

Factors for low sorghum production: A case study of small-scale farmers in East Kano sub location, Nyando District, Kenya.

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**Acronyms**

GOK- Government of Kenya

FAO-Food Agricultural Organization

KARI-Kenya Agricultural Research Institute

TARA-Trust for African Rock art

MT- Metric Tonnes

USAID- United State Agency International for Development

U.S- United States

FAOSTAT-Food Agricultural Organization STATISITCS

ICRISAT- International Crop Research Institute for the Semi-Arid Tropics

ECA- Eastern and Central Africa

ECARSAM- Eastern and Central Africa regional Sorghum and Millet

GDP- Gross Domestic per Capita

MoA- Ministry of Agriculture

DFID-Department for International Development

ILRI- International Livestock Research Institute

ASARECA- Association for Strengthening Agricultural Research in Eastern and Central Africa

SLF-Sustainable Livelihood Framework

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## **Abstract**

This research is about an investigation into the factors for low sorghum production in East Kano location, Nyando district, Kenya. The small scale farmers in East Kano have been cultivating sorghum over the years for household food consumption. The production of the crop has had lower yields in the recent years within the study area. Sorghum is known as a food security crop and its ability to withstand dry weather conditions.

The objective of this study was to get information about the factors for low sorghum production and give recommendations to KARI in order for the organization to start sorghum projects with these farmers to ensure increased production.

To answer this, the following research question and sub-questions were formulated: What are the factors for low sorghum production in East Kano sub location, Nyando district? What size of land does the household own? What is the yields/unit area of sorghum? What are the uses of sorghum at household level? What challenges do small scale farmers in sorghum farming face? What influences the choice of crop planted? What is the commercial importance of sorghum at household level? What are the services offered by the government to sorghum farmers? What other crops do the small scale farmer produce?

To answer these questions, individual interviews with the small scale farmers, key informants and focus group discussions were carried out. 30 small scale farmers, 4 key informants and 2 focus group discussions (5 women and 5 women per discussion) were involved in the research. These selected respondents were actively involved in sorghum farming in the study area.

The results of the individual interviews and the focus group discussions yielded the following outcome: First, farmers lack the financial resources to invest in farming of sorghum. Inputs such as seeds, bullocks and plough and even the money to hire people to work on the farm. The study found out that most of the farmers rely on family labour and this has been reduced as many families now opt to take their children to schools and colleges. Most farmers have less or no education background and training in farming. This has made majority to rely on their local farming practices which does not yield much compared to the modern technologies (use of tractors, sorghum hybrid seeds, fertilizers and other moden practices. The study also found out that for these farmers land is still not a problem. Most of the farmers have bigger pieces of fallow land that can be used to increase sorghum production. Land ownership is widely by men, and this also allows the men to determine what crop is being planted by the household.

Based on these findings, the study concludes that the farmers of East Kano have strong factors that have caused low sorghum production at the household level. For food security of the household to improve, the study recommends that KARI to work closely with these farmers, sensitize then on the need to improve sorghum production through the use of appropriate seeds, good land preparation, decisive planting time and adoption of new technologies. Secondly, KARI should link the farmers with micro finance institutions who can train the farmers on how to improve or widen their sources of income, savings and access to small farming loans.

Last but not least, involve the farmers in the various sorghum research projects in the area and other places so that they can learn more and better practices.

## CHAPTER ONE: INTRODUCTION

### 1.1. Introduction

Sorghum, *Sorghum bicolor* (L) Moench, is the fifth most important cereal globally after rice, wheat, maize and barley. It constitutes the main food grain for over 750 million people who live in the semi- arid tropics of Africa, Asia, and Latin America (Food Security Department, 2004). In terms of tonnage, sorghum is Africa's second most important cereal. The continent produces about 20 million tonnes of sorghum per annum, about one-third of the world crop (Taylor, 2003).

Sorghum production in Kenya has been relatively stagnant over the years. The largest groups of producers in Kenya are small-scale subsistence farmers (Food Security Department, 2004; Rohr Bach, 2003). Being poor in resources, most of sorghum farmers have only minimum access to production inputs and improved credit facilities for their purchase (Food Security Department, 2004). The factors like low profitability of sorghum, less demand as a food grain has not dithered its importance. Farmers still continue to grow sorghum though to a certain minimum level, which can be referred to as household food/fodder security level. (Muui et al 2013). While total food production of all cereals has risen considerably during the past 35 years, East Kano sorghum small scale farmers' sorghum production has remained stagnant (FAO, 1995).

**Table 1: Kenya's sorghum productivity in the last 10 years**

Year	Production	Unit of measure(Metric tonnes)	Growth rate
2000	135	(1000 MT)	3.85 %
2001	140	(1000 MT)	3.70 %
2002	90	(1000 MT)	-35.71 %
2003	130	(1000 MT)	44.44 %
2004	70	(1000 MT)	-46.15 %
2005	130	(1000 MT)	85.71 %
2006	140	(1000 MT)	7.69 %
2007	140	(1000 MT)	0.00 %

2008	60	(1000 MT)	-57.14 %
2009	95	(1000 MT)	58.33 %
2010	164	(1000 MT)	72.63 %
2011	200	(1000 MT)	21.95 %
2012	175	(1000 MT)	-12.50 %
2013	175	(1000 MT)	0.00 %

**Source: United States Department of Agriculture, 2012**

The table above shows the inconsistency in the production of sorghum over the last ten years. This is a representation of the challenges facing sorghum production in the region. Agriculture is an important sector but sorghum being a subsistence crop lacks the attention needed to increase its production at the household level. Every year there is a sharp decline in production followed by a sharp increase but the increase drops again in the following year. A number of factors could be attributed to the changes experienced. This research tried to look into these factors.

### **1.2. Nyando District**

Nyando District is a new district in Kenya which broke away from Kisumu District in Nyanza Province in 1998. Its capital is in a small town called Awasi 30 kilometers east of Kisumu. Nyando District's largest urban centre is Ahero, located 24 kilometers from Kisumu City. Nyando district borders the Rift Valley Province. The district is named after the Nyando River. The area supports a large rural population (75 per cent). The average density of the district is 284.6 people per km<sup>2</sup> with an annual growth rate of 3.4%. The agricultural land sizes have relatively become small due to redistribution and fragmentation. This is evident as the household increases; there is a general trend of land diminishing (Wawire et al. 2002; Odenya et al. 2008). East Kano location is part of Nyando district, the average small scale farm family is 7 persons who cultivate 2 acres of land on average. Agriculture is the key livelihood activity, employing over 60% of the total population and supplying over 52% of household earnings. Cropping patterns are dominated by production of subsistence crops such as maize, cassava, sorghum and sweet potatoes (Wawire et al. 2002; Odenya et al. 2008).

### 1.3. Research problem

Nyando district is a food deficit zone despite being considered 66% cultivable. This is partly due to unreliable rainfall. The district produced 33,892 MT of cereals in 2009 as compared to its annual cereal demand of 51,465 MT. This means own production can only take the district for seven months and hence the reliance on inter district trade with neighbouring high potential districts of Nandi, Trans Nzoia and other districts to meet the deficit. For the households in the district, this means reliance on the markets for a significant share of food eaten (Ministry of Planning Kenya, 2009).

Sorghum is the second most important staple crop after maize in East Kano sub-location. The crop is useful for food security of households in the region. Due to its resistance to drought, diseases and the notorious Striga weed, sorghum regularly out yields maize in the area. However, there have been decline in its production. The largest groups of producers in Kenya are small-scale subsistence farmers (Food Security Department, 2004; Rohr Bach, 2003). Being poor in resources, unreliable rainfall, most of sorghum farmers have only minimum access to production inputs and improved credit facilities for their purchase (Food Security Department, 2004). The factors like low profitability of sorghum, less demand, as a food grain has not dithered its importance. Farmers still continue to grow sorghum though to a certain minimum level, which can be referred to as household food/fodder security level. (Muui et al, 2013). While total food production of all cereals has risen considerably during the past 35 years, East Kano sorghum small scale farmers' production of sorghum has remained stagnant (FAO, 1995).

Sorghum is used as human food, where it is a staple food for many people; as animal feed and industrial raw material. Industrially, the grain is used to manufacture wax, starch, syrup, alcohol, dextrose agar, edible oils and gluten feed. As food, the grain is used in making fermented and non-fermented porridge, ugali, pilau, traditional dishes where it is mixed with legumes. The grain has high levels of iron (>70 parts per million) and zinc (> 50 parts per million), hence may be used to reduce micronutrient malnutrition. There is high demand for sorghum mainly in brewing industry to replace barley, yet the amount produced by farmers is too low to satisfy the market demand (Muui et al 2013). Sorghum has many uses and can contribute to food security especially for the small scale households. This research will investigate and provide the knowledge regarding the factors for low sorghum production as stated by small scale farmers. This research is spearheaded by Kenya Agricultural Research Institute, a national agency in charge of research on crops and livestock. The organization would like to have this information to help it in developing new strategies of working with small scale farmers in achieving food security.

**Table 2: Sorghum Production, (2005 - 2009)**

Year	2005	2006	2007	2008	2009*
Area (ha)	122,368	163,865	155,550	104,041	173,172
<i>Production</i>					
90 Kgs bags	1,668,081	1,457,503	1,637,391	602,910	1,055,051
Tons	150,127	131,188	147,365	54,316	94,955
Unit price per bag (Kshs)	1,700	1,254	1,100	1,230	3,285
Average Yield (bags/ha)	14.00	9.00	9.10	5.80	6.09
Consumption (bags)	1,425,000	1,510,000	1,551,525	366,667	900,000
Total Value (billion Kshs)	2.8	1.8	1.6	0.7	3.5

**Source: Economic Review of Agriculture, 2010**

**Table 3: Sorghum area of production in 2011 and 2012**

Commodity	2011	2012	2011	2012
	Area (Ha)	Area (Ha)	Production (90 Kg bags)	Production (90 Kg bags)
Sorghum	254,25	220,010	1,776,412	1,944,915

**Source: Food Security Assessment 2013(Ministry of Agriculture, Kenya)**

Figure 2 and 3 shows how the production of sorghum has been fluctuating since 2005. It is also worth noting that the area under sorghum is critical for production. The yield is not directly equivalent to the hectares of land under sorghum. There are instances when the area under sorghum is low but the yield in that year is more those years when the area was bigger. The question that begs is then what are these factors for low sorghum production. This data covers the whole sorghum producing area but still the study area reveals that the production of sorghum is getting less and less each year. This research therefore will use and compare the information collected from the field and the already mentioned data in order to come up with recommendations for KARI to implement in working together with the sorghum farmers.

#### **1.4. Objective of the research**

The objective of this study is to investigate the factors for low sorghum production at household level in East Kano location. The result will be a report with recommendations to Kenya Agricultural Research Institute (KARI) so that the institution can come up with strategies of working with the farmers in increasing the productivity of sorghum thereby improving the wellbeing of the small scale farmers.

### **1.5. Main questions**

The main question for this research is as follows;

What are the factors for low sorghum production in East Kano location, Nyando district?

### **1.6. Sub questions**

The sub questions are as follows:

1. What size of land does the household own?
2. What is the yields/unit area of sorghum?
3. What are the uses of sorghum at household level?
4. What challenges do small scale farmers in sorghum farming face?
5. What influences the choice of crop planted?
6. What is the commercial importance of sorghum at household level?
7. What are the services offered by the government to sorghum farmers?
8. What other crops do the small scale farmer produce?

## **CHAPTER TWO: LITERATURE REVIEW ON FACTORS FOR LOW SORGHUM PRODUCTION**

### **2.1. Background and global production**

Sorghum is the fifth most important cereal crop in the world and the third most important cereal crop in the United States after corn and wheat (FAS/USDA, 2011). Worldwide, sorghum production was 66.2 million metric tons for the 2010-2011 trade year (October through September), with the United States being the world's second largest producer, behind Nigeria (FAS/USDA, 2011). Sorghum has typically been produced for either feed or human consumption but there is increasing cultivation for bioethanol production (FAOSTAT, 2005; National Sorghum Producers, 2006). Sorghum ranks fifth in cereals for global production totalling just under 57 million MT for 2005 (FAOSTAT, 2005). Global trends in production are split between developed and developing countries, rendering sorghum the second most important cereal (after maize) in sub-Saharan Africa (FAO, 1995).

Due to decreases in global production between 1995 and 2001, as much as 90% of the world's area under sorghum cultivation lies in developing nations, mainly in Africa and Asia (Devries et al., 2001; FAO, 1995). Of total world sorghum production approximately 50% is used for human food (National Sorghum Producers, 2006). World sorghum production peaked over the period 1979-1981 at 66 million MT, although the decline to present levels has largely been due to two countries, the United States and China, which accounted for 6.2 million MT between 1981 and 1990 (FAO, 1995). This decline has been attributed to farmers planting more profitable crops in the east (such as pulses and oilseeds), and policy interventions and the availability of more drought-tolerant maize varieties in the United States, resulting in the expansion of the maize belt further west into traditional sorghum areas (FAO, 1996). In the period from 1980 to 2000, the growth in demand for this crop exceeded its production growth, the imbalance being most pronounced in Africa and its least developed countries (FAO, 1995).

The improvement in sorghum production, its availability, the best storage facilities, utilization and consumption can greatly contribute to households food security. (FAO, 1995).

In Africa, the major staple foods are cassava (118 million tons), maize (53 million tons), yam (50 million tons), sorghum (25 million tons), plantains (24 million tons), rice (23 million tons), wheat (21 million tons), millet (20 million tons), sweet potato (14 million tons), and bananas (12 million tons) (FAOSTAT, 2008). Among these staples, however, sorghum occupies a unique position due to its hardiness as a crop. Sorghum is particularly unique in that it thrives in both cold and arid areas.

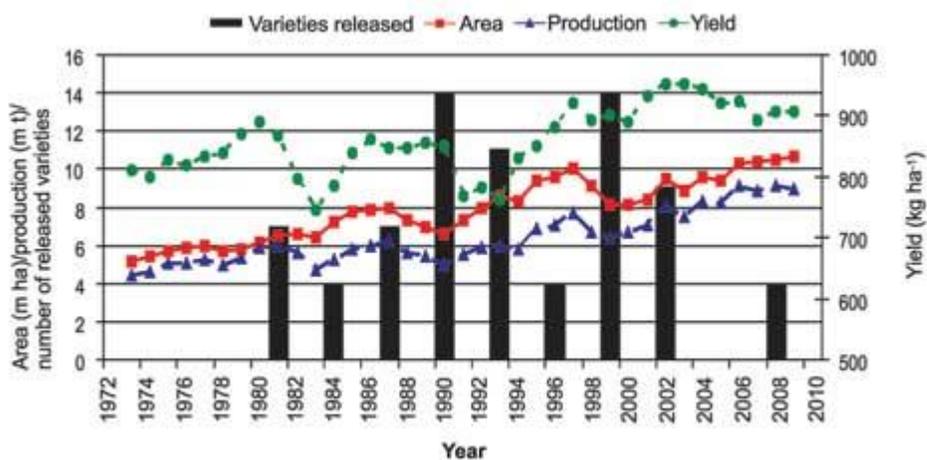
### **2.2. Eastern and Southern Africa (ESA)**

Area and production in ESA has increased significantly from the early 1970s to 2009, while there has been a marginal (18%) increase in productivity from 800 kg/ha to over 940 kg/ha during the same period (Figure 1).

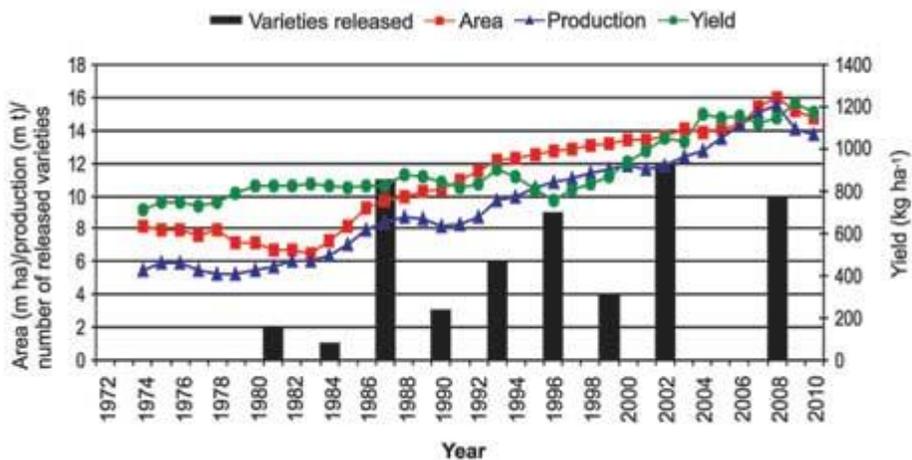
In West and Central Africa, the increase in sorghum area was more than two-fold from 1972 to 2008 (7.39 to 16.59 million ha), while production increased by almost four times during the same period (4.24 to 16.08 million tons). However, there was 22% reduction in area

(12.92million ha) and 28% reduction in production (11.52 million tons/ha) in 2009. Grain yield increased by 17% over 2008 levels (Figure 2). Overall in WCA, an 80% improvement in productivity was seen from the early 1970s (700 kg/ha) to 2009 (1260 kg/ha).

**Figure 1.** Three-year moving average for sorghum area, production, yield; and number of released varieties (3-year total) based on ICRISAT-bred material in ESA.



**Figure 2.** Three-year moving average for sorghum area, production, yield; and number of released varieties (3-year total) based on ICRISAT-bred material in WCA



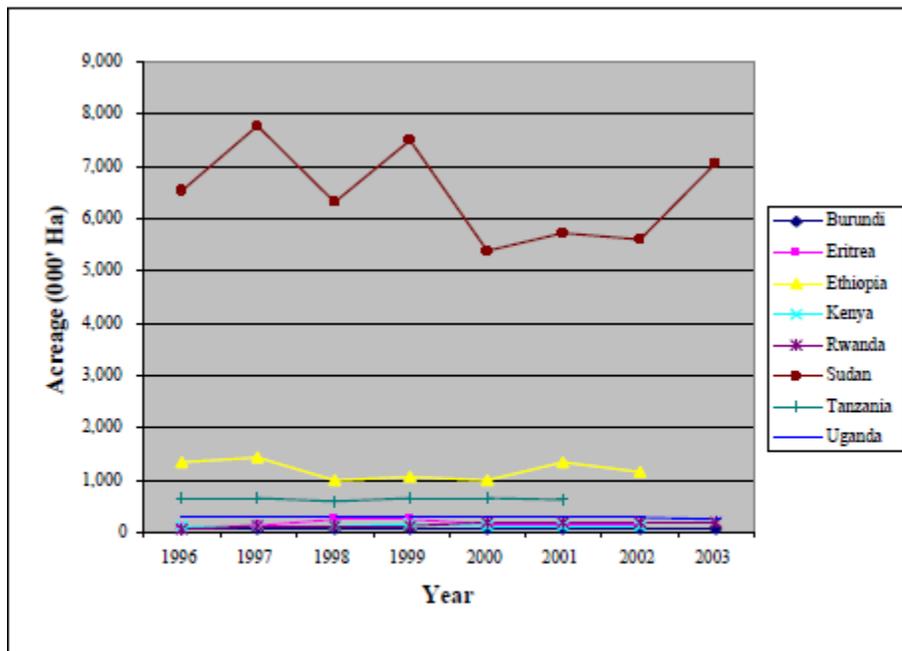
<http://www.icrisat.org/crop-sorghum.htm>

### 2.3. Utilization and importance

Aside 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; 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 (NRC, 1996). Important food uses of sorghum 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 (House, 1984). 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 *Kuon* (western Kenya).

Sorghum is drought-tolerant and resistant to water-logging (Doggett, 1988), and grows in various soil conditions (Dillon, et al. 2007). These characteristics contribute toward it being the staple crop of Africa's most food-insecure people, who live in the desert-margin, semiarid tropics—about 300 million people. Like maize, sorghum does not have a true hull or husk (Taylor, 2003). Because of its similarity to maize (hard and floury endosperm and large fat-rich germ), sorghum can be processed using technologies of dry and wet milling applied to maize (Taylor, 2003). Sorghum has the added advantage of being inherently gluten-free and has been demonstrated to be safe for people with celiac disease (Ciacci et al. 2007).

**Figure 3: Trends in yields in the major sorghum producing countries in eastern Africa (1996-2003)**



Source: FAOSTAT, 2004

Figure 1 shows the trends in sorghum production in eastern Africa. The Kenyan graph indicates how production of sorghum has been low since 1996 to 2003.

## 2.4. Production constraints

Sorghum cultivation in developing regions, and especially in Africa, is dominated by subsistence farmers who seldom produce excess to sell, thus limitations in production vary from those common to commercial scale production (NRC, 1996). Africa's sorghum producing farmers in particular face several, interlocking constraints which vary in degree and combination from one region to another (NRC, 1996). These constraints are also not homogenous in Kenya as the country is made up of different geographical patterns. Most of the challenges though are shared by majority of small scale farmers.

### 2.4.1. Biotic factors

Sorghum cultivation is hampered by biotic and abiotic stresses, especially in the semi-arid tropics (House, 1984). Sorghum can be distinguished from other cereals by the broad range of diseases to which it is susceptible (Frederiksen, 1986). Both pathogen and related disease and abiotic stress arise from the wide range of environments in which it is cultivated (Frederiksen, 1986). In fact sorghum plants grown in traditional areas may be under stress from as many as six foliar pathogens; one or more viruses; a host of soil borne organisms; a mycoplasma-like

organism; and at least two systemic fungal diseases (Frederiksen, 1986). Of great importance to sorghum cultivation is resistance to insects such as headbugs, molds and bird pests (NRC, 1996).

Drought severely hinders sorghum production in the semi-arid regions of the world; a problem which is compounded by management, variable climates, soil characteristics, pests and in some cases socio-economic political aspects (NRC, 1996). Soil fertility, fertilizer use, heavy-metal and salinity presence are particularly significant constraints in sub-Saharan Africa (Doggett, 1988). The inherently low fertility of tropical soils, in conjunction with resource poor management practices, results in drastically low yields in these regions (NRC, 1996). In addition, sorghum production is limited by a host of weed species both monocotyledonous and dicotyledonous. In particular, *Striga* species (most notably *Striga hermonthica* (Del.) Benth and *Striga asiatica*) are prevalent throughout Africa, vastly reducing yields over a wide variety of regions (Rodenburg et al., 2004). In 1998 it was estimated that *Striga* species have the potential to invade 48 million ha of grain cultivating areas in Africa (Watson and Kroschel, 1998).

#### **2.4.2. Abiotic factors**

If sorghum is so well known and accepted in Africa, why is it not more available to alleviate hunger in African populations? Some researchers (Board on Science and Technology for International Development, 1996) say part of the problem is that sorghum has not been developed into products for major urban areas, and thus lacks markets. In Africa, it remains mostly a crop of small cultivators and is consumed locally where it was grown. A consumption restraint has been the lack of commercially available foods such as flours, breads, cereals and other products for those who are not farmers and who cannot devote time to making flour from sorghum grain. However, the urban market place is changing as the food industry is beginning to develop and sell sorghum products. Even trade in domestic markets is limited. This is one reason why farmers are seldom assured of a reliable market in the event of surplus production (FAO, 1996). Sudan sometimes exports sorghum during favourable years. Marketing of these grains should also be made more efficient by reducing grain collection and stocking costs. Moreover, there is need to identify research-based alternative uses for sorghum, which would yield new avenues for increased utilization and act as a catalyst to improve production and productivity.

#### **2.5. Agriculture in Kenya and sorghum production**

Agriculture is one of the pillars for Kenya's economy. The sector is important for the socio-economic growth of the small scale farmers. The agricultural sector directly contribute 26% of GDP and additional 27% through linkages with manufacturing, distributing and service related sectors. Majority of Kenyan live in the rural areas(68%) and depend mostly on agriculture and fishing for their daily livelihoods. In addition, 87% poor people live in the rural areas. Small scale farmers make up to 80% of the farmers in Kenya. The small scale farmers in Nyeri, Kisii, Bungoma, Nyando and Siaya own farm areas of 2-12 ha while those in large scale farming such as Kericho, Laikipia, Trans Nzoia, Nakuru and Uasin Gishu are about 700ha. On average, 25% of all farms are on average of about 20-50 ha (Wambugu and Muthamia, 2009).

Food availability for most developing countries such as Kenya is derived from sources such as domestic production, import and food aid (Board, Daviron, Gerad & Voituriez, 2005). Agriculture production is an important aspect that contributes to both subsistence crop production, as well as cash crop production in Kenya (Wiebe & Tagine, 2000). Agriculture production strongly influences the availability of food crop as well as the prices at which these crops are sold

In Kenya the major cereal crops grown through subsistence are maize, wheat and rice (FAO, 2004). Traditional crops like sorghum, finger millet, cassava, indigenous green leafy vegetables and some fruits also form part of the important subsistence crops in the rural areas. Small scale farmers form the largest sector in Agriculture.

Wartman et al (2006) identified five major sorghum producing areas in Kenya which were coast, Rift valley, Eastern-central, Western and Nyanza provinces. Sorghum production per year in these areas ranges between 3000ha in Coastal province to 50000 ha in Nyanza province



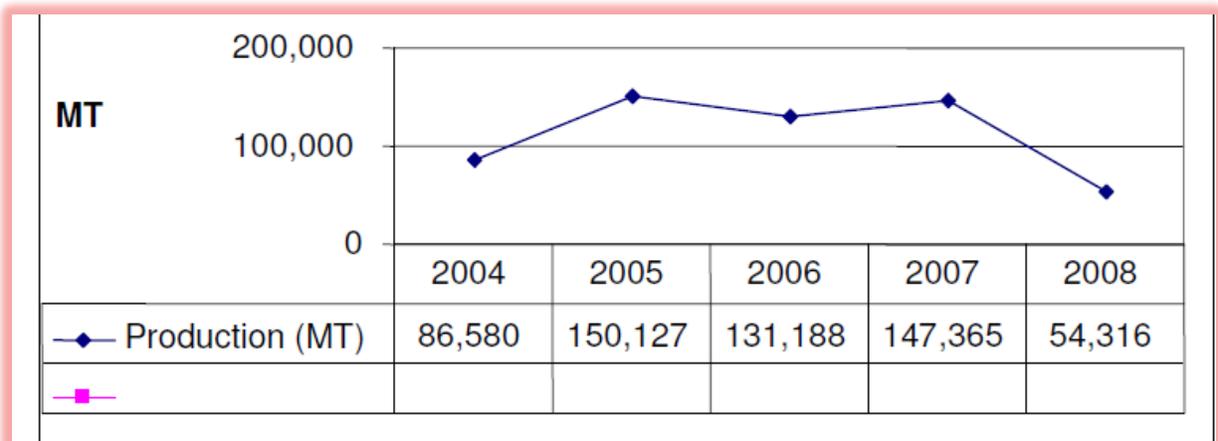
**Table 4: Estimated Production of Selected Agricultural Commodities, 2005 – 2010**

Crop	Unit	2005	2006	2007	2008	2009	2010*
Maize . . . . .	million bags	32.3	36.1	32.5	26.3	27.1	35.8
Beans . . . . .	"	4.3	5.9	3.5	2.9	5.2	4.3
Potatoes . . . . .	million tonnes	1.0	2.7	2.8	2.2	2.6	3.1
Sorghum . . . . .	million bags	1.7	1.6	1.8	0.6	1.1	1.8
Millet . . . . .	"	0.6	0.8	0.9	0.4	0.6	0.6

Source: MoA 2010

The table 4 above also shows how the production of sorghum has not been consistent over the covered years. The reduction of yields is an indicator of the influence of the factors of production and other factors surrounding sorghum production.

**Figure 4: Shows a graph of sorghum production between 2004-2008**



Source: MoA,2009

Figure 4 shows sorghum production trends between 2004-2008

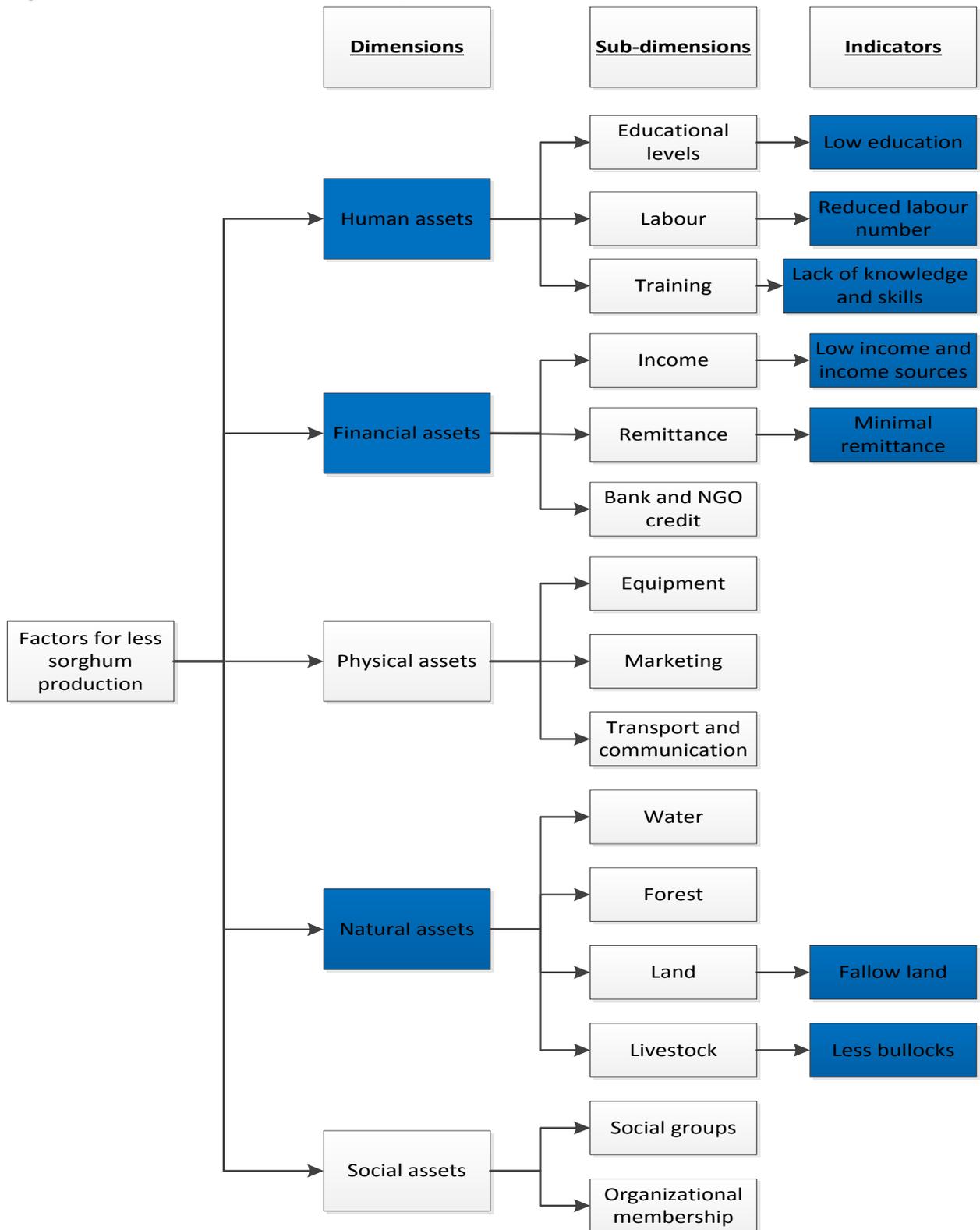
## **2.8. Factors for low sorghum production in Kenya**

According to ASARECA (2000) sorghum farming low productivity has been due to the following constraints: traditional modes of production; low levels of technology adoption; biophysical or environmental constraints, such as droughts and other natural disasters; institutional bottlenecks, such as research capacity and facilities; policy impediments, such as seed trade policies; marketing hardships, such as poor infrastructure; and information barriers. Over the years, Kenya has experienced diminishing rainfall amounts probably due to the effects of the global climate change. This has led to decreased sorghum production making her a food deficit country with most areas receiving relief food supplies in many of the years (Ogeto et al 2012). Ogeto continues to state that availability of seed is also important as it influences sorghum production. Availability also influences the time of planting and the acreage under production and therefore yield. Most farmers have no adequate access to seeds in good time for planting and this could be a major contributor to the low participation in sorghum production in the area. The access to seeds also depends on the economic strength in order to purchase the seeds when they are available. Most of the hybrid seeds are always expensive that small scale farmers can't afford.

Farmers' Organizations (FOs) are essential institutions for the empowerment, poverty alleviation and advancement of farmers and the rural poor. Individual small farmers are weak players in the market but by organizing into larger groups they can increase their bargaining power. According to Kherallah and Kirsten (2001), collective action is important in agricultural production and marketing because it contributes towards reduced transaction costs and it strengthens farmers' production and bargaining power. The agriculture sector in Nyanza is exposed to the effect of failed rains or occurrence of successive dry spells during the growing season, which usually leads to food shortage. Moreover, drastic climate changes also render large regions of marginal agricultural lands unproductive (ILRI, 2010). According to Kibet (2011) the western Kenya small scale farmers are facing a myriad of challenges in their effort to increase sorghum productivity. These include: Climate change, lack of extension services, high costs of inputs such as seed, pesticides, fertilizer, drugs and vaccines is high for resource-poor farmers, pests and diseases, use of outdated technologies, lack of market information, poor infrastructure among others.

Muhia (2009) gives an experience of the challenges facing sorghum farmers in Eastern Kenya. The kind of labour utilized in these farms is manual whereby you'll find the whole family working in their farms. The changing economic situations has forced the households to take their children to school leaving only the heads of the household to work on the farm at the same time look for casual jobs to earn income. Children are only capable of helping in the farms during the weekends and this is only in one day as one day is spared for worship in most families. Other households would seek the help from neighbours and family relatives when there is demand for additional labour. Other factors include: lack of information due to limited resources, lack of crop rotation, minimal shifting cultivation resulting into exhaustion of soils, high cost of farm inputs, and lack of market for the surplus sorghum produced. This is due to lack of infrastructure in many areas.

**Figure 5: Conceptual framework adopted from literature review**



Source: Modified by author from the DFID SLF framework,2000

The framework (figure 5) is an illustration how the livelihood framework, a modification from the DFID Sustainable Livelihood Framework (2000) shows the assets owned or accessed by small scale farmers affects the sorghum productivity in East Kano. The availability and access to the assets increases the power and strength of a household when it comes to farming and ensuring their food security through food availability and access. From the literature review, this research will focus on three livelihood assets. These include: Human; financial and natural assets. This research acknowledges the importance of these three assets as critical factors that influences the productivity in the study area. The other factors are equally important but due to time constraints, this research would focus on only the human, financial and natural assets.

## **CHAPTER THREE: STRATEGY AND METHODOLOGY**

### **3.1. Study Area**

East Kano is one of the locations forming part of Nyando District. The location is having approximately 30000 people who are mostly small scale farmers. The farmers in this location do practice subsistence agriculture. Some of the crop planted include: maize, sorghum, beans, cassava, millet, sweet potatoes and vegetables. They also keep cattle, goats, sheep, donkeys and poultry. The location is divided into 20 small villages. The soil textures ranges from loamy to clay with the landscape dominated by farming, grazing land, trees and small patches of grassland. The use of traditional methods of farming like the use of bullocks, traditionally regarded seeds and the use of hoes for weeding and ploughing is very common in the location. Modern technologies such as the use of tractors, hybrid seeds, fertilizers are also used but by a smaller population of households.

### **3.2. Research design**

The research was based on qualitative approach with a little aspect on quantitative analysis. The study involved empirical data (case study using field work) and relevant literature from journals, PhD thesis and scientific books (desk study). The data was collected through a case study on East Kano location interviewing small scale household farmers and key informants. The research used desk study as a source of collecting information.

The case study was carried out through the use of a checklist (semi structured interviews), focus group discussions and observations while in the field. The researcher was in charge of all the interviews. These included planning all the logistical arrangements about meeting the interviewees, when to have the focus group discussions, what time to start for the day's activities and how to record the information collected. The interviews were done at the convenience of the interviewees having in mind that this at this time was harvesting time and most households were busy. The interviews took place at the home of the interviewee or even in his or her farm. The researcher acknowledges the importance of the interviewee being at ease during the interview.

The study picked on a sample size that was representative of the whole area. This being a case study, the researcher collected data from 30 respondents who are small scale farmers involved in sorghum cultivation. The farmers had to be sorghum farmers, as this would give more information about the topic of research. The researcher sampled 10 respondents from female headed households, 10 respondents from male headed households, 10 respondents where both male and female members of the household are present. This criterion enabled the researcher to get varied answers to the questions and hence give balanced informed results about the factors causing less sorghum production.

4 key informants were interviewed. These included: the village elder, the area chief, the district agricultural officer and an official from the Kenya Agricultural Research Institute (KARI). The key

informants were crucial in providing additional technical knowledge with regards to the topic of study.

Focus group discussions are a form of qualitative research in which an in-depth discussion on a specific topic of interest to the researcher by a group of people representative of a population (Cameroon, 2005). The people used in the group discussion were selected using a purposive sampling which focuses on the informants knowledge and experience on the issues to be discussed. The focus group interview on the groups meaning, views and experiences in relation to the research topic being investigated (FAO, 2004). The researcher conducted two focused group discussions with 5 members (one for men and one for women). The use of focus group discussions allowed the researcher to ask for more information which the members of the discussion can further discuss before a concrete answer is provided; individual perspectives during this discussion makes it an important method of data collection and it also allows generation of other information which the researcher may have not thought about or indicated in the checklist. These data collection methods were used to investigate the factors for low sorghum production at the household level. The type of respondents is based on who is involved in sorghum farming, gender balance, household heads and the use of random sampling in deciding which exact household will form part of the study. These criteria helped in giving a much more representation of the area of study.

### 3.3. Data Analysis

The results were analysed separately at the end with the main focus on how the availability of human, natural and financial assets influences low sorghum productivity in the study area. These were illustrated through figures and tables to ensure a comparison and a deeper understanding of the various factors.

### 3.4. Summary of respondents

Number of respondents	Category of respondents	Methods of collecting data
10	Female household	Individual interview and observation
10	Male households	Individual interview and observation
10	Mixed households(male & female)	Individual interview and observation
4	Key informants	Individual interview
2 groups of 5 people	Men and women	Group focus discussions

### **3.4. Limitations to the study**

The research was about finding out from farmers the factors that have led to low sorghum production at the household level. This study was conducted in a community where relationships between communities members are very strong, people come to visit at any time. Most of the time the interview would be interrupted because a neighbour has come to inquire about something or to ask for help. With a new face in the homestead, the neighbour would go ahead to know about the researcher. This led to lots of delays or the neighbour would also get interested in the topic of discussion, the good part at times. The research had to allow the interviewee to help the neighbour if possible first. At times the visitor would be part of the discussion as of some decided to sit and learn from the interview. Most of the farmers were not happy to openly disclose the sizes of their land especially if they realize the size under sorghum was small. This research had to explain the need to asses both the size owned and the size under production for good recommendations to KARI. Being a food security student, this research was so much inclined into issues food security to a larger extent. This might have been a limitation to getting as much information as possible. Interestingly, in the process of giving my background as a student in the Netherlands, many farmers would ask for an explanation about agriculture in the country with some getting keen to know more about a country with a court where international leaders can be prosecuted. For example, the Kenyan case at the International Criminal Court in Den Hague where the president and the deputy president are charged with crime against human after the post-election violence in 2007/2008.

## CHAPTER FOUR: FINDINGS

This section presents the various issues as related to factors for low sorghum production in East Kano location.

### 4.1. Background information

East Kano is one of the locations forming part of Nyando District. The location is having approximately 30000 people who are mostly small scale farmers. The farmers in this location do practice subsistence agriculture. Some of the crop planted include: maize, sorghum, beans, cassava, millet, sweet potatoes and vegetables. They also keep cattle, goats, sheep, donkeys and poultry. The location is divided into 20 small villages. The soil textures ranges from loamy to clay with the landscape dominated by farming, grazing land, trees and small patches of grassland. The use of traditional methods of farming like the use of bullocks, traditionally regarded seeds and the use of hoes for weeding and ploughing is very common in the location. Modern technologies such as the use of tractors, hybrid seeds, fertilizers are also used but by a smaller population of households.

The preparation time and planting of sorghum starts as follows;

December(land preparation).....Early January(Planting).....Early  
February(Weeding).....May (harvesting)

### Kenya Agricultural Research Institute (KARI)

KARI was established in the year 1979 through the Science and technology Act( Cap 250). Under this act, KARI was given the roles:

1. carry out research in agriculture and veterinary sciences;
2. co-operate with other organizations and institutions of higher learning in training programmes in matters of relevant research;
3. liaise with other research bodies within and outside Kenya;
4. carrying out similar research and disseminate research findings; and
5. do all such things as appear to be necessary, desirable or expedient to carry out its functions.

Moreover, KARI was also given the responsibilities of disseminating research findings and catalyze adoption of suitable technologies; work together with other government bodies, the National Council of Science and Technology and relevant research committees in matters relating to agricultural priorities and research policies; and to work with the parent ministry through provision of research products and catalyze their use for enhanced agricultural productivity.

### **Vision**

KARI envisions a vibrant commercially-oriented and competitive agricultural sector, propelled by science, technology and innovation.

### **Mission**

To contribute to increased productivity, commercialization and competitiveness of the agricultural sector through generation and promotion of knowledge, information and technologies that respond to clients' demands and opportunities.

### **Core Values**

In KARI, decisions and actions are consistently based on a set of clear principles outlined here as the institutional core values:

- Integrated and holistic approach
- Impact, performance and service orientation
- Scientific excellence, creativity and flexibility
- Partnerships for collaborative advantage and synergies
- Effective knowledge and information management
- Respect for staff and client diversity
- Transparency, accountability and cost-effectiveness.

The research interviewed 34 respondents out of which 30 were farmers and 4 key informants and had 2 focus group discussions. The respondents had the following characteristics.

**Table 5: Total labour size for all households**

	Males	Females	Total
Male headed(10 household)	40 (29%)	20(28%)	60
Female headed(10 households)	47(34%)	30(44%)	77
Mixed(male & female(10 households)	50(37%)	19(28%)	69
Total 30	137(67%)	69(33%)	206

The research shows that men are the biggest source of labour at the households. The population of men is higher with households that are having both male and female head of the household present. The farmers indicated that the more the number of the household members the better for them when it comes to farming activities.

**A male farmer stated:**

**“I need the boys to help me in the farm. The girls are not as strong as the boys and that is why they mostly do family domestic chores”**

**Table 6: Education levels of the respondents by sex**

Education level	Male	Female	Total
Illiterate	6(32%)	3(27%)	9(100%)
Adult education	3(16%)	1(9%)	4(100%)
Primary level	5 (26%)	4(36%)	9(100%)
Secondary level	3(16%)	2(18%)	5(100%)
Tertiary level	2(10%)	1(9%)	3(100%)
Total	19(59%)	11(41%)	30(100%)

The table above shows that most of the farmers are not well educated with 74% of the male farmers having not gone past primary level. 72% of the female respondents have not gone past primary education. The adult education was introduced by the government for those old people who would like to learn but not much is offered at this level. Those who have gone past the secondary level do influence farming decisions in their household as compared to those who have low education level. It is noted that a farmer who is also professionally trained like a teacher got good harvest as compared to those farmers with low or no education at all(see table 10).

**Table 7: Average land ownership per household in acres**

Land size(acres)	0.1 till 5.0	5.1-10	10.1 and above	Total
Male headed	2 (50%)	4(33%)	4(29%)	10(100%)
Female headed	1(25%)	5(42%)	4(29%)	10(100%)
Mixed(male & female)	1(25%)	3(25%)	6(42%)	10(100%)
Total	4(100%)	12(100%)	14(100%)	30(100%)

The above table shows the amount of land owned by households. It is recognized that majority (87%) of the farmers still own larger pieces of land (5 acres and above). It is only 13% of the

farmers who own less than five acres of land. The pieces of land owned are used for various activities like farming and grazing. The availability of land should influence the area under a crop and the yield but this is not the case with the farmers in East Kano. Most of the land is not being used for farming. Farmers mentioned lack of finances as a reason for not exploiting their pieces of land. This is evident in seeing the sizes of land under sorghum as illustrated in the table below. From observation of the cattle in the field and the cattle sheds owned by the households, the number of cattle is not large enough to leave 83% of the land for grazing. The farmers own even fewer bullocks for farming as shown in table 14. Farmers also plant other crops such maize, beans and cassava. Increasing the size under sorghum production by reducing the land sizes under other crops may lead to additional food insecurity.

**Table 8: Area under sorghum**

	0.1-1.0	1.1 -2.0	2.1 and above	Total
Male headed	7 (70%)	3(30%)	0	10(100%)
Female headed	8(80%)	1(10%)	1(10%)	10(100%)
Mixed(male & female)	7(70%)	3(30%)	0	10(100%)
Total	22(73%)	7(23%)	1(4%)	30(100%)

The table above shows that a whole 73% of the farmers interviewed have at most 1 acre of their land under sorghum. This is very small despite the fact 87% of farmers still own land more than 5 acres. The area under sorghum shows how this crop has been influenced by some factors hence the reduced production. Other crops planted by the farmers are maize, vegetables cassava and beans.

**Table 9: Showing land usage in acres**

Land usage	Acres
Total land under sorghum(Acres)	37 (8%)
Maize, cassava &beans)(Acres)	40(9%)
Livestock and fallow	363(83%)
Total land owned by 30 respondents(Acres)	440(100%)

The table above shows that most of the land is fallow and also used for grazing. Observation from the field shows fewer cattle owned by the farmers. This means that most of the land is still

can be used for sorghum production without depriving the cattle of adequate grazing land. Most of the land is owned by men and they are the key decision makers when it comes to which crop should be planted. Even in the case of the female headed household, the husbands are either working somewhere far from home or have passed on, the female still do not have the powers as compared to the men. When the man passes on, the female farmer will be influenced by the brothers-in law who 'inherits' the woman or help her with farming activities.

**Table 10: Showing average household labour size and average yields**

Many of the farmers agree that most of the labour for the farm is from the family members. A larger family may use more of their members to work in the farm. Families with more than 4 members have higher yields but most of the time the parents are the full time workers on the farm because children go to schools. They only help once a week.

Average labour size per household	Number of respondents	Average area under sorghum (acres)	Average yields(Kgs)
4	7	1	71
8	16	1.3	115
9 and above	7	1.6	231
Total	30	3.9	132

**Table 11: Respondents with education levels above secondary**

Education levels	Number of respondents	Average yield(Kgs)
No education	10	79
Primary education	9	120
Secondary and above	11	204
Total average	30	134

The table above shows the average yields from the farmers with various education levels. The farmers whose education are above secondary levels have a higher yields as compared to those with education. The farmers who have gone past secondary levels have better farming

skills and those who are employed can afford to hire more people to work on their farm. Those who are employed earn salaries that helps them to access inputs.

**A female farmer:**

**“Apart from the reasons I have given, sorghum is good for a household food security. I like sorghum; it is good for our health too. People should plant more of sorghum. Tell my husband to allow us to plant more sorghum”**

**Table 12: Showing the sources of income per household**

Respondents N=30	Total per group	Sources of income		
		Agriculture	Small businesses	Others
Male	10	10(100%)	7(70%)	2(20%)
Female	10	10(100%)	8(80%)	1(10%)
Mixed (male & female)	10	10(100%)	9(90%)	1(10%)
Total	30	30(100%)	24(80%)	4(13%)

The table above shows the main sources of income for the East Kano small scale farmers. It reveals that apart from farming, the farmers also have other sources of income. The businesses (charcoal burning, rope weaving, basketry, operating a small shop in the house, motorcycle transport services) are done at the village level. The businesses and activities are also influenced by the low purchasing power of the whole community hence low profits. Most farmers have no consistent source of income. Most farmers rely on farming as their main source of livelihood while at the same time do these other small scale businesses to complement farming.

### **Food security of households**

This research found out that most of the farmers rely on maize and sorghum as their staple food crop. During this research, the farmers had harvested and the sorghum and maize were already in the houses and granaries. The assessment of the total harvest and family sizes does show food security of the households. The harvest from maize was a little higher (averagely 150kgs per household) as compared to sorghum (averagely 134Kgs per household). The household sizes and the amount of harvest in the house does not last the families more than four months. The sources of income at the household level also cannot enable the households to adequately access food from the markets for the remaining eight months. Every household has to struggle to meet the food demand after the harvest in finished. The rainfall patterns in the area only

allows the farmers to plant in one season per year. The remaining part of the year, farmers wait by doing other off farm activities while others start preparing their farms for the next season.

#### 4.2 Factors for low sorghum production

**Table 13: A summary of the factors for low sorghum production per household**

**Arrange the table in the order of human, financial and natural assets**

Respondents	Factors for low sorghum production								
	Human assets		Financial assets		Natural assets		Others		
	Low education levels and training	Reduced labour	Lack of inputs (bullocks, seeds, plough)	Low income	Land availability and ownership preference	Fewer bullocks	Culture	Birds and theft	Maize preference, sorghum subsistence and poor planning
Male headed	6(60%)	10(100%)	7(70%)		8(80%)	9(90%)	0	10(100%)	5(50%)
Female headed	8(80%)	10(90%)	9(90%)		5(50%)	8(80%)	10(100%)	10(100%)	6(60%)
Mixed(male and female)	8(80%)	9(90%)	10(100%)		6(60%)	9(90%)	5(50%)	10(100%)	6(60%)

##### 4.2.1. Labour, education and training

Most farmers rely on family labour to work on their farms. With the changing socio-economic demands, 26 households have taken their children to schools, colleges and universities leaving less man power at the household level, mainly the parents (2) as full time workers on the farm. This has affected the labour size needed to produce more yields in sorghum and maize that are mostly produced in the study area. Most of the time the heads of the household are left to work in farms alone or with less number of family members resulting in low production. This is not enough for the household food security. The children are only capable of giving a hand during the weekend and particularly once a week. The lack of adequate labour for the household has influenced the size of land being tilled hence the reduced sorghum production. Averagely the families with bigger household numbers have higher yields as compared to those household

with less number of people (see table 10). All family members are supposed to help in the farm including the young ones. It was also worth noting that those families with many members in the household working on the farm also had bigger pieces of land for sorghum (see table 10).

The children who have gotten education also do not consider farming as a source of income. Most of the educated men and women have migrated to the cities to look for jobs. This has left the old people in the area to work in the farms. Farmers who have higher education have better farming practices as compared to those whose education levels are low(see table of education levels (see table 11). The use of technology such as a tractor was only found with a farmer who is also a teacher. This he explains as money from the teaching job. Most of the farmers have never been visited by the extension officer in the location. The farmers entirely depend on their indigenous knowledge in producing sorghum. KARI has not worked with the farmers in this area. Farmers indicate that there are better farming practices that they can benefit from through training. These include the use of tractors, hybrid sorghum seeds, fertilizers, land preparation and planting time. The farmers have never had any training regarding sorghum production.

**Gone, the village elder stated:**

**“The mentality of white collar jobs by the youth is killing sorghum farming and agriculture as a whole. Those who are still in the village just eat a lot and work less”**

**A female farmer said:**

**“Education is good but it can also hinder agriculture. All children have gone to schools and colleges, who helps in the farms? I am left to work alone in the farms”**

#### **4.2.2. Lack of finances**

Most of the farmers showed that lack of farming inputs being a major cause for low sorghum production. These inputs included: bullocks, seeds, plough and even the labour for the weeding. Majority of the farmers only cultivate the size of land that they can easily manage as far as the inputs requirement is concerned. Most farmers have one or two bullocks instead of the required four to pull a plough. This is mentioned by over 50% of farmers. This has led to the sharing of resources causing delay in sorghum farming.83% report delay in planting due to sharing of bullocks. KARI recommendation states that good sorghum production requires pesticides, fertilizers, seeds and in time farm preparation. Most of these inputs need to be bought but farmers cannot afford such inputs hence most of the time rely on their local inputs. For example, seeds stored from the previous harvest, bullocks and plough with which some cannot afford still.

Most farming practices uses four bullocks. Majority of the farmers had up to 3 bullocks. This is because they lack the money to buy the required number. This forces the farmers to share with other in order to plough the clay and loamy soils in the area(see table 14 below).

**Table 14: Showing average number bullocks owned per household**

Respondents N=30	Number of bullocks			
	1	2	3	4
Male headed	4(40%)	2(20%)	1(10%)	3(30%)
Female headed	5(50%)	1(10%)	1(10%)	3(30%)
Mixed(male and female)	6(60%)	0(0%)	2(20%)	2(20%)
Total	15(50%)	3(10%)	4(13%)	8(27%)

**Picture 1: Part of the farm that the farmer could not cultivate due to lack of money**



#### **4.2.3. Land and land ownership restrictions**

Majority of the respondents own more than 5 acres of land per household. Land ownership is still bestowed with the males. Most of the houses have men as the sole owner of property thereby putting them at the top of decision making in the household. Land is inherited by men from their parents. The point of land being passed to the sons is the duty of the father. Young

men and women who may want to own a piece of land at a younger age to plant sorghum are viewed with suspicion. The father does not accept such ownership thinking that the son wants to possess land at a tender age. This has made most young people to rely on their fathers to decide what need to be planted and which pieces of land needs to be cultivated. Women also find themselves in the same precarious position. They can only use the land with the permission from the man and what crop needs to be planted. Even the female headed households still do not exploit the lands with freedom. When the husband is way, he can still influence what needs to be planted. This variation brings a power difference in the households. Men prefer maize to sorghum while many women prefer sorghum because of the food security and other health benefits. Women say that maize consumption rate is higher than that of sorghum.

#### **4.2.4. Birds and theft**

The biggest threat to farmers for not adopting the hybrid seeds from the government and KARI is the fact that the hybrid is liked by birds because it has a sweet sap and its endosperm is thin for easy breakage by the birds. 7 households reported having used the sorghum hybrid once then stopped. The seeds were given to farmers by the chief of the area. This is very common when the farmers do not plant all in one season. When one or two farmers plant sorghum then the threats from the birds in higher. The local seeds are eaten by the birds but not to the levels of the hybrid variety. This has really discouraged farmers when it comes to the use of hybrid sorghum seeds leading to low sorghum production. Some farmers say that this can only be solved if all farmers have inputs and prepare land and plant at the same time. Theft of the crop from the field was also mentioned by farmers as a major cause as to why most farmers are producing less and less of the sorghum crop. Due to lack of farming inputs, some farmers have stopped farming and they do not have enough income to sustain their families throughout the season. They end up stealing from their neighbouring farmers who cultivated. The chief of the area and the district agricultural officer mentions these factors as critical factors that need to be addressed. The chief mentions having held meetings with the various clan elders about the crops (sorghum, maize, cassava thieves but it is still difficult to fully eradicate.

#### **4.2.5. Maize preference, Sorghum subsistence nature and planning**

Most of the farmers have over the years cultivated sorghum for household consumption only. The farmers agree that they plant sorghum to complement other crops like maize and cassava. Farmers noted that if sorghum was to be produced with markets available for it either for commercial use of international markets then the farmers would put more effort to it. Sorghum is not a cash crop. Many farmers prefer crops that can easily be sold. This is why most farmers prefer maize to sorghum. Planning about when to prepare the farm, when to plant and when to weed are challenges farmers are still struggling with. This is widely pegged on the availability of inputs for farming. Most farmers will delay in land preparation and planting due to either sharing of bullocks and plough or lacking the finances to facilitate the whole process.

Apart from the other factors, the planning in terms of when to prepare the farms and plant is also mentioned as key to sorghum production. Most farmers do not prepare their farms early enough in order to plant in time. Most of the farmers indicated that late planting of sorghum also

influences the yields. This is farming inputs linked. The meeting during the focus group discussion confirms the issues raised by the farmers interviewed regarding what could be the cause for low sorghum production.

**Picture 2: A farmer's harvest in his granary**



The chief of the area describes sorghum as an orphan crop together with green grams, beans and cowpeas. The idea here is that sorghum and the other crops have been ignored and most people prefer on maize.

#### **4.2.6. Extension services**

In this study area, there are inadequate extension services for the big population of the farmers. The chief of the area mentioned that the whole location (30000 people) has only one extension officer. He adds that farmers still believe in the traditional crop practices that even the available extension officer has a difficult time convincing the farmers to adopt new technologies such as use of hybrid sorghum seeds. KARI staff members agree that farmers have many challenges adopting new ideas on farming. This is an experience from working with farmers who have relied on their traditional farming methods over a long period of time.

## CHAPTER FIVE: DISCUSSION

This chapter discusses the major findings of the current study and focuses on the financial assets, natural assets and human assets as factors for low sorghum production.

### 5.1 Human Assets

Kenya has always placed education as a priority at all levels, promoting it as a key indicator for social and economic development. Indeed, investing in education is a critical part of Vision 2030 (GoK 2007). In agriculture, the level of education is closely related to technology adoption. This can increase agricultural production, incomes and improved livelihoods (Olwande et al 2009, Uaiene et al 2009).

Out of the 30 farmers interviewed, 25 farmers have an education level not more than primary levels with only 5 having gone past secondary level. The low level of education of the farmers has contributed to low production as mentioned by the Chief of the area. The chief states that most of the farmers are reluctant in adopting the new breed of sorghum which they don't understand how it works. Due to their low education levels, they prefer the traditional sorghum seeds as compared to hybrid sorghum seeds. The education level also causes poor planning when it comes to planting especially with the noted changing rainfall patterns. Those who have acquired education have also ignored sorghum farming terming it a blue collar job. Most of those who have gone past the colleges have all moved to towns to look for white collar jobs leaving only the weak and old farmers in the villages.

The data collected indicate that the families with some members who have had higher education and are in the village are the ones with higher yields from sorghum farming. Training on sorghum was at its minimal. The whole location has one extension worker against a population of approximately 30,000 people. Farmers still depend entirely on their indigenous knowledge on sorghum farming. The use of local seeds, use of oxen and plough are still a common seen in East Kano. Most of the farmers are saying that lack of training on the best equipment to use could have caused the reducing sorghum yield over time.

This research concurs with the findings of ASARECA (2000) saying that sorghum farming low productivity has been due: traditional modes of production; low levels of technology adoption; biophysical or environmental constraints, such as droughts and other natural disasters; institutional bottlenecks, such as research capacity and facilities; policy impediments, such as seed trade policies; marketing hardships, such as poor infrastructure; and information barriers. The small scale farmers are facing a number of challenges. This research was specifically looking at those factors linked to human, financial and natural assets. The other factors mentioned by ASARECA have to be confirmed through research.

Labour required for the farm is entirely family dependent. Most of the farmers use family labour on their sorghum farms. The challenge noted by farmers is the need to take the children to school at the same time they are needed to help in the farms. Most of the time the two heads of

the household are left to work in farms alone. This is not enough. The children are only capable of giving a hand during the weekend and particularly once. The lack of adequate labour for the household has influenced the size of land being tilled hence the reduced sorghum production. Averagely the families with a bigger household numbers have higher yields as compared to those household with less number of people. All family members are supposed to help in the farm including the young ones. It was also worth noting that those families with many members in the household also had bigger pieces of land for sorghum. The management of the crop is tedious as compared to maize for example. The post-harvest handling has discouraged many from producing more of the crop.

According to Dryland Seeds Limited (2011), an average yield per acre piece of land in Kenya is 10-15(90 Kgs bag).This is mostly with hybrid sorghum seeds. Farmers in East Kano still rely on traditional seeds especially those stored from the previous year's harvest. The low yield in sorghum here is attributed to the many factors that the farmers outlined during the research. Improvements in production, availability, storage, utilization and consumption of this crop will greatly contribute to the household food security and nutrition of the inhabitants of these areas (FAO, 1995).

## **5.2 Financial assets**

Sorghum production can be increased, farmers' incomes raised, more people fed and in deed, the general economic welfare enhanced. The SRA (2004-2014) recognises this and that to improve smallholder farm productivity as well as increase incomes; smallholder farming must be changed from producing for subsistence to commercial profitable businesses. It will then attract private entrepreneurs willing to invest therein and employ modern farming techniques necessary to achieve increased productivity. When agriculture is technology-led, not only is food security achievable but also poverty alleviation is also possible. Inability to afford new and readily available farming technology, however, is partly blamed on poor access to financial resources, especially in a nation where the majority, and not only farmers, are poor and the financial markets have not developed to support agricultural investment (Alila and Otieno, 2006).As recorded by Alila and Otieno, most of the farmers would really want to increase the sorghum production. The biggest constraint faced by farmers from this study is lack of finance. Farmers need the money to buy the inputs that they can use or even expand to the use of modern technologies like the use of tractors and hybrid sorghum seeds. The bid to move from subsistence farming to more production will both increase the food at the household at the same time avail extra for commercial purposes.

According to Alila and Otieno (2006) indicates that there are still opportunities for increasing the farmers income through increased production. This in turn make more people have food access leading to improved welfare of the community. This can only be achieved if the small scale farmers have a shift from subsistence farming to more commercial large scale farming. The large scale farming has the possibility of attracting investors who will provide more inputs and new technologies for farmers. With the adoption of technology, mass production will not only reduce food insecurity but also help in alleviating poverty. Reasons for farmers not being able to

access farming technologies are blamed of poor access to finances especially in Kenya where the financial markets have not developed to support small scale farmers.

(Rohrbach, 2004) adds that most of the sorghum produced in the developing countries is consumed majorly at the household level. The research shows that this is still being practiced by most of the households due to lack of producing enough for sales. Increasing the production can lead to additional sources of income to the house hold as they will be selling the surplus. It is true what Kibet (2011) says about factors for low sorghum production in western Kenya: small scale farmers are facing a myriad of challenges in their effort to increase sorghum productivity. These include: Climate change, lack of extension services, high costs of inputs such as seed, pesticides, fertilizer, drugs and vaccines is high for resource-poor farmers, pests and diseases, use of outdated technologies, lack of market information, poor infrastructure among others.

### **5.3 Natural Assets**

#### **Bishop Odongo:**

**“Land has never been a problem. There is enough land to produce more than enough”**

The findings from the field confirm the statement above. Most of the farmers say that they have enough pieces of land to expand their production. The question is why don't they cultivate all their land with crops? The farmers were eager to say all that they need to increase the production. A survey done shows that Nyando district only produces food that can last the people only seven months, the rest of the days all households rely on the market in order to access food. Land as a natural asset is key to production. The people of East Kano have it. The size of the land owned does not indicate higher sorghum production. For example respondent number 30 has 35 acres of land and only uses 2 acres for sorghum production despite a household number of 11 people. This is not enough for the family. The other crop cultivated is maize which he also cultivates in a 2 acre piece of land. Lack of adequate labour and capital are reasons mentioned by the farmers as a hindrance to cultivating more pieces of the land.

The number of bullocks owned by a farmer plays an important role in the size of land ploughed for sorghum. Most farmers have less than the four bullocks needed. This means that they have to share with other farmers or hire. When they share then one farmer has to be preparing the land first. This causes delay in farm preparation for the other farmer.

Other factors mentioned include the fact that Most of the land is inherited form one generation to another. The culture of the male household being the one responsible for giving out land at a later age in his life was mentioned as a hindrance to production. Young people cannot start tilling a piece of land by themselves without the consent of the father. The father determines which pieces of land will be planted the next season. This has left the young men with little options of practicing farming by themselves not unless they rent a piece of land from the neighbours. This over time has created a lazy youth population who do not value farming. Young people are only entitled to land after it has been given officially to them by the fathers.

This idea is also linked to the migration of the youths to the cities to look for jobs leaving a population of old people who cannot produce more food.

Despite the availability of land, the area under sorghum is strangely small. Apart from the factors mentioned above, the farmers have additional reasons as to why they still produce less of sorghum. Sorghum is exposed to birds that if not looked after then the farmer can get zero harvest. Many farmers like it because of its ability to satisfy one however small piece it is. Another challenge with sorghum is the fact that it is not edible with vegetables. You have to buy fish or meat for one to enjoy sorghum food (Ugali) mentions a farmer.

The agriculture sector in Nyanza is exposed to the effect of failed rains or occurrence of successive dry spells during the growing season, which usually leads to food shortage. Moreover, drastic climate changes also render large regions of marginal agricultural lands unproductive (ILRI 2010). The farmers interviewed confirms that during the year the rains were too much then followed by drought. This actually led to reduced yields affecting both sorghum and maize farmers

## CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

### 6.1 Conclusion

According to Chambers & Jiggins (2001) agricultural research has often failed to achieve the impact required for many resource-poor farmers especially in Africa. There is a pressing need to look beyond the conventional research approach to find more effective and sustainable ways of making agricultural research more relevant for small-scale farmers. The Convergence of Sciences Project (Anon., 2001) advocates interactive science by which the research agenda is set and implemented through the systematic participation of all stakeholders. Interactive science suggests the need for an approach that will make research more useful for farmers in their own local context. To this end, this research appreciates the involvement of the local farmers in providing adequate information about the problems they face with farming. The conclusion and recommendation of this research should also involve not only the farmers who participated in the research but all in the various agricultural sectors in Kenya.

The objective of this research was to get information about the factors for low sorghum production in Nyanza province but with a special focus on East Kano Location, Nyando District. This case study narrowed down to look at the financial, natural and human assets owned by the farmers in the case study. The research considered the three assets as key to sorghum production but time was also a factor in narrowing down to the three areas only.

The main research question for this study was the factors for low sorghum production in East Kano location. This main question was answered through the following sub-questions: What size of land does the household own? Out of the 30 respondents interviewed, 87% own more than 5 acres of land. The research reveals that despite the big pieces of land the farmers have, they still can't afford food availability throughout the year. The harvests are dismal and can only take the families for at most four months, the rest of the time food is bought. Sorghum is recognized by many as a food security crop in the area. Land is one of the factors of production but it has to be blended with labour and capital. These farmers lack adequate labour and enough capital to inject in the farming of sorghum. What is the yields/unit area of sorghum? The average per unit acre of sorghum is 70kgs per household.

What are the uses of sorghum at household level? Most of the households interviewed use sorghum to make stiff porridge (Kuon), porridge; a mixture of sorghum with beans (Nyoyo). The stalk is used as cow fodder, fencing and building of temporary structures like bathrooms. What challenges do small scale farmers in sorghum farming face? The farmers interviewed gave a number of problems they are facing that has resulted into low sorghum production. The major factors mentioned were: lack of inputs (bullocks, seeds and plough), less knowledge and skills on good sorghum farming practices, less education and lack of training, reduced household labour size due to school and college going and working members, culture restriction on the women side, low income, birds and theft. What influences the choice of crop planted? The choices of the crop to be planted is dependent on so many factors, the availability of inputs is the main factor reported by most of the farmers.

What are the services offered by the government to sorghum farmers? Farmers in the area do not have any extension services from an extension worker except from the chief of the area. What other crops do the small scale farmers produce? Most of the small scale farmers still rely on traditional crops for their household consumption. These include: maize, millet, beans, vegetables and some fruits.

Other researchers indicated that the area can only harvest food that last them at most five months. Currently it is less than four months. The rest of the year, farmers are forced to buy food from the market. With the dwindling income, this is a big problem. The only way out is to bring on board other relevant stakeholders (Government and KARI) to work with the farmers and provide them with the necessary inputs to ensure maximum production once again in the area.

The answers to the sub questions above have provided enough information showing how a number of factors have led to low sorghum production. These factors are: lack of inputs (bullocks, seeds, plough), lack of adequate labour to work on the farms, low income especially from the small scale businesses. Other factors such as culture, land ownership restrictions, maize preference and changing rainfall patterns have also played a role not only to sorghum production but also to other crops planted within the study area.

This research came across gender roles and power relations. This is a factor that cannot be ignored if sorghum production has to be increased. Some female farmers strongly supported sorghum farming while the husbands did not. Since the man is the "head of the house" and also owns the land, the wife has less say when it comes to which crop to plant. Women are left with no or less choice even if they prefer the crop to others like maize and beans. This reason also applies to young boys who want to have a piece of land to plant a given crop. When this happens then the father is already suspicious that the boy wants to own the land since land is still inherited. This is not possible for the young boys and therefore most of the times are left to follow what the father decides as the crop to be planted as a family.

Farmers recognize the importance of taking their children to schools at the same time they blame it for their sorry food state. Most of the families depend largely on family labour. This no longer happens. In most of the households children are either in primary schools, colleges or at the university. When this takes place, it is the two heads of the household who are left with all the farming activities with the children only capable of helping during the weekend. This has largely weakened the labour force of most of the household. They are either forced to minimize the size of land under cultivation or decide who goes to school when and who goes to help in the household activities including going to the farm. Those who have gone to schools do not want to do farming terming it a blue collar job.

The changing climatic condition is not widely supported by farmers especially the old farmers. Most of the farmers support the fact that farming is all about getting the right inputs, good timing for planting. This is what the small scale farmers require to achieve food security at the household level through increased sorghum production.

## 6.2 Recommendations

Considering the fact that land is still available,

Considering the fact that farmers themselves know what factors cause low sorghum production,

Considering the fact that sorghum is still recognized as a food security crop,

Considering the fact that most of the farmers still grow sorghum at subsistence level,

Considering the fact that sorghum prices are getting higher each season (80shillings/2kgs for 2013),

Considering the fact that the young generation have gone to schools, colleges and universities,

Considering the fact that the location extension officer is available,

Recommend the following actions;

KARI working together with the local government should sensitize the small scale farmers for the need to increase the production of sorghum in order to ensure their food security. This should go together with sensitization on best sorghum practices starting with the seeds, land preparation, time for planting and weeding harvesting and post-harvest handling.

KARI should link up the farmers with micro-credit institutions who can be able to see the potential of these farmers utilizing their land to produce more food. The financial institutions will also help in training the farmers on how to expand their businesses, training on saving, financial associations and even accessing small loans. Household financial strength is key to food security (availability and accessibility)

KARI and the local government should help the farmers start a sorghum farmers' association. The association can help farmers in sharing knowledge and skills through meetings and workshops arranged and also access input giving cooperatives.

KARI should help farmers do large scale farming of sorghum as beer brewing companies are starting to use sorghum for the national beers. This can be done through sharing the outcome of this research with the brewing companies to that that farmers have land and only need other factors of production like capital. This will ensure increased production for both household food security and surplus for the company.

KARI should incorporate small scale farmers in the research work they do. The participation of small scale farmers is critical to adoption of the new technologies in sorghum farming. This can be done through workshops, field research including visit of other farmers who have adopted new technologies in sorghum production.



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## **ANNEXES**

### **ANNEX 1: Checklist for farmers**

#### **Household respondents**

1. Household size
2. Roles of household members

#### **HUMAN CAPITAL**

1. What is the educational status of household members?
2. What skills, capacity, knowledge and experience do different household members have (training, labour capacity, etc.)?
3. What are the sources for the household sources of labour?
4. What agricultural extension services do the small scale farmers access?

#### **NATURAL CAPITAL**

1. What land size do household members have?
2. What do they use the land for?
3. What are the terms of access (ownership, rental, share arrangements, open-access, leasing) to land?
4. Who owns the land? Men or women

#### **Sorghum production**

1. What size is sorghum allocated
2. What are the yields of sorghum per unit acre
3. Why do small scale farmers prefer maize to sorghum
4. What are sources for sorghum seeds

#### **FINANCIAL CAPITAL**

1. What are the earnings of the household from different sources (income-generating activities, remittances)?
2. What other sources of finance are available and how important are they (bank credit, NGO support, etc.)?

## **ANNEX 2: Checklist for focus group discussion**

### **Background information**

- Household size
- Land owned
- Household activities

### **Topic information**

1. Size of land for sorghum
2. Estimated yield
3. Months for sorghum availability
4. Commercial importance
5. Government or NGO services in sorghum production
6. Challenges in sorghum production
7. What improvements can be done
8. Other crops planted

## **ANNEX 3: Checklist for key informants (local leader, chief, District Agricultural Officer, KARI staff)**

1. How long has she/he worked in the area?
2. What are the main farming activities of the sorghum small scale farmers in the area?
3. What are the yields of sorghum in the area (statistics)?
4. The importance of sorghum to sorghum small scale farmers' households?
5. What support do small scale farmers get from the government or NGOs in the area?
6. What are the challenges experienced by sorghum small scale farmers?
7. What improvements can be done to ensure food security of sorghum small scale farmers?

**ANNEX 4: Picture gallery**



