), and Ngigi (2009), who revealed that planting of drought resistant varieties by smallholders' farmers in West Africa helped to reduce the effects of adverse weather conditions and also acted as an insurance against rainfall variability. The measures were practiced in Uganda by spreading the risks in the farms, but the nomadic communities applied the use of drought varieties against drought effects are adapted measures along the margin region of Kenya. This supports the arguments by Ndathi et al., (1998), who studied varieties against drought as adopted by Pastoralist communities along the desert margin of Kenya. Mixed cropping as a measure involves the use of two or more crops planted in one field. The management practice system is commonly practiced in Manyoni farms in Tanzania where maize crop and sorghum crop are planted in one field, with varying maturity period. This act as risks spread in case of one crop fails, the other crop products will be used by the farmer as cash sources. This coping measure agreed with the findings of Mendelsohm et al., (2000) in Cameroon, where farmers planted different varieties of crops in one field.

Bryan et al., (2011) findings confirms that, the adaptation measures to rainfall variability may require possible management practices such as planting trees or agroforestry, uses of tolerant varieties of crops, the land management practice methods, which includes; planting of trees along the river banks for protection, use of irrigation, efficient water harvesting, soil and water conservation measures as responses to agricultural technology that can refer to as long term and short term measures. But Hoang et al., (2014), in their research, showed findings contrary to the opinion that proper maintenance of farming measures is essentially important in dealing with climatic variations.

This is because many approaches or measures have been applied by many farmers and became successful in farming activities and achieved high productivity during the unconducive weather conditions in some years. However, other measures like the use of harvested rain water and weather forecast have been ranked as the lowest response by the respondents.

Indeed, the practice is considered as highly costly in technology practices where farmers need heavy capital for procurement of materials. For instance, rain water harvesting, require the sheet and plastic materials and this investment cannot be implemented at an individual farm level alone and this therefore confirm the findings of Bryan et al., (2011) who indicated that the rate of adoption of technology remains low in farming practices. The use of smart phones for weather forecast as a strategy is very important for farmers by accessing the information that is related to weather forecast and enabling farmers to plan well during farming periods. This measure will counter the rainfall variability effect in the Endebess Sub County that only bases on seasonal weather forecast information as a short term and long-term solution. However, the measures have been practiced by Esoko smallholders' farmers in West Africa, where they sign up and receive weather information and this finding coincided with those of Muga et al., (2010) and FAO (2014).

CONCLUSION

The study established that there a significant positive effect between rainfall variability mitigation strategies and maize production among small scale farmers in Endebess Sub County Kenya.

RECOMMENDATION

Small-scale maize farmers often face challenges due to rainfall variability, which can impact maize production. To mitigate the effects of such variability, farmers adopt various measures to enhance resilience and improve overall productivity. Here are some common mitigation measures: Farmers may invest in simple rainwater harvesting techniques like building small ponds or using catchment systems to store rainwater for irrigation during dry periods. Implementing techniques such as mulching and cover cropping helps to reduce soil moisture evaporation and maintain soil moisture levels.

Alternating maize cultivation with other crops helps break pest and disease cycles and can also be beneficial in managing water demand and planting different maize varieties that have varying maturity periods can spread the risk associated with unpredictable rainfall. Investing in drip or sprinkler irrigation systems helps farmers efficiently manage water resources and provide crops with consistent moisture.

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