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Effectiveness of Sorghum Farming In Addressing Household Food Security in Nyakach Sub-County of Kisumu County, Kenya

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Abstract: **Sorghum farming is one of the strategies that have been used for decades to alleviate poverty by addressing household food security globally. However, the full potential of the sorghum for household and industrial uses has not been harnessed in Kenya. The purpose of the study was to assess the effectiveness of sorghum farming in addressing household food security in Nyakach Sub-County of Kisumu County, Kenya. The study targeted a population of 29,000 small-scale farmers in 5 wards that cultivate both sorghum and maize at the same time besides other crops. The sample size of 395 was computed using Yamane Taro's (1967) simplified formula for sample sizes. Systematic sampling procedure was used to select head of households by dividing the total population of each stratum (ward) by the sample size of each stratum (ward). Kisumu County, Nyakach Sub-County, the wards and the key informants (local administration, National and county staff, village elders, extension officers, NGOs) were purposively selected. Structured questionnaires, observation checklists, focus group discussion and community vulnerability assessment schedules were used to obtain information from heads of farming households. Interview guides was used for both heads of households and informants' while SWOT analysis guides was mainly used to interview key informants'.This study found out that sorghum farming effectiveness in addressing household food security depended on acreage under sorghum, yield, stock, income from sorghum, uses/benefits/versatility, source of employment and ability to adapt to the two extreme weather conditions of floods and drought. This paper recommends increase acreage under sorghum, formation of sorghum farmers cooperative society for credit facilities, empowerment of farming households in sorghum farming. In addition, stakeholders should encourage sorghum and sorghum products consumption and value addition such as baking bread, bans and cookies that can create community markets for sorghum and sorghum by-products.**

Keywords: **Effectiveness, Sorghum, Acreage, Yield, Stock, Income, Benefits/UsesVersatility, Employment, Adaptability, Food security, Farming households.**

1. INTRODUCTION

Globally sorghum is grown for food, animal feed, fiber, and fuel in both subsistence and commercial agricultural systems (Bhagavatula *et al*., 2013 and Morris *et al*., 2013). Garcia argues that sorghum is valued because it is used as grain for human consumption and forage particularly in livestock and poultry feeding as well as reserve cereal for households' consumption incase maize production falls below the threshold (Garcia, 2012). Trouche *et al*., stated that due to its resistance to drought, sorghum grain is an important staple crop for many areas (Trouche *et al*., 2012). During the last three decades (1980-2010), acreage under sorghum has decreased thus reducing production. This has been due to several factors from belief systems to lack of market (Kumara *et al*., 2014). African countries contribute 22% of the global sorghum output, despite accounting for only 8% of the global sorghum area. In other words Africa accounts for 61% of the global area and 41% of global production. What worries is the low allocation of acreage to the crop with inadequate input conditions and, consequently the yield levels are relatively low (Bhagavatula *et al*., 2013).

Ogeto *et al*., indicated that although in the late 20th century a great number of sorghum produced was used directly for human consumption its share has continuously diminished in quantity while improving in quality in the 21st century due to improved seeds (Ogeto *et al*., 2013). According to Muhatia, the total food consumption of all cereals has risen considerably during the past 35 years while human sorghum consumption has either decreased or remained stagnant, mainly because it is regarded in many countries as an inferior grain, backward and tasteless although highly nutritious compared to other grains. For decades maize took over indigenous crops like sorghum, millet, cassava and sweet potatoes. Severe drought of 2016 when rains fell below farming threshold, maize farmers were the most affected and many of them have not recovered since 2017. These and many other factors necessitated the need to move back to drought resistant and flood tolerant crops such as sorghum or millet (Muhatia, 2017).

Sorghum farming in Kenya is an important agricultural activity in the economy. The crop is grown in Eastern, Western, Nyanza, North Rift Valley, parts of Central and Coastal areas. The yield range from 500-1500kg per hectare but with good farming management one can harvest 3000 kg per hectare. The utilization of sorghum varies by region; in Africa and Asia, it is grown mainly for food use, although industrial use of sorghum grain has been increasing in both Africa and Asia. Sorghum grains are grounded or milled to flour to make the local bread *(ugali)*, local brew *busaa*, porridge, cookies, pancakes and other beverages. Young growing plants, leaves, stalks and immature seeds are also used to make fodder and silage for feeding animals (Muui, et al., 2011). According to USAID report, Nyakach Sub-County like other semi-arid areas continue to experience a typical decline in household food security, a situation that started even before the short rains of October to December 2016. The inadequate short and long rains exacerbated dry conditions affecting water resources and warmer than normal land surface temperatures resulting in inadequate harvest. While weather conditions vary from ward to ward ranging from fair to poor, certain wards experience severe water deficits such as Central and West Nyakach. Generally, Nyakach Sub-County has been termed as hardship area in the past (USAID, 2017).

2. RESEARCH METHODOLOGY

The study was limited to sorghum and maize farmers besides other crops in Nyakach Sub-County of Kisumu County, Kenya. According to GOK, 2009 the Sub-County covers both lowlands, commonly known as the lower Lake Victoria basin and a series of hills from Nyabondo Plateau to Kajimbo hills. The total population stands at 133,041 thousand people with an area of 357.30 sq.km. The Sub-County is situated from latitude 0 135 to 0 18N and longitude 35 38 to 34 35E. The mean annual rainfall ranges between 1000mm to 1800 mm. The Long rains occur from March to May while the short rains from August and October although the onset of the seasons sometimes starts early or delay Three out of ten households in Sub-County live in abject poverty (MOP&ND 2009). The majority of household drive their livelihood from farming and fishing which are the main activities besides other incoming generating activities. The North is highly populated in comparison to the other locations. North East is thickly populated due to the highlands with fairly good rains leading to good harvest while due to constant floods and drought, Central, West and South West are fairly populated MOP&ND, (2009). There is one parliamentary constituency in the Sub-County namely Nyakach represented by Member of Parliament (MP) and five wards (Central, West, North, South-East and South-West) represented by Members of County Assembly (MCAs) (GOK 2009).

The study targeted maize and sorghum farming households besides other crops in Nyakach Sub-County of Kisumu County, Kenya. According to Kenya Government, the Sub-County had a total population of 29,000 farming households spread across five wards. Data was collected from 395 households that cultivate both sorghum and maize beside other crops using questionnaire to gather on the effectiveness of sorghum farming in addressing household food security which included information on acreage under sorghum production, sorghum yield, stock, income from sorghum enterprise, sorghum farming as an employment sorghum adaptability and sorghum uses in order to increase response rates (Lado, 2004).

Systematic sampling procedure was used to select head of households and key informants' were purposively selected these included National and County Ministries of Agriculture and Trade, Country and Sub County administration officers, chiefs/assistant chiefs, village elders, agricultural extension officers, NGOs, CBOs, FBOs, social workers, conventional seed companies, indigenous seed sellers and MP and MCAs. Structured questionnaires, observation checklists, focus group discussion and community vulnerability assessment schedules were used to obtain information from heads of farming households. Interview guides was used for both heads of households and informants' while SWOT analysis guides was mainly used to interview key informants'. Data was analyzed using descriptive statistics and t-test to compare the means (x) of factors under study between sorghum farming and household food security.

2.1 Summary:

The study was limited to sorghum and maize farming households besides other crops in Nyakach Sub-County of Kisumu County, Kenya. The study targeted population was 29,000. The Sub-County is divided into five wards (strata). The sample size of 395 was computed using Yamane Taro's (1967) simplified formula for sample sizes. Proportionate random sampling method was used to determine individual heads of households based on total population and the population of each strata while the area and key informants were purposively selected. Data was gathered using questionnaires, interview guides, observation check lists and SWOT analysis. Descriptive statistics and t-test were used to analyze data. The findings were presented in tables and charts to clearly explain the relationship.

3. RESULTS AND DISCUSSIONS

This study analyses the effectiveness of sorghum farming in addressing household food security in Nyakach Sub-County of Kisumu County, Kenya under the following variables: acreage, yield, income, uses, ability to adapt to two extreme weather conditions of drought and floods and income generation.

3.1 Acreage Under Sorghum in Nyakach Sub-County:

Acreage analysis was important in finding out whether acreage under sorghum was sufficient to produce enough sorghum for households' consumption and surplus for sale to access other foods in the market.

Table 3.1: Sorghum Acres per Household in Nyakach Sub-County of Kisumu Counry, Kenya

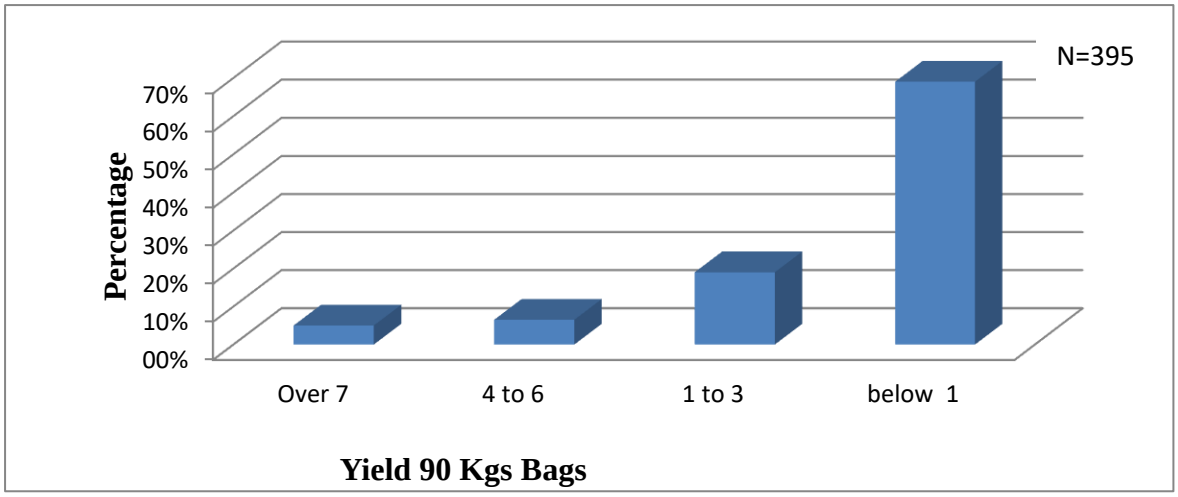
No of Acres per Household	No of Households	Valid Percentage	Cumulative Percentage
Below 1	312	79	79
1-3	55	14	93
4-6	16	4	97
Over 6	12	3	100
Total	**395**	**100**	

Source: Field Data (2017)

The Results showed that most land used by households to cultivate sorghum was individually owned. Households had ¼ to 3 acre of land under sorghum while households owned an average of 4-20 acres. This showed that acres allocated to sorghum farming were very low compared to acres owned by households. This means many households are engaged in sorghum farming as subsistence farmers. The result of the current study is in agreement with those of earlier studies, Omoro (2013) who stated that farmers have enough pieces of land to expand their production. "Land has never been a problem. There is enough land to produce more than enough". The result showed that most farmers were not interested in huge sorghum production. Sorghum is cultivated in small areas as a buffer incase maize and other crops fail in both long and short rains. A farmer in West Nyakach commented that it was good to have some sorghum always to cushion the family during famine so sorghum is kept to mix with maize or cassava to limit the consumption and extend grain availability. Amount produced however small was able to extend food availability in households leading to food security for a short period. This finding is confirmed by Kumar (2016) stating that sorghum is generally grown in the rainy season (spring) but in India and in some parts of Africa it is grown in both rainy and post-rainy seasons to cushion households against hunger.

3.2 Sorghum Yield in Nyakach Sub-County:

Yield analysis was done to find out the quantity of sorghum produced annually. Both food security and food sovereignty emphasize the need to increase food production and productivity to meet future demand (FAO 2012). The results from sorghum production during both short and long rainy seasons revealed that there was a significant difference in quantity of sorghum produced per household depending on the area cultivated. The results are indicated in Figure 3.1 shows the no of sorghum bags produced per household annually.



Source: Field Data (2017)

Figure 3.1: Number of Sorghum bags per household annually in Nyakach Sub-County

Figure 3.1 shows that annually 69% of households' harvest an average of below 90Kg bag, 19% 1-3 bags, 7% 3-4 bags and 5% Over 7 bags. The results showed that approximately 88% of households had an average of ½-3 bags of 90kgs annually. It was evident that sorghum production is very low among households in Nyakach Sub-County of Kisumu County, Kenya due to factors such as use of indigenous seeds, inadequate knowledge on best farming practices and lack or resources. Though Kisumu County is among the high potential areas for sorghum, indications are that farmers are only engaged in subsistence and not commercial production and that the farmers are not able to produce sufficient quantities for consumption and get surplus for sale due to volume produced. This is in line with Ogeto *et al*. (2013), Muui et al (2013) and Omoro (2013, who stated that most sorghum farmers in Africa are subsistence farmers who only produce for their own consumption which as a matter of fact is never enough and they hardly have surplus to generate income. However, farmer in South-West Nyakach was so happy with ½ a bag of sorghum produced saying it would only be used when other grains were not available or too expensive.

3.3 Sorghum Stock per Households in Nyakach Sub-County:

The Stock analysis was important in highlighting how long sorghum stock lasted to extend household food availability and access. The results are indicated in Table 3.2.

Table 3.2: Months Sorghum Stock Last among Households in Nyakach Sub-County

Months	No. of Households	Valid Percentage	Cumulative Percentage
1-3	197	50	50
4-6	121	30.8	80.8
7-9	58	15	95.8
Over 10	19	4.8	100
Total	**395**	**100**	

Source: Field Data (2017)

The results showed that half 50% had their stock lasting between 1-3months after harvesting. About 30.8% had sorghum stock lasting between 4-6 months. Between 7-9 months only 15% of the respondents had sorghum stock. Over 10 months only 4.8% of households still had sorghum stock. Stock availability after harvesting revealed that there was significant difference in stock by household from one to ten months after harvesting seasons. It was important to note that over 80% had stock for three months after harvesting this is in agreement with Chao (2016) who stated that some farmers are able to get enough food from their previous sorghum harvest to take them through dry spell up to the next season. Such farmers use cans and sacks to store their produce and are willing to increase sorghum acreage to be food secure.

3.4 Income from Sorghum farming among households in Nyakach Sub-County:

Analysis of Income from sorghum farming was important in showing sorghum ability to generate income to access other foods and fulfill other obligations .Food security and food sovereignty concepts stress on redistributive public policies in terms of income and employment (FAO 2012). The results are indicated in Table 3.3.

Table 3.3: Income from Sorghum farming among Households in Nyakach Sub-County

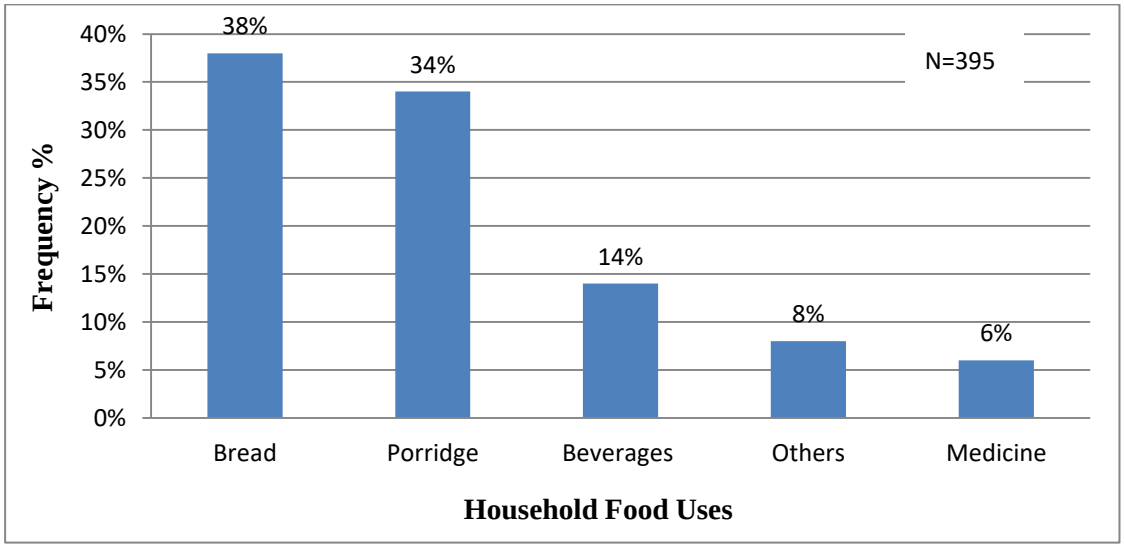
Income In KES	No. of Households	Valid Percentage	Cumulative Percentage
Over 16,000	11	2.7	2.7
11,000-16,000	16	4	6.7
5,000-10,000	39	10	16.7
Below 5,000	329	83.3	100
Total	**395**	**100**	

Source: Field Data (2017)

83.3% had annual income of below Kes.5,000, 10% had between 5,000-10,000, 4% were earning between 15,000-20,000 while 2.7% were earning over Kes.20,000 from sorghum enterprise. The results showed that most farmers had some income from sorghum sales however little. This income was from direct sale of sorghum stock and by products such as porridge, flour, and bread (*ugali*). Income from sale of sorghum although very low, differed from one household to another and was important compared to the amount of acreage under sorghum and the little attention given to sorghum farming. The number of households that had higher income from sorghum sales seemed to be too small simply because they were the ones that had more than two acres of land under sorghum crop. Generally income from sorghum enterprise was low. This is in agreement with Kipng'etich *et al.* (2015) who stated that most households 78% earn less than KES 3,000 per month as farm income, 30% are unable to access farm income. According to them more than half of rural households do not get any income from their crops because they produce mainly for subsistence and only sell surplus, the grain hardly remain for sale.

3.5 Sorghum Uses In Households in Nyakch Sub-County:

Sorghum uses analysis was important in finding out if sorghum was one of the crops which could be value chained. The results indicate that there were several uses particularly traditionally accepted. Figure 3.2 shows food uses of sorghum for household food security.



Source: Researcher 2017

Figure 3.2: Food Uses of Sorghum in Nyakach Sub-County

Figure 3.2 shows that Ugali (Kuon) local dish had the highest percentage at 38% followed by porridge at 34%, Beverages come third with 14%, *Nyoyo* (local dish) comes fourth at 8% and finally medicine at 6%. The results showed that the households had at least four major uses of sorghum as food. It is evident that there are various uses of sorghum as food and most people are using sorghum for bread followed by porridge and beverages. Used as food sorghum availed food through consuming sorghum or exchange for other foods thus contributed towards food security. This is in agreement with Omoro (2013) who stated that there are several food uses of sorghum which include: leavened and unleavened bread; bread from alkali cooked grain; thick and thin porridge; boiled grain; noodles; alcoholic and non-alcoholic beverages; and popped and sweet sorghum snacks. Examples of these foods include: porridges such as *tô* (west Africa), *bogobe* (Botswana), *sankati* (southern Africa) and *ogi* (Nigeria); leavened breads such as *injera* (Ethiopia) and *kisra* (Sudan); unleavened breads such as *roti* (India), *chapatti* (south Asia) and *tortilla* (Latin America) and fermented beverages such as *umkhombothi* (South Africa) and Ugali (Kenya) and Kuon (western Kenya) (Omoro 2013). who stated that there are many food uses of sorghum such as leavened and unleavened bread, cookies, porridge, boiled grain, noodles, alcoholic and non-alcoholic beverages, vegetable oil, popped and sweet sorghum snacks.

Sorghum is also used by both brewing and animal feeds industries as a row material besides other non domestic uses. This is in agreement with Omoro (2013) who stated that generally, apart from the use of grain for human consumption sorghum has a variety of potential uses. Whole plants are used for forage, hay or silage; stems of some varieties are used for firewood, building, fencing, weaving or broom making; stems and grains of others are used for liquid biofuels production; whole living plants serve as windbreaks and are used for staking heavy climbers such as yams, cowpeas; seeds are used for animal feed; and a variety of products can be produced including industrial alcohol, vegetable oil, adhesives, waxes, dyes and starches for lubricating oil-well drills.

3.6 Sorghum Farming as Source of Employment for Households in Nyakach Sub-County:

This analysis was important to assess effectiveness of sorghum farming in addressing household food security by creating employment to households to access food and fulfill other obligations. Employment analysis was also important in highlighting how many sorghum farmers were engaged in farming as a source of employment. The results are indicated in Table 3..4.

Table 3.4: Sorghum as Source of Employment for Households in Nyakach Sub-County.

Income In KES	No. of Households	Valid Percentage	Cumulative Percentage
Sorghum Farming	276	70	70
Weaving and Molding	55	14	84
Fishing	35	9	93
Business	20	5	98
Formal Employment	8	2	100
Total	**395**	**100**	

Source: Field Data (2017)

Results in Table 3.4 shows 70 % are sorghum farmers, weaving and molding 14%, fishing industry 9%, business 5% and 2 are those who are formally employed by TSC, NGOs and civil servants. This signifies that majority of respondents had sorghum farming as their main occupation while others cultivated sorghum besides other activities. This finding is in agreement with Oyediran *et al.* (2017) who stated that sorghum production contribute to economic empowerment of the farming households as most (86.5%) of the family members are engaged in every stage of sorghum production chain, it increases family earnings (70.7%) and saves the family members from running into domestic debt (60.0%). Profit from sorghum is also used to cater for basic household needs (88.4%). Sorghum production plays an important role in providing food, job and income for the rural farming households.

The finding is also confirmed by Kiniti, (2017), that farming is asignificant source of employment in Kenya and the largest contributor to the gross domestic product accounting for 35.6 percent of GDP in 2016. Sorghum creates more than 30,000 farmers and supports over 80,000 businesses (Kiniti 2017). The finding is also in line with Mbogo (2010) who stated that small scale sorghum farming remains the largest employment opportunity in Kenya and it is central to the

empowerment of women who form the bulk of the workforce. The income generated help in acquiring food, pay for education and health services.

Findings showed that respondents in Nyakach Sub-County were all involved in farming besides businesses such as kiosk and motor cycle or transport businesses to earn extra income to supplement farming. This is to have food available for the households all the time to mitigate food insecurity. This confirms Kwa (2001) findings that in developing countries agriculture continue to be the main source of employment, livelihood and income for between 50-90 percent of the population. Kwa further states that of the total farmers 70-90 percent are small scale farmers based in the rural areas. Small scale farmers are therefore, important part of rural economy and have traditionally survived on subsistence farming for decades. It is because of this that these farmers should not be marginalized by policies of development as this may lead to a vicious circle of poverty, high uneven development and finally the inability of developing countries households to attain food security.

3.7 Sorghum Adaptation to two extreme Environmental Conditions of floods and drought in Nyakach Sub-County

The study sought to find out the ability of sorghum to adapt to the two diverse weather conditions of floods and drought. The respondents were asked to rank crops in their adaptability order to the two extreme weather conditions (floods and drought).The results revealed that there was significant difference adaptation ability to the two extreme weather conditions by each crop. The results are indicated in Table 3.5.

Table 3.5: Sorghum Adaptation to two extreme Environmental Conditions of Floods and Drought in Nyakach Sub-County

Types of Crops	No. of Households	Percent Percent	Valid Percentage	Cumulative Percentage
Sorghum	251	63.6	63.4	63.4
Cassava	90	22.7	22.7	86.3
Maize	44	11.2	11.2	97.5
Rice	10	2.5	2.5	100
Total	**395**	**100**	**100**	

Source: Field Data (2017)

Table 3.5 shows that sorghum had the highest adaptability levels at 63-4% followed by Cassava 22.7%, Maize 11.2%, rice 2.5% (see figure 4.6 above.) Sorghum adapted well to dry conditions or hot weather with little rain, the seeds may be tinier than usual but one is able to harvest and use. It also resists floods due to its rooting system, which is firmly placed in the ground. Once the floods have subsided sorghum picks up and even does better. By greater extent sorghum contribute to household food security by availing food despite harsh weather conditions. The results are in line with earlier finds, Ogeto *et al*,. (2013), stated that sorghum is unique in its ability to produce under a wide array of harsh environmental conditions where other crops grow or yield poorly. It is grown with limited water resources and usually with low fertilizer supply or other inputs by a multitude of smallholder farmers in many countries.

It is also in agreement with FAO (2009), which stated that sorghum has a number of adaptation abilities that allow it to be very drought resistant. The characteristics include, its extensive root system that helps in gathering water, a waxy coating on the leaves that helps in water retention and the development of its seed heads over a longer period of time than other grains such that short periods of water stress does not prevent kernel development. This makes it a valuable subsistence crop for arid and semi-arid areas of Sub-Saharan region.

Sorghum is important to a substantial number of farm households in the East African region, especially in the semiarid areas. Most cultivars of these drought resistant grains are food for the household, and bring cash income when there is a market for the sale of surplus production. Some cultivars are also grown for brewing, which offers another source of cash (Ogeto *et al.*, 2013). This also confirms the study finding of tolerance to harsh weather conditions. Kumar (2016) stated that Landraces and wild relatives of cultivated sorghum from the centers of diversity have been rich sources of resistance to new pathogens, insect pests, and other stresses such as high temperature and drought, as well as sources of traits to improve food and fodder quality, animal feed, and industrial products. Farmbixafrica also stated that sorghum farming is particularly important in Kenya because the crop does well in areas that are drought prone and which suffer the biggest impact of hunger when the amount of rainfall reduces or is in excess.

From focused group discussions, interviews and SWOT analysis sorghum was the most suitable crop for the weather as it adapts to both floods and drought followed by cassava.

Sorghum was followed immediately with cassava. Traditionally sorghum is mixed with cassava for milling to make the flour tender for baking cookies and bread (*ugali*). It was clear from the discussions that of all the crops it was sorghum that could resist the two extreme weather conditions and even do better in normal rainy seasons. The findings are in line with KALRO (2017) stating that sorghum is both floods tolerant and drought resistant as compared with grain crops such as maize. It can survive dry-spell conditions then resume growth once moisture becomes available because of its morphology and physiology.

This has also been confirmed by earlier findings of Kuza Biashara and FAO stating that the crop performs well in most parts of Kenya with best returns being recorded from semi-arid areas of Mwingi and the high temperatures of Siaya. Sorghum is tolerant to drought due to its root system and performs better than most crops such as maize during droughts and occupies areas unsuitable for maize in stress-prone semi-arid areas. It is tolerant of salinity and to water logging for sometime (FAO 2009, Kuza Biashara 2015).

FAO further stated that under harsh economic conditions sorghum can be rotated with legumes benefiting from the nitrogen provided by the legume. After harvest, ploughing in the stubble can improve the organic matter status of the soil and help limit erosion. When sown in 20 cm rows, sorghum gives good protection from soil erosion.

Dead stalk of sorghum grain can provide support to climbing legumes such as cowpea several months after harvesting reducing the work of erecting posts and strings thus saving time and money. Sorghum is tolerant to many pollutants and it thrives in toxic soils that kill most plants. Due to its root penetration sorghum also captures the nitrogen which may be in excess in the soil, a property that has been useful in reclaimation of fallow lands, where wastes have been discharged and where soil nitrogen is very high (400kg/ha). During the fall and winter, if sown during the fall, it covers more than 60% of the soil before winter and protects the soil from wind erosion. Sorghum also thrives on salty irrigated soils. It restores porosity of the soil making it possible to grow a high yielding wheat or maize in another season (INRA CIRAD AFZ and FAO 2012-2017) As a drought tolerant crop sorghum improves water use efficiency while supporting relatively high levels of production of animal feeds.

4. SUMMARY AND CONCLUSIONS

In conclusion the effectiveness of sorghum farming in addressing household food security lies on its resistance to two extreme weather conditions such as low-lying heavy soils that is often flooded during rainy seasons and drought, given the same conditions sorghum yield is much better than other grains particularly maize which is predominant in the area, can be stored for a longer period well into next harvesting season, has various uses from household consumption to industrial raw material for poultry and animal feeds and the ability to offer off-season labour. There are varieties of sorghum seeds that can be planted when rainy season is almost over, continually year round production due to regeneration (ratooning), good profitability during drought as the demand is higher and use by food processing industries. Sorghum can easily be intercropped with legumes to enhance soil fertility while assist climbers such as yams and cowpea after harvesting. Sorghum increases sustainability as it does not deplete soil and can be grown in the same field year after year due to annual floods replenishing soil nutrients and its ability to withstand drought.

5. RECOMMENDATIONS

This paper recommends that sorghum farmers increase sorghum area of cultivation enough for household consumption and surplus for sales to generate income and create employment, form sorghum cooperative society to be able to access credits from SACCOS, banks and micro-finance banks. There should be a combined effort by all stakeholders from government, NGOs, seed companies and advanced citizens of the community to empower households in sorghum farming particularly on new technologies and indigenous wisdom on seed varieties and nutrition value, land preparation, harvesting, drying, processing and storage of sorghum and other grains to extend grain shelf life and to minimize food waste leading to food security. In addition, stakeholders should encourage sorghum and sorghum products consumption, value addition such as baking bread, bans and cookies that can create community markets for sorghum and sorghum by-products. Finally, there is need to conduct a study in Nyakach Sub-County to determine the impact of socio-cultural factors that influence sorghum production and consumption.

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