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Perception of Seasonal Climate Forecast Information among Smallholder Farmers in Semi-Arid Southeastern Kenya: A Case of Voi Sub-County.

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Abstract
This paper examines the perception of seasonal climate forecast (SCF) information used in agricultural decision-making by smallholder farmers in semi-arid Voi sub-County, Kenya. Questionnaires were administered to a total of 204 respondents randomly selected from farming households in two administrative locations. Questionnaires were used to collect data on farmers' perception of the quality of SCF. Seasonal climate forecast data for October-November-December (OND) 2015 and daily rainfall data for the same season was also collected. Both descriptive and inferential statistics were used in data analysis and in particular one sample Pearson's Chi-square was used to establish how smallholder farmers perceived SCF information. Study findings established that smallholder farmers' perception of seasonal climate forecast information was somewhat good with a significant difference in their perception (P=.000). The study concludes that although OND 2015 SCF was accurate the perception of smallholder farmers was not good enough to positively influence their agricultural decisions. This study recommends enhancement of awareness and increased dissemination of within-season climate forecast so as to improve positive perception of seasonal climate forecast in order to assist farmers make informed decisions so as to increase farm productivity.
Keywords: Perception, Seasonal climate forecast, Semi-arid, Smallholder farmer, Southeastern Kenya

1.0 Introduction

Greater knowledge on ocean-atmosphere interactions and use of Global Circulation Models (GCMs) has led to improved seasonal climate forecasting skills useful in agricultural decision-making (Baigorria *et al*., 2008). Climate forecast is divided in three categories: weather forecast for few days, seasonal climate forecast for few months and decadal climate forecast which predicts climate conditions for several years (Faures *et al*., 2010). Out of these three, information on seasonal climate is the most appropriate for smallholder farmers growing annual crops.

Seasonal climate forecast information is generated and issued to various end-users accompanied by relevant sectoral advisory with the view of assisting in making economic decisions. Farmers, as the major consumers of this information, are expected to make decisions concerning farming activities in line with the received forecast. Use of seasonal climate forecast information by smallholder farmers in adaptation to climate variability depends on how they perceive the forecast. Farmers' perception of the quality of SCF in terms of onset, amount and cessation has greatly affected its adoption in agricultural decision-making (Garbrecht & Schneider, 2007). Seasonal forecast which yields different results from the predicted ones can discourage farmers and lower their future adoption rates. Climate forecast information is beneficial to users when there is a clearly perceived adaptive response and benefits them once it is considered in decision-making process (Fraisse *et al.,* 2006). Seasonal climate forecast information should, therefore, be perceived as scientifically credible, salient and legitimate if it is to be used by end-users in decision-making. In a study conducted on use of seasonal climate forecast in decision-making on corn farming in Philippines, farmers termed forecast as untruthful thus making many people to ignore them (Borines *et al*., 2009). In another study carried out by the department of Agriculture, Fisheries and Forestry in Australia in 2002, about 73% of the respondents interviewed stated that the issued seasonal climate forecast was not in line with the observed climate conditions (Hayman *et al*., 2007). The use of seasonal climate forecast, therefore, depends on the perception of the user on the quality of the forecast. This, therefore, merits the need for location-specific studies to establish users' perception of seasonal climate forecast (Hansen & Indeje, 2004).

Culture and attitude of people in a society affects how they perceive events and integrate information in their decision-making. While looking at the role of seasonal climate forecast in risk management among Georgian farmers, Crane *et al*., (2008) established that farmers deal with risks associated with climate variability within a broad spectrum of cultural contexts of social factors and values. This affects the way farmers perceive seasonal climate forecast and therefore there is a need for gradual infiltration of forecast information into farmers' social networks rather than technical information input. Despite improved seasonal climate prediction and dissemination pathways, farmers' attitude towards the forecast is still poor due to difficulties faced in the attempt to change people's attitudes when transferring scientific information into practical use (PytlikZillig *et al*., 2010).

In many regions of the world such as the sub-Saharan Africa, seasonal climate forecast information is perceived as uncertain, for instance while looking at the use of indigenous knowledge to forecast climate in semi-arid central Tanzania, Elia *et al*., (2014) established that uncertainty about seasonal climate forecast is one of the most critical factor influencing continued use of indigenous knowledge to predict weather and climate. In a survey in USA on uncertainty in weather forecasting, Morss *et al*., (2008) found out that communicating uncertainty to users of climate forecast information remain a major challenge and this is because smallholder farmers lack the understanding that the forecast is issued in probabilistic terms. They also believe that forecasters have lied whenever the forecast fails (Coelho & Costa, 2010). Seasonal climate forecast information issued in Kenya by Kenya Meteorological Service (KMS) is often faulted by many users and termed as inaccurate due to their perceived deviation from the observed seasonal climatic conditions (Hansen & Indeje, 2004). Improving the perception of quality of seasonal climate forecast can greatly increase farmers' capacity to make better use of information and to respond favourably to climate variability especially in semi-arid areas such as Voi sub-County.

2.0 Methodology

2.1 Study Area and Sampling

Voi sub-County is found in Taita Taveta County in the Southeastern region of Kenya. It lies within latitude $2^0 42'$S and $4^0 08'$S and longitude $37^0 41'$E and $39^0 14'$E covering an area of 3,269.1 Km^2. The area is generally dry with an average temperature of 25^0 C and a mean annual rainfall of about 500mm. Rainfall is received in two seasons; long rains between March and May and short rains between October and December with the short rains being most useful for crop farming. The rains received are usually unreliable and have erratic patterns in terms of onset, amount and cessation.

Two study sites (administrative locations) namely Sagalla and Mbololo were purposively selected from the six locations in Voi sub-County. This was due to availability of many smallholder farmers in the two locations as compared to the other four locations where commercial sisal growing and ranching are the predominant activities. The two locations are also found near Voi meteorological station which was the main source of the required rainfall data. The target population was smallholder farming households in the two locations. A list of all smallholder farming households from the study area was used to develop a sampling frame from where 204 households were selected for the study. This represented five per cent of the households in the study area which was considered adequate because the population had fairly homogenous socio-economic characteristics. This is in line with sentiments of Neuman (2007).

2.2 Sources of Data

There were three sources of data. Data on the smallholder farmers' perception of quality of seasonal climate forecast information was collected from household heads using questionnaires. Seasonal climate forecast for OND 2015 was downloaded from the KMS website. Observed daily rainfall data for OND 2015 season was collected from Voi Meteorological Station.

2.3 Data Analysis

Data was analyzed by both descriptive and inferential statistics.

Perception of OND 2015 SCF was categorized as good (the forecast was in line with the recorded rainfall), somewhat good and poor (the forecast was not in line with the actual rainfall received). One sample Pearson's Chi-square test was used to analyze smallholder farmers' perception of quality of SCF. One sample Chi-square (Chi-square goodness of fit) is a statistical tool used to determine if the observed frequencies are significantly different from the expected frequencies (Neuman, 2007). One sample Chi-square was, therefore, used to test whether there is a significant difference in the perception of the quality of OND 2015 SCF from KMS among smallholder farmers in Voi sub-County. Rainfall data for OND 2015 recorded at Voi meteorological station was also compared to the forecast issued by KMS before the season.

3.0 Results and Discussion

3.1 OND 2015 SCF and Recorded Rainfall Characteristics in Voi Sub-County

The KMS issued OND 2015 forecast for the country about one month before the season indicating the expected amounts, onset dates and cessation dates as well as relevant advisories for different sectors of the economy. The OND 2015 rainfall forecast for Southeastern Kenya was expected to be highly enhanced (above normal). The forecast further indicated that the rainfall season was to be influenced by the evolving El Niño conditions as well as the warming of the Sea Surface Temperatures (SSTs) in the western equatorial Indian Ocean adjacent to the East Africa coastline. According to KMS forecast, the coastal region within which the study area is found was expected to experience onset during the 2nd to 3rd week of October. The forecast also indicated that cessation was expected in the last week of December. In addition to amount, onset and cessation of the rainfall, KMS advised farming communities to maximize crop yield by applying appropriate land use management practices and work closely with agricultural officers to avoid losses which may be associated the highly enhanced rainfall conditions (KMS, 2015).

Daily rainfall for OND 2015 season recorded at Voi meteorological station was obtained and analyzed. Fig. 3.1 shows daily rainfall trend for recorded rainfall.

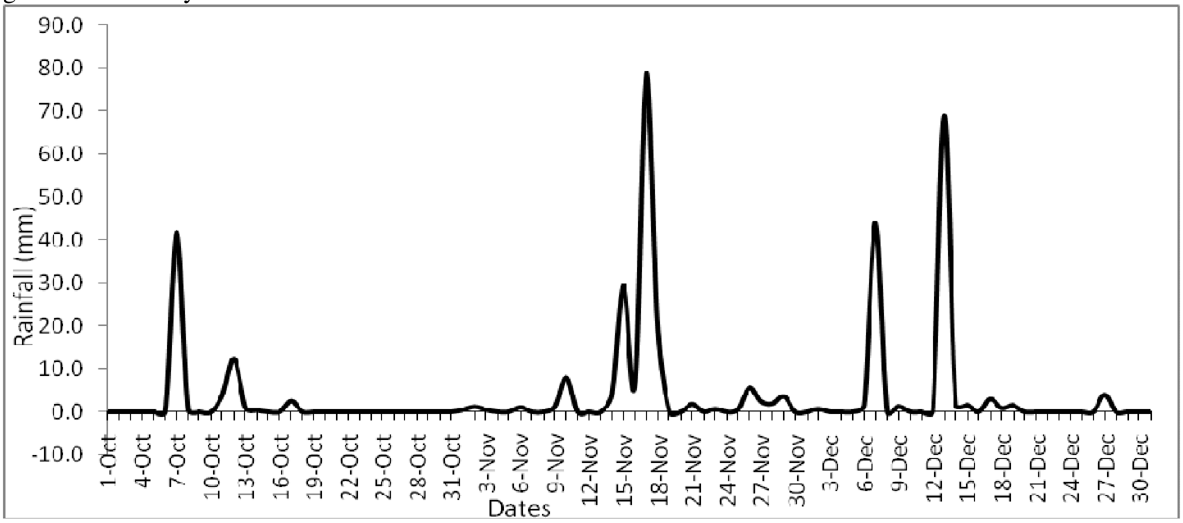

Figure 3.1: Daily OND 2015 recorded rainfall for Voi meteorological station
Source: Survey Data, 2016

The onset date for OND 2015 rainy season was on 7th October (Fig. 3.1) which was in agreement with the forecasted onset date for Voi sub-County. The cessation date for OND 2015 rainfall was forecasted to be in the last week of December. This was also in line with the cessation date observed at Voi which was on 27th December. The total amount of rainfall for OND 2015 rainfall season received in Voi was 358.7mm according to the records at Voi meteorological station. This was about 121% of the calculated 30 years OND mean of 296.1mm. According to KMS guidelines, normal rainfall lies between 75% - 125% of the mean, above normal is rainfall over 125% of the mean while below normal is rainfall less than 75% of the mean. From these guidelines it is clear that Voi sub-County received normal, with a tendency to above normal, rainfall in OND 2015 season. Although Voi sub-County received rainfall amount close to the forecasted by KMS, the distribution was poor. Despite the onset date for the rainfall being in line with the forecast, there were only six rainy days in October receiving rainfall amounts not exceeding 10mm except for two days. The result was farmers lost crops due to the prolonged within-season dry spell. Farmers replanted thrice during the start of the season as crops dried up.

3.2 Smallholder Farmers' Perception of the Quality of OND 2015 SCF

Smallholder farmers in the study area had the following characteristics: 63.7% of the household heads were males while 36.3% were females. A large proportion (62%) of the sample was below 40 years and about 92% of them had attained formal education. This implies that the population was youthful and literate thus likely to understand SCF information and utilize it in agricultural decision-making. About 83% of the households owned small farms of 3acres and below.

A high population, 87.7%, of the smallholder farmers in Voi sub-County reported that they had received OND 2015 SCF information. This implies that the most smallholder farmers in study area were aware of the climate outlook for the OND 2015 season and were therefore expected to be guided by the forecast in their agricultural decision-making. This is in agreement with Hayman *et al*., (2007) study which showed that majority of Australian farmers had awareness of SCF information before the start of rainfall seasons. When respondents were asked rank the quality of OND 2015 SCF, about 29% perceived it as good, 69% as somewhat good and only 2.2% as poor. Majority of the respondents perceived OND 2015 SCF as somewhat good. This is contrary to the general assumption that the perception of most farmers of seasonal climate forecast is poor (Coelho & Costa, 2010; Borines *et al*., 2009; Hansen & Indeje, 2004).However, despite the good ranking of the quality, only about 42% of those who had received the SCF information indicated that they had confidence in the forecast. This implies that farmers in Voi sub-County generally do not see SCF information provided by KMS as the true prediction of the rainfall season. This finding resonates well with Hayman *et al*., (2007) whose study in Australia noted that seasonal climate forecast issued were not in line with the observed seasonal climate conditions.

In order to make an inferential statement on the perception of the quality of OND 2015 SCF by smallholder farmers in Voi sub-County, a one sample Chi-square test was done whose results were $x^2 = 160.09$, df = 2, p = .000. This showed that there is a significant difference in the perception of the quality of SCF among smallholder farmers in Voi sub-County. This implies that the perception of smallholder farmers that SCF from KMS of somewhat good is not caused by random factors. The perception that farmers have on the quality of seasonal climate forecast issued by the KMS, therefore, determines the level of uptake and utilization of such information in agricultural decision-making.

4.0 Conclusion and Recommendation

The study shows that OND 2015 seasonal climate forecast for Voi sub-County was accurate as per the KMS prediction but smallholder farmers' perception was somewhat good. This can be attributed to within-season rainfall variability. Perception of seasonal climate forecast information determines its uptake by smallholder farmers in their farm management decisions. The study, therefore, recommends that smallholder farmers be educated on the importance of seasonal climate forecast in agriculture in order to improve their perception. This can be done through the mass media and use of extension services. KMS should also strive to ensure that monthly and weekly forecasts reach smallholder farmers, especially the vulnerable ones in semi-arid areas. This will ensure that forecast on intra-seasonal dry spells are used in agricultural decision-making thus improving trust on SCF.

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