# Access and Use of Seasonal Climate Forecasts Information on Maize Crop Production in Vihiga County, Kenya

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***Abstract:*** **Vihiga County has been faced by drastic reduction of maize crop yields in recent years making the realization of food security unattainable. The county live in absolute poverty, and therefore food insecure. The purpose of this study was to exploit the extent of access and use of seasonal climate forecast information by small-scale maize farmers on maize crop production in Vihiga County. The scope of the study mainly focused on evaluating the influence ofaccess and use of seasonal climate forecast information as the most adaptive strategy on maize crop production. This study was conducted through descriptive survey research design. This study targeted a population of 3,234 households of small-scale farmers with > 1 to 4 acres of land. The sample size of 153 households was used in the study. A systematic sampling technique was employed by purposeful selection of three constituencies of Hamisi, Vihiga and Luanda. Secondly, by purposeful selection of three wards of Muhudu, Mungoma and Luanda South that cut across agricultural zones in the county. Finally developing a sample frame of 3,234 households. Meteorologists and crop officers were purposefully sampled based on their availability. Primary data on the access and use of SCF information on maize crop production were collected by use of pre-tested Questionnaires. The secondary data was collected by use of Key Informant Interview Schedule for meteorologist and crop officers for the period 2004-2014 on rainfall, temperature, and maize crop production. Data was analysed both in descriptive and inferential using Microsoft software's. Descriptive analysis was used to assess the extent of access and use of SCF on maize crop production. Correlation analysis was used to establish the relationship between access and use of SCF and maize crop production in Vihiga County. The information obtained provided a feedback on the extent to which farmers are responding to seasonal climate forecasts information and provided a framework for improving maize crop production in Vihiga County. The study showed that there is a decline in maize crop production in Vihiga County and yet farmers accesses and uses SCF information. Where by the number of bags per acre dropped from 21.5 bags to 15.2 bags between (2004-2014). The study found that there is no significant relationship between access, use (r=0.018588, p=0.098141). The study concludes that futher research need to be conductedin the area to find out the main cause of decline in maize production in Vihiga County.The study however recommends the County government and the NGO's in Vihiga County to come up with interventions strategies that may help small-scale farmers to increase maize crop production.**

***Key words:*** **Seasonal climate forecasts, access and use, maize crop production**

## I. INTRODUCTION

Agriculture is by far the most of the world's economic activities; it uses one-third of the total land surface and employs 45 percent of the working population (David Grigg, 1984). Employing nearly one-half of the world's work force, agriculture is clearly of great economic and social importance of any country due to its malfunctioned nature.

Agriculture serves as the main source of food and employment world-wide and more so to the rural population with rain-fed farming contributing to about 97% of the total crop land in sub-Saharan Africa (Calzadila*et al.,* 2009). Impact of climate change and variability is an issue of international concern after it was given closer attention at the United Nations Conference on Environmental and Development (UNCED) summit in 1992 where causes and mitigation measures were addressed. In Kenya agriculture remains central to the economy and the growth of the sector is positively correlated to the growth of the overall economy, Agricultural Sector Development Strategy, (2009 2010). The agricultural sector contributes 24% of the National Gross Domestic Product (GDP) and employs about 70% of the population in both basic production and industry in Kenya (GOK 2009). Agriculture is thus a major contributor to the socio- economic framework of Kenya where majority of Kenyan population is involved in subsistence agriculture yet this is vulnerable to weather shocks especially due to the lack of adequate moisture (Irungu*et al.,* 2009). Agriculture in Kenya is mainly rain-fed and is practised by smallholders, who have noticed changes in weather patterns hence need for various coping mechanisms (Macharia*et al.,* 2010).

Globally the tele-connections of ocean-atmosphere leads to occurrence of major synoptic systems such as; El Nino Southern Oscillation (ENSO), Inter-Tropical Convergent

Zone (ITCZ), and North Atlantic Oscillation (NAO) which brings about climate variability. It affects rain-fed agricultural production by reduction length of growing season, decreasing soil fertility, increasing pests and crop disease and aggravating lack of access to farm inputs. The effects of rainfall variability are spatio-temporal, and greater among the poor smallholder farmers in Sub-Saharan Africa (Brooks & Adger, 2005). Climate change and variability has been the main cause of the occurrences of extreme weather conditions in many parts of the region of the world. In Europe it is responsible for the shift in the occurrences times of hail, frost, snow and drought which adversely affect agriculture (Gimenez and Lan Franco, 2012). In sub-Saharan Africa, climate change and variability has greatly affected food production due to prolonged droughts which have become severe in recent years (Funk *et al.,*2008). Climate change in Eastern and the Horn of Africa has been manifested in the frequent occurrence of droughts and shift in growing seasons. In Kenya, rain seasons have become unpredictable and unreliable with many regions experiencing long dry spells (Machariaet *al.,* 2012).

Several studies on how climate change, aggravated by greenhouse gases emissions will affect various ecosystems have been carried out as international effort on many fronts (IPPC, 2007a; IPPC, 2007b; Chipanshi*et al*., 2003), yet many more case-focused studies remain to be conducted in order to reduce blanket generalizations and solutions that often characterize the regional and global assessments of the impacts of climate change on crop production (Chipanshi*et al,* 2003). Several studies suggest a number of mitigation and adaptation measures that can be used to reduce vulnerability to climate change and variability. Mitigation and adaptation are two main approaches used in dealing with climate change and variability. Mitigation is a global long term approach to address problem of greenhouse gases (GHG's) emission while adaptation is a short term local measures of coping with the climate situation which involves avoiding its adverse effects or taking advantage of positive changes (Bawakiyillenou et al.,2014). Adaptation to climate change has entailed measures put in place to cope with changing climatic conditions as well as taking advantage of opportunities created by such changes.

In sub-Saharan Africa, adaptation takes centre stage in dealing with climate change and variability since the region is more vulnerable due to its limited skills and financial resources as well as weak institutions concerned with adaptation strategies (Bagamba, 2012). In Kenya, policies have been put in place for adaptation to climate change and variability. The National Climate Change Response Strategy (NCCRS, 2010) out lines adaptation measures to climate change and variability. These includes: Access and use of seasonal climate forecasts, use of short duration crop varieties, use of water conservation techniques, change in time of farm operation, soil conservation techniques, mulching crop rotation, intercropping, rainwater harvesting, zero tillage to conserve soil moisture, planting of drought tolerant crop varieties, agro forestry, irrigation, diversifying crops planted, migration and engaging in non-farm operation (Deressa*et al.,*2008; Yusuf *et al* 2008; Gbetibouo,*et al* 2008) observed that adapting rainfall variability is the best way of realizing sustainable agricultural output for those communities that are dependent on rain fed agriculture as humans may not stop climate variability.

Seasonal climate forecasts, regarded as one of the most effective adaptation strategies, are operationally produced at various climate prediction centres around the world and are useful for climate sensitive sectors such as agriculture, health and water resources. Current approaches for producing seasonal climate forecast include: use of physically based global climate models, regional climate models and empirically based statistical models (Coelho & Costa,2010).Seasonal climate forecasts have potential value and should be produced and disseminated with the user in mind and used continuously and effectively for good results (Klopper & Landman, 2006). Scientific information such as climate forecasts, should always meet the perceived needs of the user population. It should be communicated in comprehensible manner and must be consistent with existing value of potential users (Thompson& Rayner, 1998; Gerach, 1993).

Climate forecasts have the potential to contribute to sustainable agricultural production and eradicate extreme poverty and hunger if effectively used (Recha et al., 2008;Misselhorn, 2005; FAO, 2013). Effectively disseminated seasonal climate forecasts assist farmers in coping and adapting to variable climate conditions (FAO, 2013). They should be used together with a range of other tools and methods to enhance decision-making and improve overall risks management options relating to planting, irrigating, harvesting and fertilizer and pesticides applications (Gadgil*et al.,* 2002; Hansen 2004).

Presentation of forecasts and its mode of communication to policy makers and farmers are critical to application success. Much attention has been paid to science of climate forecasting and its application for drought mitigation and limited understanding of the socio-political environment through which climate forecasts are channelled and interpreted (Lemos, *et al.,* 2002). Application of seasonal forecast should be analysed through: examining the characteristics of the forecast in terms of accuracy, timing of release, data format and mode of communication; the policy making system at all relevant administrative levels and; the relative social and economic vulnerability of the population toward which the forecasts are directed (Lemos*et al.,* 2002).

The rural poor such a small holder maize farmer in Vihiga County heavily rely on rain-fed agriculture and poor timing of start of rains results in crop failure. Such farmers commonly produce their own individual forecasts through reading and interpreting localized natural signs and some of them have access to local rain prophets' knowledge that is well disseminated and respected (Lemos, 2002). Use of forecasts reduces the farmer's vulnerability to climate variability and over-reliance on food aid (Patt&Gwata, 2002).

Studies have identified several constraints that limit use of forecasts among smallholder farmers. These include: Credibility: this results from failure of forecasts to be accurate especially when forecasts are communicated in deterministic, rather than probabilistic form; Legitimacy: arises when assessment is perceived as recommending behavioural changes by one group of actors that would disproportionately benefit some other group of actors. Smallholder farmers may be suspicious of the forecasts if they do not understand the scientific methods used to develop it. Scale: results when the information covers a wide geographical areas such an entire continent, region or country but where the local implications of that information remain unclear; Constraints to downscaling: rainfall patterns may be very heterogeneous over small physical area and it may be impossible to downscale a forecast`s temporal dimension; Cognition: occur when user do not understand a forecast and therefore use it incorrectly or not at all.

Procedures: Arises when forecasts take long to reach the end users due to various standard operating procedures; Choices: forecasts do not contain enough new information to alter specific decisions. Farmers will always make decisions based on cost effectiveness analysis (meeting predetermined objectives at the least cost) rather than cost-benefit analysis (choosing the objectives and the means to maximize net gains) Patt&Gwata, 2002; Thompson & Rayner, 1978; Ziervogel, 2001).

Carrying a critical analysis of the use of seasonal climate forecasts among small-scale maize farmers in Vihiga County is crucial as this will help identify the time farmers access the forecasts after release by the Kenya Meteorological Department, degree of usage, accuracy and if the socio-economic constraints affects small-scale farmers on maize crop production in Vihiga County. All these are aimed at reducing the small-scale farmer's vulnerability and in turn improve maize yields. In light of this, it was important to establish the extent to which seasonal climate forecast had been accessed and used in maize production among the small-scale maize farmers in Vihiga County.

## II. METHODOLOGY

### *2.1 Study Site*

Vihiga County lies between longitudes $34.30^0$s and $35^00^0$ East and between latitudes $0^0$and $0^0$ 1s North. The Equator cuts across the southern tip of the County. The county covers a total of $531km^{2.}$ The County is located on the Western region of Kenya, in the lake Victoria Basin. It borders Nandi County to the East, Kakamega County to the North, Siaya County to the West and Kisumu County to the South. The county is made up of five constituencies namely; Emuhaya, Luanda, Hamisi, Vihiga and Sabatia.

The County's altitude ranges between 1300m and 1800m above the sea level and slopes gently from the East to West. Generally county has undulating hills, valleys with streams flowing from North East to South west draining into Lake Victoria. There are two major rivers; Yala and Etsalwa that drains into Lake Victoria. The County experiences riverine erosion. Consequently, the eroded soils are swept to Kisumu County where they are deposited mainly as building Sand.

Vihiga County has modified Equatorial climate with fairly well distributed rainfall throughout the year. The annual precipitation is about 1900mm. The temperature's ranges from $14^0$c to $32^0$c with a mean temperature of $23^0$ Celsius (KNBS 2013, CIDP 2013 a). Long rains are experienced in the months of March – May and the short rains in the months of October to November. The driest and hottest months are December to February with an average humidity of 41.5%. This climate supports a variety of crop farming such as maize, coffee, tea and horticultural crops. Livestock farming is also practiced (CIDP, 2013 a). Maize crop is the main staple food in Vihiga County with an estimated production of 90,000 bags per annum in the previous years.

Vihiga County has a total population of 554, 622 people and 123,349 households according to (KNBS 2013, CIDP 2013 a). With annual growth rate of 2.5%, the population is projected at 688,778 people in 2017.Vihiga County has a child rich population, where 0-14 year olds constitute 45% of the total population. This is due to high fertility rates among women as shown by the highest percentage household size of 4-6 members at 43%.

Vihiga County is one of the poor Counties in Kenya with a high poverty level, with 62% poverty index and dependence ratio of 100:90, the people in this County live in absolute poverty, and therefore food insecure (RoK, 2013 ).The poverty line is a threshold below which people are deemed poor. Statistics summarizing the bottom of the consumption distribution (i.e. those that fall below the poverty line) are therefore provided. In 2005/06, the poverty line was estimated at Ksh1,562 and Ksh2,913 per adult equivalent1 per month for rural and urban households respectively. Nationally, 45.2 percent of the population lives below the poverty line (2009 estimates) down from 46 percent in 2005/06.

A total of 20% of Vihiga County residents have a secondary level of education or above. Sabatia constituency has the highest share of residents with a secondary level of education or above at 23%. This is 6 percentage points above Emuhaya constituency, which has the lowest share of residents with a secondary level of education or above. Sabatia constituency is3 percentage points above the county average. Two wards, Emabungo and Lugaga/Wamuluma, have the highest share of residents with a secondary level of education or above at 25% each.This is 11 percentage points above Muhudu ward with the lowest share of residents with a secondary level of education or above. Emabungo and Lugaga/Wamuluma wards are 5 percentage points above the county average.A total of 63% of Vihiga County residents have a primary level of education only. Emuhaya constituency has the highest share of residents with a primary level of education only at 64%.

This is 2 percentage points above Sabatia constituency, which has the lowest share of residents with a primary level of education only.

Emuhaya constituency is 1 percentage points above the county average. Mungoma ward has the highest share of residents with a primary level of education only at 66%. This is 7 percentage points above Emabungo ward, which has the lowest share of residents with a primary level of education only. Mungoma ward is 3 percentage points above the county average.A total of 18% of Vihiga County residents have no formal education. Hamisi constituency has the highest share of residents with no formal education at 20%. This is 5 percentage points above Vihiga constituency, which has the lowest share of residents with no formal education. Hamisi constituency is 2 percentage points above the county average. Muhudu ward has the highest percentage of residents with no formal education at 22%. This is almost twice Lugaga/Wamuluma ward, which has the lowest percentage of residents with no formal education. Muhudu ward is 2 percentage points above the county average

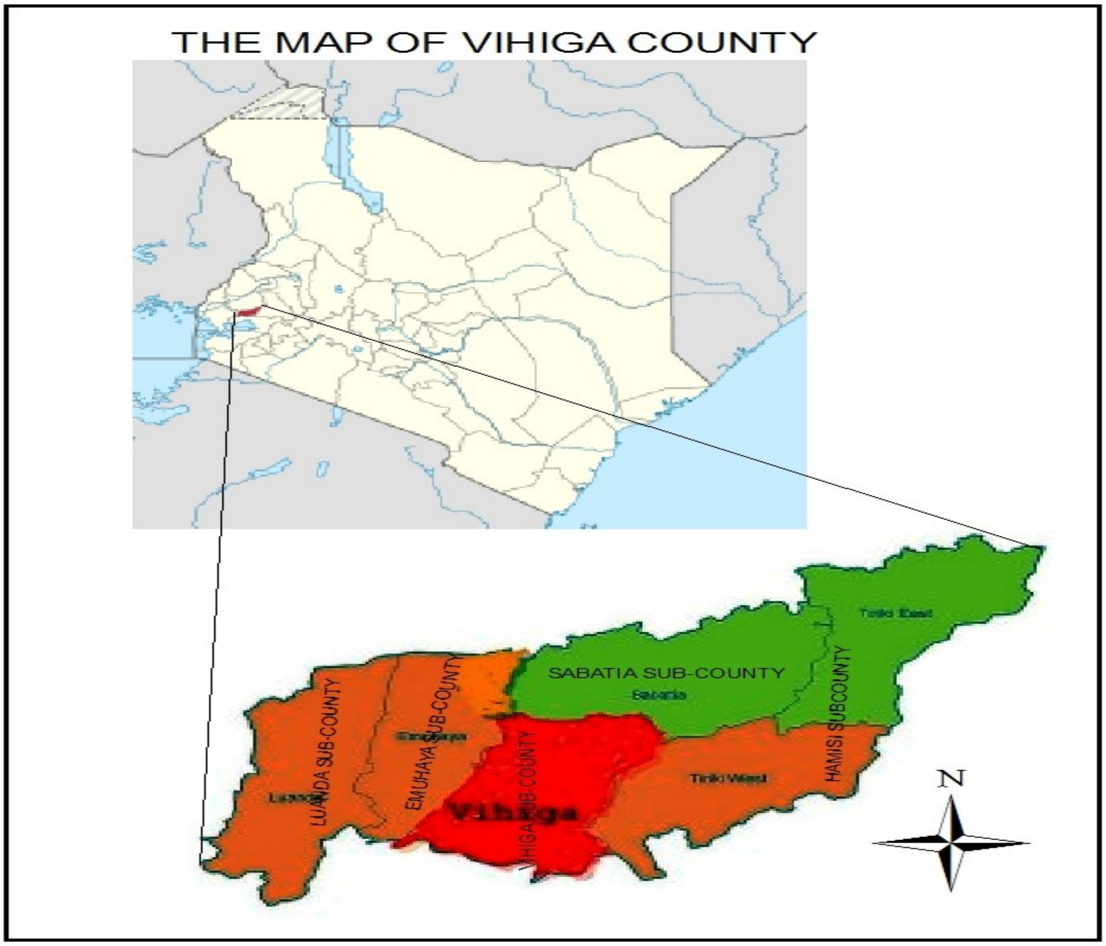


**Figure 2.1:** Map of Vihiga County

*Source; Kenya Data*

*2.2 Design*

The study adopted a descriptive survey design. Descriptive survey is an observational research design that focusses on determining the status of a defined population, phenomenon, situation or condition being studied (Kothari, 2004). The primary advantage of descriptive design is that one can gather a great amount of data from members of a population in order to determine the status of the population with respect to one or more variables (Mugenda&Mugenda, 2003). The design was appropriate for this study because the study dealt with a large amount of data from the respondents regarding seasonal climate forecasts on maize crop production and constraints in the use of seasonal climate forecasts by small-scale maize crop farmers in Vihiga County of Kenya.

*2.3 Data Sources and Data Collections*

Both primary and secondary data were collected. Primary data included the responses from questionnaires from farmers, and Key Informant Interview Schedules from Crop officers and the Meteorologists. The information on primary data was gathered by administering questionnaires to small-scale farmers. The data mainly focused on the farmer's access, use and accuracy of seasonal climate forecasts information on maize crop production. The key interview schedule was administered to Crop officers and Meteorologists. The key informant schedule was used to collect in-depth data on rainfall, temperature, seasonal climate forecasts and maize crop production in Vihiga County.

The secondary data collected included statistical data on rainfall and temperature retrieved in Kaimosi Meteorological stations within the study area for the past ten years. The statistical data on maize crop production per acreage for the past ten years was obtained from the Ministry of Agriculture Vihiga County.

*2.4 Sampling Procedures*

Systematic Random Sampling technique (SRS) was adopted in the selection of the respondents for the study. Crop officers and Meteorologists were purposeful sampled based on their availability. Sampling also is referred as the procedure, process or technique of choosing a sub-group from a population to participate in the study (Ogula, 2005). It is the process of selecting a number of individuals for a study in such a way that the individuals represents the large group from which they are selected.

The researcher targeted 3,234 households in the study of small-scale maize farming households with acreages of less than one to four acres in all the three wards. Foremost, a purposive selection the three constituencies of Hamisi, Vihiga and Luanda in Vihiga County was adopted. In this case the selection was based on the fact that majority of people are small-scale maize crop farmers. Secondly, the three Wards ofMuhudu, Mungoma and Luanda South were purposively sampled. In this case it was based on the fact that they cut across all agricultural zones in Vihiga County.

Finally, a list of small-scale maize farming households with acreages of less than one to four acres was made in all the three wards was made. The researcher and the enumerators then developed a sample frame for small-scale farmers. This involved determining the total number of respondents that were used in the study. A total number of 3,234 households were identified by names to form the sample frame. There was systematic selection of the $n^{th}$ household after establishing the starting point. The $n^{th}$item was elected using the formula; $K=N/n$,to obtain the interval of selecting the $n^{th}$ household. (3,234 ÷153 = $21^{st}$).

The starting point was established using simple random technique where 21people representing households were subjected to pick 1 Yes and 20 No's papers. The $5^{th}$ person picked the yes paper and this represented the household where starting point began and it continued after every $21^{st}$ interval to obtain the 153 households that were used in the study.

*2.5 Data Analysis*

Data analysis comprises of closely related operations such as establishment of categories, application of these categories to raw data through coding, tabulation and then drawing statistical inferences (Kothari, 2004). Primary data gathered was coded and keyed into the computer for subsequent analysis.

Data was analyzed by use of both descriptive and inferential statistics using Microsoft Office, Excel 2010,INSTAT version 3.37software and SPSS. Descriptive analysis was used to determine access and use, and accuracy of seasonal climate forecasts small-scale maize crop farmers in Vihiga County. Correlation analysis was used to establish the relationship access and use of seasonal climate forecasts and maize crop production by small-scale farmers in Vihiga County.

## III. RESULTS AND DISCUSSION

*3.1 Demographic Characteristics*

The study sort to find out the demographic characteristics of the farmers. Foremost it was important to find out the age of the farmers. According to the findings, According to the findings, 68% of the farmers were aged 46 years and above, 20% were aged 36 years – 45 years and 12% were aged18 year's- 35 years. The mean age of the respondents was 44.5 years. The result finding show that older people were involved in the farming activities in the study area than the youth. This is because, most young people travel to urban centres to look for white collar jobs.

It was important to find out the gender of the respondents. From the findings, 60% of the respondents were female while 40% were male. This shows that women involved in farming were many as compared to men. This is because, most men travelled to the urban centres to look for jobs while women remained behind to look after the farm.

It was important to find out the academic qualification of the farmers. From the findings, 32% of the respondents had non-formal education, 24% had adult education, 20% had primary education, 16% had secondary education and 8% had secondary to tertiary education. There is low level of literacy among the small scale farmers in the in the study area and this would contribute to low to the adoption of various farm technologies as well as influence on use of agricultural information.

The study sought to find out the professional qualification in agriculture of the farmers. According to the findings, 52% of the farmers had no training in agriculture, 36% had induction course in agriculture, 4% had a certificate in agriculture, 4% had diploma in agricultureand 4% had degree in agriculture. This implies that majority of farmers had no training in agriculture and this would affect low adoption measures to farming.

It was important to find out farmers experience in crop production. Majority of the farmers had a farming experience of above 20 years representing 40%. 32% had between 16-20, 12% had between 11-15, 8% had between 6-10 and 8% with 1-5 years. The mean farming experience 17.4 years. This implies that the respondents had acquired much experience in farming enterprise.

The study sought to find out the size of farm of the farmers. From the findings, 52% of farmers had <1acre, 24% had 1-1.99 acres, 16% had 2.0-2.99 acres and 8% had 3.0-3.99 acres of land. The average cultivated land was 1.575 acres. The implication is that the majority are small-scale farmers, which is a major characteristic among the households in Vihiga County.

The study sort to find out the household size. A total 60% of farmers had between 1-3 members, and about 20% 4-6 members and another 12% 7-9 members. Only 8% had household size of 11 members and above. The mean household size was 4 members. This implies that there is relatively small household size among the respondents. There is a negative implication is availability of family labour as most of the family members migrate to urban areas seeking for jobs. Most farms produces an average of 16.5 bags per acre with 52 % producing between 1-5bags, 32% producing 6-10 bags, 8% producing 11-15 bags, 4% producing above 16-20 and 4% producing above 20 bags. This indicates that the maize crop production in Vihiga County is poor.

Table 1: Demographic Characteristics

| **Farmers Age ( years)** | | **Percentage** |
|---|---|---|
| < 20 | | 12 |
| 20-39 | | 20 |
| 40-59 | | 40 |
| 60- above | | 28 |
| X =44.5 | | 100 |
| **Gender** | | **Percentage** |
| Male | | 40 |
| Female | | 60 |
| Total | | 100 |
| **Educational Level** | **(Years)** | **Percentage** |
| Non formal | ( 0 ) | 32 |
| Adult Education | (1-6 ) | 24 |
| Primary Education | (7-9 ) | 20 |
| Secondary Education | (10-12) | 16 |
| Tertiary Education | (13-above) | 8 |
| X=13.6 | 100 | |
| **Professional Qualification** | **Years** | **Percentage** |
| No Training in Agriculture | 0 | 52 |
| Induction Training in Agriculture | 1 | 36 |
| Certificate Course in Agriculture | 2 | 4 |
| Diploma in Agriculture | 3 | 4 |
| Degree and above in Agriculture | 4 | 4 |
| X=1.12 | 10 | 100 |
| **Farming Experience ( Years)** | | **Percentage** |
| 1- 5 | | 8 |
| 6-10 | | 8 |
| 11-15 | | 12 |
| 16-20 | | 32 |
| Above 20 | | 40 |
| X=17.4 | | 100 |
| **Farm hold Size (Acres)** | | **Percentage** |
| <1 | | 52 |
| 1-1.99 | | 24 |
| 2.0-2.99 | | 16 |
| 3.0-3.99 | | 8 |
| X = 1.299 | | 100 |
| **House hold Size ( Members)** | | **Percentage** |
| 1-3 | | 60 |
| 4-6 | | 20 |
| 7-9 | | 12 |
| 11- Above | | 8 |
| X= 4 | | 100 |
| **Farm production per acre( 90kg bag)** | | **Percentage** |
| 1-5 | | 52 |
| 6-10 | | 32 |
| 11-15 | | 8 |
| 16-20 | | 4 |
| Above 20 | | 4 |
| X=16.5 | | 100 |

***Source**: Field Survey (2016)*

### *3.2 Seasonal Climate Forecast Information Access and Use*

#### *3.2.1 Seasonal Climate Forecast Information Access*

A number of global, regional and national stakeholders generates climate information. Whether the public can access the climate, data depends on the policies of the stakeholders involved in funding, producing, processing, dissemination and storing the data. Effectively disseminated seasonal climate forecast assist farmers in coping and adapting to variable climatic conditions (FAO, 2013)

It was important to find out how the farmers accessed information on seasonal climate forecasts. From the findings, (96%) of the farmers accessed information on seasonal climate forecasts on radio, (92%) on experience, (56%) on commercial input dealers, (52%) on television, (40%) from school, (40%) on mobile phone, 32% from friends and neighbours. Other sources of information include 25%from newspapers, (8%) from rain makers/prophets 8%, from Agricultural shows, (4%) on meteorological records, (4%) from rainfall data, (4%) from extension agent and (4%) on internet. The result findings shows that the respondents accessed seasonal climate forecasts information through electronic media, interpersonal and modern information technology as well as indigenous media in the study area to satisfy agricultural information needs. The meteorologists and extension agent rarely communicated the seasonal climate focus information to the farmers in Vihiga county. Farmers also rarely get rainfall data and information on seasonal climate forecast from the meteorologist.

Table 2: Accessing Information on Seasonal Climate Forecasts

| Sources of Information | Percentage |
|---|---|
| Radio | 96 |
| Television | 52 |
| Experience | 92 |
| Meteorological department | 4 |
| Newspaper | 25 |
| School | 40 |
| Commercial input dealers | 56 |
| Rainfall data | 4 |
| Extension agent | 4 |
| Internet | 4 |
| Mobile phone | 40 |
| Agricultural shows | 8 |
| Friends/ Neighbours | 32 |
| Rainmakers / Prophets | 8 |

***Source:*** *Field Survey (2016)*

### *3.2.2 Knowledge on Seasonal Climate Forecasts*

The study sought to find out if the farmers had knowledge on seasonal climate forecasts. According to the findings, 80% of the farmers indicated that they had knowledge on seasonal climate forecasts while 20% indicated that they had no knowledge on seasonal climate forecasts

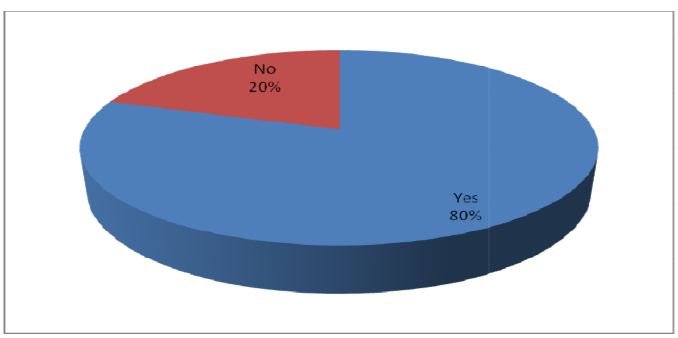


Figure 3.1: Knowledge on Seasonal Climate Forecasts

***Source:*** *Field Survey (2016)*

### *3.2.3 Seasonal Climate Forecast Usage*

The study sought to find out the extent the farmers used seasonal climate forecast. According to the findings, 80% of the respondents frequently used seasonal climate forecast, 12% used seasonal climate forecast more frequently and 8% did not use seasonal climate forecast at all. The organisational setting, practises and routines, flexible decision-making processes, in-house expertise and technical capacity, and information seeking are aspects that can promote the use of SCF in organisational contexts (Lemos, 2008).Climate and environmental information is most useful if it can be integrated into the agricultural decision-making process. The benefits of the Green Revolution, which greatly improved food security and reduced poverty in Asia and Latin America, largely bypassed most of sub-Saharan Africa (SSA). Dependence on uncertain rainfall and exposure to climate risk characterize the livelihoods of roughly 70% of the region's population; and frustrate efforts to sustainably intensify agricultural production, reduce poverty and enhance food security. Forecasting climate fluctuations at a seasonal lead time is possible because of the interaction between the atmosphere and the slowly varying ocean surfaces. While early advances in seasonal climate forecasting were largely driven by climate science and by investment in ocean monitoring and climate modelling, the promise of using information to better manage agriculture and food security has been part of the rationale for sustained investment. Interest in targeting African agriculture was stimulated in part by a study by Cane *et al.* (1994), who showed that Pacific sea surface temperatures, associated with the El Niño/Southern Oscillation (ENSO), were more strongly correlated with maize (*Zea mays*) yields than with seasonal total rainfall in Zimbabwe.However, forecasts do not contain enough new information to alter specific decisions. Farmers will always make decisions based on cost effectiveness analysis (meeting predetermined objectives at the least cost) rather than cost-benefit analysis (choosing the objectives and the means to maximize net gains) Patt&Gwata, 2002; Thompson & Rayner, 1978; Ziervogel, 2001).

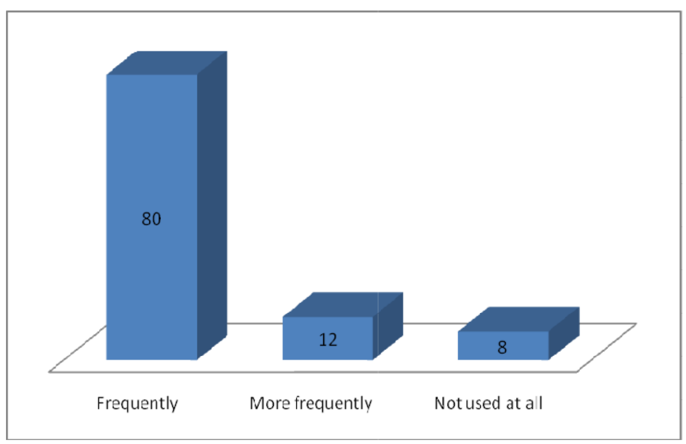


Figure 3.2: Usage of Seasonal Climate Forecast

***Source:*** *Field Survey (2016)*

*3.2.4 Categorization of Respondents According to the Extent of Access and Use of SCF on Maize Crop Production*

The study sought to find out the extent the farmers accessed and used the seasonal climate forecast information while making decisions. A Likert scale was used where 1-1.49 was very low extent, 1.5-2.49 was low extent, 2.5-3.49 was moderate extent, and 3.5-4.49 was great extent. The study reveals that 55 %of the respondents were classified as high users of seasonal climate forecasts, 23%are moderate users, 12% low users and 10% very low users. Generally, high proportion of small-scale maize crop farmers are high users of SCF.

Table 3: Categorization of Respondents According to the Extent of Access and Use of SCF on Maize Crop Production.

| Likert scale | Category of information | Percentage |
|---|---|---|
| 1-1.49 | Very low extent | 10 |
| 1.5-2.49 | Low extent | 12 |
| 2.5-3.49 | Moderate extent | 23 |
| 3.5-4.49 | High extent | 55 |
| Total | | 100 |

***Source:*** *Field Survey (2016)*

*3.2.5 Access and Use of Seasonal Climate Forecast Information while making Agricultural Decisions*

This results on data analysis reveals that most small-scale farmers access and use agricultural information on land allocation/crop choice (WMS=3.30); Maize variety choice (WMS=3.25); Method of harvesting (WMS= 3.24). These were ranked first second and third respectively. Other agricultural information used by the respondents include; method of fertilizer application (WMS=3.05); Spacing (WMS=2.98); Mobilization of labour (WMS=2.84); Soil management practices (WMS=2.52). The agricultural information is least accessed and used in; Control of pests and diseases (WMS=1.78); Environmental protection on land (WMS=1.51). This pattern of utilization could be linked to the availability of SCF information on maize crop production in the study area.

Table 4: Access and Use of Seasonal Climate Forecast Information while making Agricultural Decisions.

| S C F information Access and Usage | WMS | SD | RANK |
|---|---|---|---|
| Land preparation and crop choice | 3.30 | 1.97 | 1 |
| Maize variety choice | 3.25 | 1.96 | 2 |
| Method of harvesting | 3.24 | 1.98 | 3 |
| Method of fertilizer application | 3.05 | 2.06 | 4 |
| Spacing | 2.98 | 2.02 | 5 |
| Mobilization of labour | 2.84 | 2.15 | 6 |
| Soil management practices | 2.52 | 2.10 | 7 |
| Control of pest and diseases | 1.78 | 1.66 | 8 |
| Environmental protection on land | 1.51 | 1.44 | 9 |

***Source:*** *Field Survey (2016)*

*3.2.6 Analysis Establishing the Relationship between the Extent of Access and Use of Seasonal Climate Information on Maize Crop Production.*

The study sort to find out if there exist a relationship between access and use of seasonal climate forecast information and maize crop production. From the analysis, it was revealed that there exist no significant relationship between seasonal climate access and usage and maize crop production in Vihiga County. The correlation analysis in table 8 and summary on correlation analysis on Table 5 revealed that the extent of access and use of use (r=0.018588, p=0.098141), does not significantly influence maize crop production in Vihiga County. This implies that the extent on access and use of seasonal climate forecast information does not necessary increase maize crop production.

Table 5: Analysis Establishing the Relationship between the Extent of Access and Use of Seasonal Climate Forecast Information and Maize Crop production

| Likert scale | Category of information | Percentage | Average Production per Acre |
|---|---|---|---|
| 1-1.49 | Very low extent | 10 | 15.20 |
| 1.5-2.49 | Low extent | 12 | 17.40 |
| 2.5-3.49 | Moderate extent | 23 | 16.50 |
| 3.5-4.49 | High extent | 55 | 15.45 |
| Total | | 100 | X= 16.13 |

***Source:*** *Field Survey (2016)*

Table 6: Summary on Analysis establishing the Relationship between the Extent of Access and Use of SCF Information and Maize Crop Production.

| Variable | r | p-value | Remarks |
|---|---|---|---|
| Access and use | 0.018588 | 0.0981412 | Not significant |

***Source:*** *Field Survey (2016)*

*3.3 Accuracy of Seasonal Climate Information on Maize Crop Production*

It is very important for the SCF information to be accurate. Failure to it can mislead the farmers thus affecting the maize crop production. The main barriers to the use of SCF included; the lack of reliability of the forecasts, the lack of relevance of this type of information for the organization, the lack of awareness about SCF, the lack of resources and the investment required to allow them to make use of SCF and established practices such as the tradition of performing historical analysis (Alvaro,. et al., 2009).

The study sought to find out how accurate the seasonal climate forecast was. From the findings, 80% of farmers indicated the information was accurate with 20% indicating the information was inaccurate.

Table 7: Influence of Seasonal Climate Forecast on Maize Crop Production

| Variable | Percentage |
|---|---|
| Accurate | 80 |
| Inaccurate | 20 |
| Total | 100 |

***Source:*** *Field Survey (2016)*

### *3.3.1 Categorization of Respondents according to the Extent of Influence of SCF on Maize Crop Production*

The study sought to find out the extent the seasonal climate forecast information influenced maize crop production in Vihiga County. A Likert scale was used where 1-1.49 was very low extent, 1.5-2.49 was low extent, 2.5-3.49 was moderate extent, and 3.5-4.49 was great extent. The study reveals that 52 % of the respondents indicate that seasonal climate forecasts information was influenced maize crop production at high extent. 23% at moderate extent, 15% at a low extent and 10% at very low extent. Generally, seasonal climate information offered by meteorologist are largely influenced maize crop production.

Table 8: Categorization of respondents according to the Extent of Influence of SCF on Maize Crop Production.

| Likert scale | Category of information | Percentage |
|---|---|---|
| 1-1.49 | Very low extent | 10 |
| 1.5-2.49 | Low extent | 12 |
| 2.5-3.49 | Moderate extent | 23 |
| 3.5-4.49 | High extent | 55 |
| Total | | 100 |

***Source:*** *Field Survey (2016)*

### *3.3.2 Training Attendance on Seasonal Climate Forecasts*

The study sought to find out whether the farmers had attended training on seasonal climate forecasts. According to the findings, 68% of the farmers had attended training on seasonal climate forecasts while 32% had not attended. The meteorologists rarely trained farmers on how to use and interpret the seasonal climate forecast. However, the seasonal weather forecasts were accessed and used by farmers as an adaptation strategy to rainfall variability on maize production in Vihiga County.

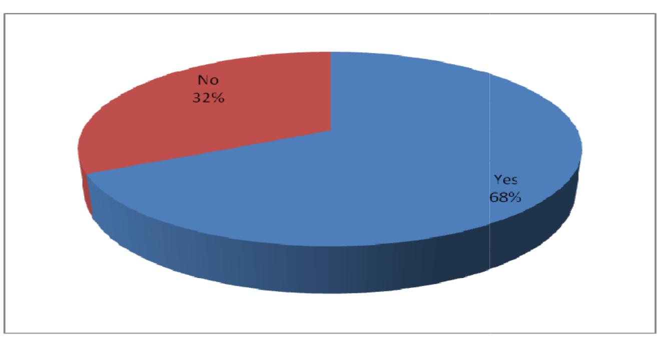


Figure 3.3: Training Attendance on SCF

***Source:*** *Field Survey (2016)*

### *3.3.3 Influence of Seasonal Climate Forecast Information on Climate Adaptations*

According to the findings, seasonal climate forecast information helped in developing more targeted climate adaptation responses largely as shown by a mean of 4.3. In addition, seasonal climate forecast information helped to develop a more comprehensive response strategy to deal with the multitude of ways in which climate change may influence crop production to a great extent as shown by a mean of 4.1. Moreover, seasonal climate forecast information helped in development of strategies to deal with the influence of typhoons, heavy rain, floods, and hailstorms on cropping systems as shown by a mean of 3.8. The accuracy and reliability of the information being provided, its credibility and salience, and the relevance and usability of that information in the organization are all factors that can facilitate the uptake of SCF (Cash *et al.,* 2003).

Table 9: Influence of Seasonal Climate Forecast Information on Climate

| Impact | Mean | Stdev |
|---|---|---|
| Developing more targeted climate adaptation response | 4.3 | 0.6 |
| Development of strategies to deal with the influence of typhoons, heavy rain, floods, and hail storms on cropping systems | 3.8 | 0.1 |
| Develop a more comprehensive response strategy to deal with the multitude of ways in which climate change may influence crop production | 4.1 | 0.4 |

***Source:*** *Field Survey (2016)*

### *3.3.4 Analysis between the Extent of Influence of Seasonal Climate Information on Maize Crop Production*

The study sort to find out if there exist a relationship between accuracy of seasonal climate forecast information and maize crop production. From the analysis, it was revealed that there exist no significant relationship between the extent of seasonal climate accuracy and maize crop production in Vihiga County. The correlation analysis in Table 11 and summary on correlation analysis on Table 10 revealed that the extent of influence ($r=0.028967$, $p=0.097103$), does not significantly influence maize crop production in Vihiga County. This implies that there's less extent on influence of seasonal climate forecast information maize crop production in Vihiga County.

Table 10: Analysis between the Extent of Influence of SCF Information on Maize Crop Production

| Likert scale | Category of information | Percentage | Average Production per Acre |
|---|---|---|---|
| 1-1.49 | Very low extent | 10 | 15.90 |
| 1.5-2.49 | Low extent | 15 | 16.40 |
| 2.5-3.49 | Moderate extent | 23 | 16.80 |
| 3.5-4.49 | High extent | 52 | 15.75 |
| Total | | 100 | X=16.21 |

***Source:*** *Field Survey (2016)*

Table 11: Summary on Analysis establishing the Relationship between the Extent of Influence of Seasonal climate information and Maize crop production

| Variable | r | p-value | Remarks |
|---|---|---|---|
| Extent of Influence | 0.028967 | 0.097103 | Not significant |

***Source:*** *Field Survey (2016)*

## IV. CONCLUSIONS AND RECOMMENDATIONS

The rural poor such a small-scale maize famers in Vihiga County heavily rely on rain-fed agriculture and poor timing of start of rains results in crop failure. There has been a decline in maize crop production in Vihiga County and yet the county enjoys good climatic conditions. It is worth noting that the average maize production per acre has gone down to an average of 17.5 bags in the recent years from the previous years of above 20 bags.

The study revealed most farmers (80%) had knowledge on seasonal climate forecasts in formation and they access this information mainly through electronic media, interpersonal and modern technology as well as indigenous media. Most farmers had also attended the training on seasonal climate forecasts conducted by the meteorologist. According to the findings, 68% of the farmers had attended the training on seasonal climate forecast information.

The study revealed also that most farmers are higher users of seasonal climate forecast information with 60% classified as very high users, 28% as moderate users, 8% as low users and only 4% as very low users. These farmers use seasonal climate forecast information while making agricultural decision on; land allocation, maize crop variety, method fertilizer application, method if harvesting, mobilization of labour, spacing, soil management practices, control of pests and diseases and environmental protection of land.

The finds also revealed that seasonal climate forecast information is accurate. From the findings 80% indicated that seasonal climate forecast information is accurate with 20% indicating inaccuracy in the seasonal climate forecast. Majority indicate that the seasonal climate forecast information impact on developing more targeted adaptation response and strategies to deal with influence of climate change on the crop production.

The study concludes that farmers had knowledge on seasonal climate forecast information and majority accessed seasonal climate forecast informationon radio. Farmers had attended training on seasonal climate forecasts, which were offered by the meteorologists.

The study concludes that farmers frequently used seasonal climate forecast. The farmers used seasonal climate forecast while making agricultural decision on, land allocation, maize crop variety, method fertilizer application, method if harvesting, mobilization of labour, spacing, soil management practices, control of pests and diseases and environmental protection of land.

The study concludes that seasonal climate forecast information was accurate and helped in developing more targeted climate adaptation responses. The correlation analysis on revealed that the extent of influence seasonal climate forecasts information (r=0.028967, p=0.097103), does not significantly influence maize crop production in Vihiga County. This implies that there's less extent on influence of seasonal climate forecast information maize crop production in Vihiga County.

The study recommends the government to encourage farmer's especially small-scale farmers to check and use seasonal climate forecast information regularly to cope with the changing climate.

A training should continue to be offered to farmers on how to interpret and use seasonal climate forecast information as this will ensure accuracy when using the seasonal climate forecast information by farmers.

The study recommends the meteorologists to make seasonal climate forecast data, tools and targeted products available through the Internet. This may not be enough to reach all potential users, but would be a good starting point. The main purpose is to reach those who can then reach others by other means. Seasonal climate forecast data need to be updated every 10 days, thus enabling close monitoring of the season.

Kenya meteorologists need to formulate a data policy to make the combined time series freely available for research and other non-commercial purposes. Once available, an expanded array of new products could be created to answer the specific needs of a wider range of stakeholders. These will provide basic information to aid climate risk management in a number of climate-sensitive sectors for example agriculture, food security, water resources and health.

National policies governing data sharing should be easened to ensure that farmers are able to access the data without a lot of hustle.

The differences in attitudes, priorities and expectations between the scientific and policy communities need to be recognized and addressed in order to bring these groups together.

This study has explored the use of seasonal climate forecasts on maize crop production in Vihiga County. The emerging constraints in the use of seasonal climate forecast facing maize small-scale farmers should not be ignored. Therefore, there is need to research emerging constraints that may have contributed to poor maize crop production in Vihiga County.

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