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Maize (*Zea mays* L.) Production Challenges by Farmers in Cheptais Sub-County, Kenya

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Maize (*Zea mays* L.) is the main staple food for the inhabitants of Cheptais Sub County as well as other parts of Country. However, its production is facing a number of challenges that have led to yield reduction. Maize production challenges can be technological, policy, socio-economic, abiotic and biotic challenges. This paper therefore was designed to evaluate the challenges facing the maize farmers in Cheptais Sub County of Bungoma County. 350 respondents were selected through stratified random and purposive sampling technique from Chepyuk, Cheskaki and Kapakateny wards. Data was collected from small scale, medium scale and large-scale farmers using questionnaires with open and closed ended questions. Farmers were interviewed using an interview schedule and data analysis was done using descriptive statistics with the aid of Statistical Package for Social Sciences (SPSS). The findings revealed that maize farmer in Cheptais Sub County experienced financial constraints, high cost of farm inputs, inadequate and poor storage facilities, poor state of roads and markets. They also experienced high interest rates on credit from financial institutions and lack of improved maize seeds to use due to presence of many seed varieties in the markets from different seed companies, which have created an avenue for unscrupulous vendors to sell uncertified seeds in the study area. The paper recommends that, government to subsidies on

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farm inputs and imposes price control on essential farm inputs and also to direct the financial institution to lower the interest rates on credits borrowed by farmers. Demonstration plots be increased in the area by the seed companies and training be intensified by the extension officers. Farmers need to look for extension services from the government and even from private practitioners to overcome their production challenges.

Keywords: Production challenges; maize producers; cheptais sub-county.

1. INTRODUCTION

Maize (*Zea mays* L.) is the main staple food for the inhabitants of Cheptais Sub County as well as other parts of Country. However, its production is facing a number of challenges that have led to reduction in the yields. Maize crop is the source of employment and income for the poor rural people [1]. It accounts for 30−50% of low-income household expenditures in Eastern and Southern Africa [2], and when the price of this commodity is increased, it's the poor consumers who suffer most. Furthermore, the grains are rich in vitamins, carbohydrates, essential minerals, and contain 9 per cent protein, they also rich in dietary fiber and calories which are a good source of energy [3]. Globally, food shortage has been always existed; its magnitude has increased due to the world's rapid population growth. This is happening at a time when the idle arable land for maize cultivation is diminishing due to land sub-division for peoples' settlement. More than eighty percent of the Kenya's population regards maize grains as their staple food and the shortage in supply is to a large extent, synonymous with food insecurity [4]. Maize shortage still exists despite heavy investments in agricultural sector and these shortages are as a result of constraints surrounding small scale farmers [5]. Maize production challenges among the maize producers can be technological, policy, socio-economic, abiotic and biotic challenges, [6]. Socio-economic, technological and policy limitations facing maize producers include use of poor quality seeds, population pressure, land sub-division, limitations to market access, poor state of infrastructure and high costs of farm inputs. Abiotic factors affecting maize production in Cheptais Sub County include low and unreliable rainfall leading to recurrent droughts [7]. Biotic challenges that affect maize production are insect pests such as weevils and the rodents [8-10].

Historical trend indicates that maize yields fluctuate more widely from year-to-year than any other cereal crops. This is because maize crops are more sensitive to climate change and vulnerability to pests and disease. The variations in production often give rise to price fluctuations that can negatively impact the livelihood of small scale maize producers and consumers [11]. The national maize production levels have been declining from over 34 million bags to about 25 million bag in 2008 [12].

Keeping in view of the above facts, this paper was designed to evaluate the challenges faced by maize producers in Cheptais-Sub County, Kenya and come up with the possible recommendations that can guide farmers in overcoming those challenges.

1.1 Conceptual Framework

The conceptual framework in Fig. 1 shows the relationship between maize productivity and production constraints faced by maize producers in Cheptais Sub County. The framework also shows the relationship between the intervening and moderating factors, which affect directly and indirectly maize production. Maize producers operate in a complex environment where the outcomes are being shaped by a number of constraints. These challenges include; Economic challenges which determine farmers' participation in markets and the kind of farm inputs to be used i.e. ability to acquire certified maize seeds and inorganic fertilizer the alternative one is to use local maize variety or organic manure which is limited. Infrastructural constraints that affect farmers include poor market facilities and impassible road in the region. The constraints associated with maize storage includes poor storage facility, lack of post harvesting handling skills, insect pests and diseases both in the field and in the storage. Marketing challenges includes, prices fluctuations, lack of ready market, presence of middlemen and imported maize among others. Since most household in the region do not effectively participate in the cash economy, therefore cannot access expensive technologies.

2. METHODOLOGY

2.1 The Study Area

Cheptais Sub County is in Bungoma County and covers four wards namely: Chepyuk, Cheptais, Chesikaki and Kapkateny with a total population of 106,960 according to the 2009 population census. The population derives their livelihood mainly from agriculture with maize being a key crop grown besides horticultural crops, coffee and livestock. High potential areas suitable for maize farming are those in Kikilili, Sirisia and cheptais (The study site) covered with reddish brown friable loam soils. The region receives fairly high amounts of rainfall ranging from 1200 mm to 1800 mm annually well distributed. Most of the rain fall is experienced in the months of April-May and July-August. The coldest months are July, August and September. Temperature ranges from 15-30ºC.

2.2 Target Population

The study targeted a total population of 106,960 as presented in Table 1. The sample included small, medium and large scale farmers and agricultural officers from their respective wards. This target population was selected because it was easily accessible and had right information about the challenges they undergo in cultivating maize crop.

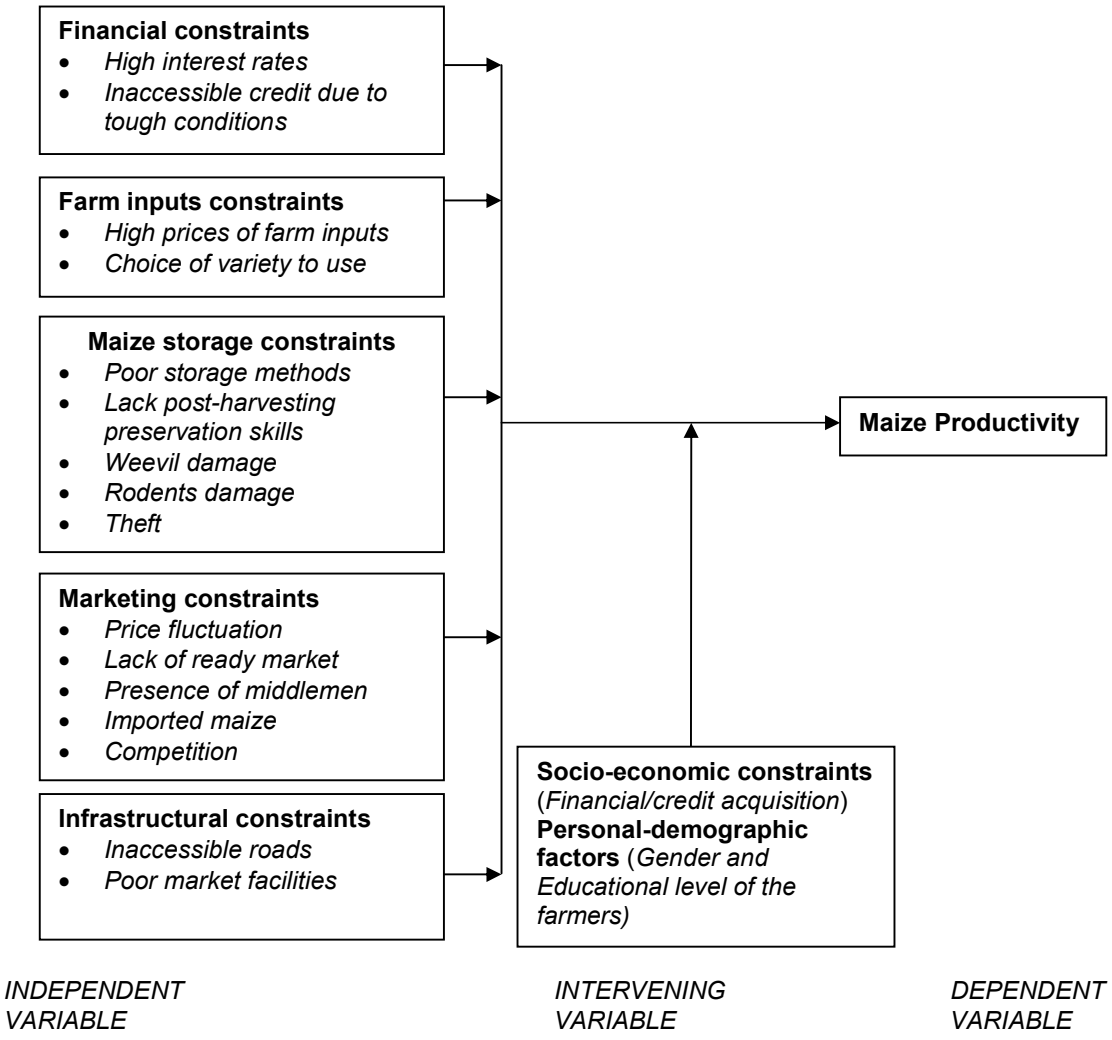

Fig. 1. Conceptual frame work

2.3 Sampling Procedure

This study applied stratified random sampling and purposive sampling techniques. Stratified random sampling was used to select wards under study while purposive sampling was used to get the agricultural extension officers from their respective wards. The sample was selected without bias from each stratum using [13] table to obtain a sample size of 368 respondents drawn from a target household population of 9,765. Data was then collected from the three strata obtained through stratified random sampling technique from Cheptais Sub-County. The proportionate distribution of sample shown in Table 2 from each stratum was obtained using equation 1.

$$Strata\ Sample = \frac{Strata\ population}{\text{Target population}} \times Sample\ Size \quad \text{(Equ. 1)}$$

2.4 Instrumentation

A structured questionnaire with both open and closed ended questions was used to collect data from the respondents. The questionnaires were then administered to the maize farmers and extension officers to determine the challenges maize producer were going through.

2.5 Piloting of the Research Instrument

Piloting of the research instrument was done in Cheptais Ward using twenty randomly selected farmers for the questionnaire. The ward was not selected (as a sample) in the main study. This was important in determining the reliability and validity of data collection instrument. Research instrument should pilot-tested to detect weaknesses or errors in the instrument.

2.6 Data Collection

Primary data was collected using structured questionnaires, which were administered to study units, and in some cases an interview schedule was used. Data collected using the questionnaires were coded. The coded data were those of closed end items. Responses from the open ended questions were recorded as reported since most of these questions intended to seek opinions and recommendation from respondents.

2.7 Statistical Analysis

Data analysis was done using the Statistical Package for Social Sciences (SPSS) Version 20 Software and Microsoft excel. Data analysis outputs included descriptive statistics such as frequencies and percentages. Frequency distribution tables were used to allow the researcher to present visual and accurate reflections on data variations.

3. RESULTS AND DISCUSSIONS

3.1 Questionnaires Return Rate

Out of 368 questionnaires administered to the study units, a total of 350 were returned translating to 95% return rate.

Table 1. Administrative wards of Cheptais Sub-County

Wards	Population*	Number of households
Chesikaki	2,4062	3,001
Kapkateny	28,668	3,584
Cheptais	28,788	3,599
Chepyuk	25,442	3,180
Total	106,960	13,364

*Source: Kenya Demographic health survey, (2009); *National population census (2009)*

Table 2. Proportionate samples for each stratum

Sampled Wards	Population*	No. of households	Proportionate samples
Chepyuk	25,422	3180	120
Kapakateny	28,668	3584	135
Chesikaki	24,062	3001	113
Total	78,152	9,765	368

*Source: Kenya Demographic health survey, (2009); *National population census (2009)*

3.2 Gender of the Respondents

Majority of the farmers represented by 68.3% were male whereas 31.7% were female (Fig. 2). The findings showed that there was gender imbalance in maize production operations in Cheptais Sub-County an indication that women had a challenge in accessing land for practicing maize production.

3.3 Level of Education among Respondents

Majority of the respondents were primary education holders represented by 41%, followed by secondary educational level at 33%, the diploma holder's were 18%, while about 5% of the farmers were degree holders and the remaining 3% were master's degree holders as shown in Fig. 3.

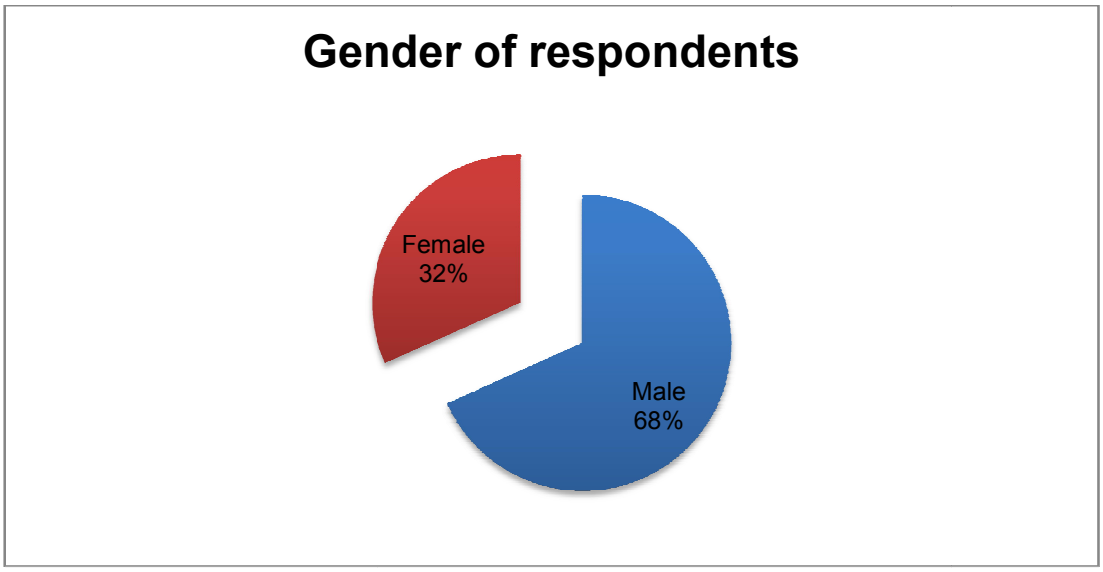

Fig. 2. Gender of respondents

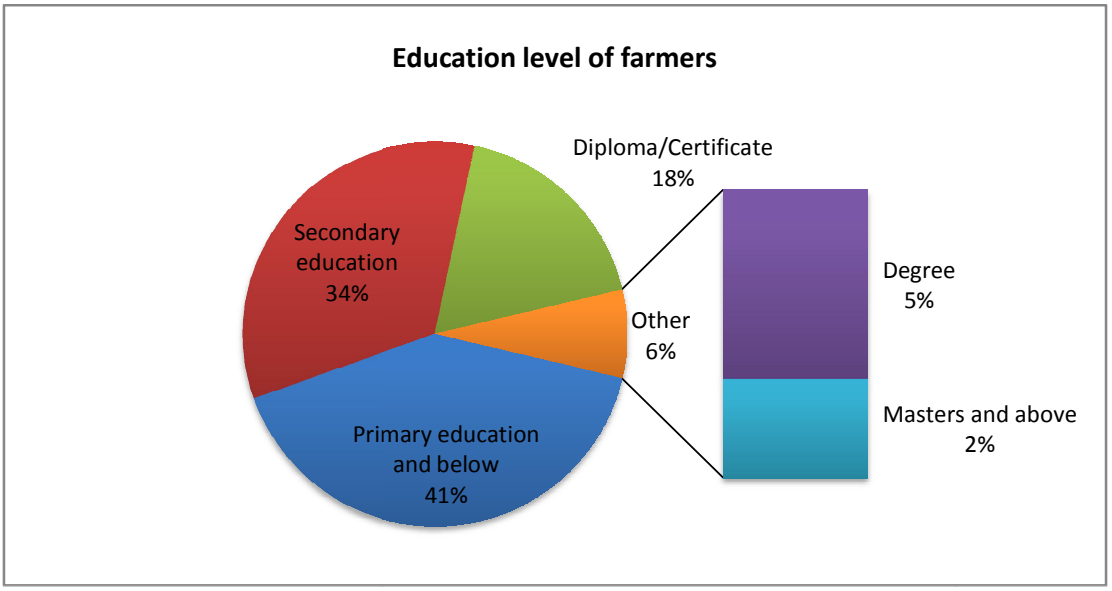

Fig. 3. Education level of farmers

Farmer's educational background was sought to give the researcher an insight of the level of education of the farmers in Cheptais Sub-County. In effectively dealing with the challenges affecting maize producers, a certain level of education is an important variable in capacity development. Educated farmers usually have a better opportunity to access information on new technologies and are generally better able to assimilate, to process and to use this information in solving any challenging situation [14]. The number of years when a person spent in formal education is one of the most important determinants in problem solving and adoption of good agricultural practices. Further, education facilitates the process of information flow and leads persons to explore as wide as possible on the different pathways of acquiring information regarding maize production [15]. The findings indicated low illiteracy rates of 41% among the farmers of Cheptais Sub-County (those with primary education and below) Fig. 3.

3.4 Financial Status of the Farmers

Majority of the respondents earned between Kshs 3,001- 4,000 per month represented by 28%, followed by farmers who earned between Kshs 2,000 - 3,000 per month at 21.7%, about 15.1% of the farmers earned below Kshs 2,000 per month and those farmers who earned above Kshs 5,000 per month were represented by 20.9% (Fig. 4).

3.5 Challenges Related to Financial Status of the Farmers

Income status information was sought to get an in-depth of the financial status of the farmers. This would assist in understanding how finances contribute towards solving the challenges encountered by farmers in the study areas. It's believed that, farmers with high income are likely to afford expensive agricultural technologies and inputs than the lower income earner. Therefore farmers were unable to purchase essential inputs such as seeds, fertilizers and pesticides. These findings are in agreement with that of [16,17] that, lack of enough financial credit translates into inadequate working capital. In addition, farmers were facing high interest rates with annual percent rate between 12% for commercial banks to 65% for village banks. These are the main deterrent to borrowing credit [18]. Lack of finance among the maize producers is a challenge that is recognized by the Government of Kenya. The Agricultural Finance Corporation (AFC), the co-operative movement and Cooperative Bank of Kenya, have made considerable efforts to provide affordable credit to maize farmers, the high interest rates charged by these institutions make it impossible for most farmers to access credit [19].

Generally, farmers operate in a constrained optimization scenario and this often leads to low maize productivity in the region. Low productivity then translates into poverty since agriculture fails to sustain farmers through sale of produce and condemn them to subsistence production that is, producing only for family needs. Since most household in Cheptais Sub-County do not effectively participate in the cash economy, therefore cannot access expensive technologies for maize farming and preservation methods. Assuming rationality, the maize producers often resort to conventional methods of maize farming and storage that lead to transitory and chronic food shocks in the region [20].

3.6 Purchasing of Seeds and Fertilizers in Cheptais Sub-County

Majority of farmers represented by 38.5% purchase farm inputs in the month of February during planting season, closely followed by the month of January by 35.3% while few farmer represented by 25.6% purchases seeds and fertilizers in March (Table 3). This implied that most farmers purchase farm inputs (seed and fertilizers) closely to planting seasons which contribute to increased prices of those inputs due to high demands.

Table 3. Time when farmers buy their seeds and fertilizers

Buying time	Frequency	Percentages
January	124	35.4
February	135	38.6
March	91	26.0
Total	350	100.0

3.7 Challenges Related to Acquisition of Farm Inputs (Seeds and Fertilizers)

Early acquisition of seed and fertilizers enable the farmers to plant early in advance so as to maximize moisture available; early planting also enables the maize crops to escape from the major pests and diseases. During the month of February and January, which is normally planting season, the prices of seeds and fertilizers are usually higher due to increased demand compared to off-peak seasons.

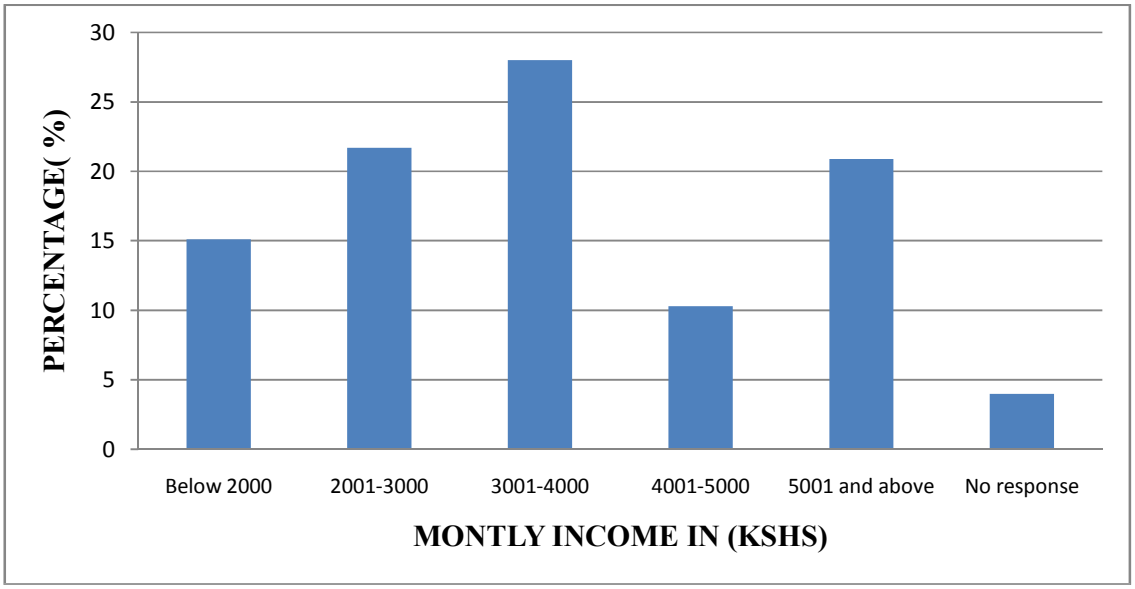

Fig. 4. Average monthly income per month

Another constraint facing maize farmers in Cheptais Sub-County was the selection of seed varieties to use due to presence of many seed varieties in the markets from different seed companies, which have created an avenue for unscrupulous vendors to sell uncertified seeds in the study area. This concurs with the study of [21] that, the choice of seed varieties in Western Province is the major challenge for most farmers due to the existence of many seed companies with many seed varieties in the market and some seed varieties may not have been tested to determine the viability on the farms in the study areas and the extension officers may not have been familiar with them.

Farmers were therefore confused on which seed variety to buy because of the presence of numerous varieties of maize seeds in the market. The availability of many seed varieties in the country is due to government failures to regulate the marketing of farm inputs as it was during the implementation of Structural Adjustment Programmes [16]. Furthermore, farmers in the study areas were experiencing increased input prices because of the removal of government subsidies on farm inputs resulting in the farmers bearing the full cost of purchasing the item [22]. The findings are comparable with that of [23] that, low government involvement as a result of the agricultural reforms has resulted into high seasonal price fluctuations, sometimes as high as 80%. This is due to the emergence of a large number of informal traders.

3.8 Methods of Maize Storage in Cheptais Sub-County

A total of 80.6% of the farmers use modern storage methods whereas 19.4% use traditional methods of maize storage (Table 4). However this research suggests that some households do not have storage facility for handling maize produce. However, the farmers indicated that they convert a room in the house to serve as stores for safety of maize against theft.

Table 4. Storage methods frequency table

Methods	Frequency	Percentages
Modern storage	282	80.6
Traditional storage	68	19.4
Total	350	100.0

3.9 Constraints Related to Storage Facilities in Cheptais Sub-County

A total of 53.1% of the maize was damage by weevils due to poor storage facilities, while 30.3% of maize stored was damaged by rodents, a further total of 8.0% of the maize was lost through theft and 8.6% by aflatoxins (Table 5). Maize storage is important because it bridges the gap between surplus at harvest time and scarcity during the post-harvest period. However maize producer in Cheptais Sub-Countyis facing a number of constraints especially in poorly stored grains.

Table 5. Constraints of poor maize storage frequency table

Effects of poor storage	Frequency	Percentages
Weevil damage	186	53.1
Rodents damage	106	30.3
Theft	28	8.0
Aflatoxins	30	8.6
Total	350	100.0

3.10 Challenges Related to Marketing of Maize

Majority of the farmers in Cheptais Sub-County sell their maize produce immediately after harvest, this has led to 80.6% of the farmers selling their produce at low prices; ideally, during harvesting seasons the supply of maize grain is higher than its demand, and this lowers the selling price of the maize produce. Whereas 19.4% of the farmers experienced maize shortage challenges (Table 6). Poor Market facilities leads to farmers selling of maize at low prices and this is even compounded by the fact that high population in the area depend on agriculture for livelihood; this has also resulted from structural adjustment policies that have abolished state controlled price levels and the restructuring of the National Cereals and Produce Board [24,19]. Therefore, farmers have been left to set their own prices and look for their own market resulting in exploitation from middlemen. Most ceremonies like circumcision, rituals and weddings are carried out during the harvesting season therefore most farmers sell their maize grains at low prices in order to get enough money to facilitate the ceremonies.

About 38.6% experienced low prices of maize produce as their major constraints in maize marketing. 20.6% of farmers lacked ready market for their produce, 13.4% claimed that the prices were not stable and they kept on fluctuating, 11.4% of farmers faced competitions from other cereals such as rice, wheat, sorghum and millet, 6.0% of farmers indicated that poor roads affects transportation of their produce to the market and 5.1% of farmers stated that the imported maize from other countries compete which their maize produce in the market thus end up losing market, this is because the imported maize is sold at a cheaper price (Table 7). The findings of this study indicated that market challenges had an influence on food security, in that it delays the preparation of planting and the purchase of inputs as many farmers depend on sold maize as source of income.

Table 6. Effects of marketing

Effects of markets	Frequency	Percentages
Farmers selling maize at low prices	282	80.6
Maize shortages	68	19.4
Total	350	100.0

Table 7. Marketing constraints faced by maize farmers

Market constraints	Frequency	percentages
Low prices	135	38.6
Presence of middlemen	17	4.9
Lack of ready market	72	20.6
Competition	40	11.4
Imported maize	18	5.1
Price fluctuation	47	13.4
Poor infrastructure	21	6.0
Total	350	100.0

3.11 Constraints Related to Infrastructures

Poor infrastructures such as market facilities and road networks were the physical challenges affecting farmers in the region, inadequate capacity of the actors and their institutions as well as unfavorable policy environment [25]. Very little maize is sold in the international markets rather than local and regional markets but returns to farmers are very low and unstable [26]; this demoralizes the maize producers from actively engaging in maize productivity fully.

4. CONCLUSIONS AND RECOMMENDATIONS

The findings indicated that farmers in Cheptais Sub-county were unable to purchase essential inputs such as seeds, fertilizers and pesticides due to high prices. Farmers were facing high interest rates which were the main deterrent to borrowing credit. Selection of seed varieties to use was another challenge facing maize farmers in Cheptais Sub-County due to presence of many

seed varieties in the markets from different seed companies; this had created an avenue for unscrupulous vendors to sell uncertified seeds in the study area. In addition, lack of awareness of improved agricultural technologies and inadequate agricultural extension staff were experienced. Poorly stored grains; stored maize was damaged by weevils, rodents, maize lost through theft and even affected by aflatoxins. Farmers in Cheptais Sub-County sold their maize produce immediately after harvest; this led to selling their produce at low prices and exploitation from middlemen. Poor infrastructures such as market facilities and road networks were the major physical challenges faced by maize farmers. The paper recommends that government to subsidies on farm inputs, impose price control on essential farm inputs and also to direct the financial institution to lower the interest rates on credits borrowed by farmers. Demonstration plots be increased in the area by the seed companies and maize value chain handling techniques training be intensified by the extension officers. Farmers need to make an initiative of looking for extension services from the government and even from private practitioners; extension officers ought to emphasis on maize handling techniques so as to reduce losses related to yield and income.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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