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Maize Production and Its Implication on Food Security for Small Scale Farmers in Bukhayo West-Busia Kenya.

By

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DEDICATION

To my lovely daughter Sharon and dear mother Janet.

ACRONYMS AND ABBREVIATIONS

ABA Agro Biodiversity Association

CBO Community Based Organisation

CMD Cassava Mosaic Disease

KARI Kenya Agricultural Research Institute

KORDP Kenya Orphans Rural Development Programme

MOA Ministry of Agriculture

REFSO Rural Energy Food Supply Organization

WFP World Food Programme

RISE Regional Institute for Social Enterprise

FAO Food and Agriculture Organization

IFAD International Fund for Agricultural Development

IFPRI International Food Policy Research Institute

AATF African Agricultural Technology Foundation

DAP Diammonium Phospahate

OPVs Open Pollinated Varieties

Kgs Kilograms

Kshs Kenya shillings

1 Hectare = 2.47 Acres

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ABSTRACT

Agriculture is the mainstay of Kenya's economy accounting for approximately 25 percent of Kenya's Gross Domestic Product (GDP) and is the main source of livelihoods for about 85 percent of the population in rural areas. Maize is one of the commodities that form the core of Kenya's food and agricultural policy. The food security in the country is generally equated with availability of and access to adequate supplies of maize. However, the country normally experiences deficit which is filled by informal cross-border trade from Uganda and Tanzania.
In western Kenya, maize is an important crop grown by almost all households. The crop therefore plays a significant role in food security status of the farming households of Busia in western Kenya. The importance of maize crop and the decline in its production has therefore motivated small scale farmers of Bukhayo west in Busia to form a farmer organisation known as Agro-Biodiversity Association (ABA).The organisation which is a registered Community Based Organisation (CBO) aims to improve food security status of the small scale farmers of Bukhayo through engaging various stakeholders. In order to achieve its goals, the CBO commissioned a local non-governmental organisation, Regional Institute for Social Enterprise (RISE) to carry out a research in order to document the factors that affect maize production in Bukhayo west, Busia. The objective of the study was to assess the contribution of maize crop production in food security for the small scale farmers of Bukhayo west so as to identify interventions for improvement for food security. The study employed both qualitative and quantitative approach. Desk study was carried out to help in developing the tools used in the research. A survey was carried out with thirty randomly selected small scale farmers forming the respondents. Semi-structured questionnaires were administered to the respondents. Interviews with selected key informants were conducted as well as group discussions and observations. Data was analysed using Statistical Package for Social Sciences (SPSS). The study revealed that majority of the farming households cultivates maize as the main crop for subsistence and cash. Other crops of importance in the area include cassava, beans millet and sorghum. The small scale farmers practice intercropping system with legumes such as beans and groundnuts being the main intercrops for maize and or cassava. The yields of maize were found to be as low as less than a ton per hectare. This is caused by various socio-economic, technical and natural factors. Majority of the farming households use local rather than hybrid varieties of maize and end up with low yields. The farms are constraint by low soil fertility but the use of mineral fertilizers that can boost the soils is low among the farming households due to its cost. The situation is exuberated by pests and diseases such as stemborer, maize streak, weevils, termites and destruction by monkeys. Important is the striga weed which has threatened the food security of these farming households due to the fact that it competes with the host crop for nutrients and requires various methods for combating. Worse still is the low access to agricultural extension services which are only offered by the Ministry of agriculture in the area. Diseases such as malaria and HIV/AIDS are also important in household labour availability. Since farmers' own maize production cannot meet the household food needs, members of the farming households engage in non-farm activities to generate income. The income can be used in accessing food from markets and for other household needs. Due to the importance of the maize crop, interventions on provision of subsidised inputs are required to improve the yields. Empowering agricultural extension officers is necessary so that they can provide training in inputs use and methods of combating striga weed among other essential cropping systems. Research and promotion of diseases resistant, early maturing cultivars of indigenous crops such as cassava, millet, sorghum and sweet potatoes will enhance the food security. More also is the need to promote small animal rearing in the area and boosting the non-farm activities for increased income generation. These interventions will require Agro-Biodiversity Association to engage

various stakeholders since the organisation does not have the funds to undertake the interventions.

Keywords:
Small scale farmers, maize, production, socio-economic, technical, natural, households, Bukhayo west

CHAPTER ONE

1.0 INTRODUCTION

Agriculture is the mainstay of Kenya's economy. It accounts for approximately 25 percent of Kenya's Gross Domestic Product (GDP) and is the main source of livelihoods for about 85 percent of the population in rural areas (MoA, 2009). Therefore the sector plays a determinant role in almost all the dimensions of food security (IFAD report, 2009). The primary food crops produced in Kenya are beans, cassava, potatoes, maize, sorghum, millet and fruits. Maize is one of the seven commodities that form the core of Kenya's food and agricultural policy (Gitu, 2004).Over the years, the Kenya Government has strived to achieve national, household and individual food security. The production of maize, the most important staple food crop of the country has fallen short of demand while the total annual on-farm production of food crops has lagged behind consumption, resulting in food deficit, and thereby preventing the achievement of Kenya's aspiration of food security (KARI report, 2011).Self -sufficiency in maize was attained in the 1970's when production was high and the surplus was exported. Current trends show that the country is struggling to attain self-sufficiency in major staples mainly maize (AATF report, 2010). Nyoro and Muyanga (2007) attributes the low self-sufficiency to an array of causes including lack of productivity enhancing technologies, high incidence of pests and diseases, erratic climatic conditions and difficulties in accessing credit.

With agriculture playing a key role, continuous research to boost production has always been crucial with different approaches being used in generating technologies and knowledge to improve farmers' production, reduce poverty and improve food security. This study uses a bottom –up approach where a group of small scale farmers who have formed an association (Agro-Biodiversity Association(ABA)) have commissioned a research to be undertaken which will lead to documentation of the factors that affect their maize production. The study was carried out by an employee (project officer) of Regional Institute for Social Enterprise (RISE) and covered the area of Bukhayo west in Busia Kenya. The aim of the study is to assess how maize, the principal crop in Busia has contributed to food security of the farming households in Bukhayo through investigating the factors that affect its production. The study also examines other possible alternatives for the farming households for food security interventions.

The report is organised as follows: Chapter one gives the introduction of maize, the problem statement, objectives and research questions. Chapter two explains the literature searched and the tools used while chapter three is describing the methodology used in carrying out the research. Chapter four outlines the results obtained from the field work and the following chapter five is discussing the results while chapter six presents the conclusions and recommendations of the study.

1.1 Maize production in Kenya

Maize is a major food crop in Africa, especially in the eastern and southern regions of the continent. For many people, it is the main staple, as evidenced by annual consumption levels of 81 kg/per capita in the region and 103 kg/per capita in Kenya (De Groote, 2001).According to the Kenya Maize Development Program (KMDP) (2009) an average Kenyan consumes 98 kilograms of maize yearly yet the maize prices are among the highest in Sub-Sahara Africa. It is for this reason that in Kenya, food security is generally equated with availability of and access to adequate supplies of maize (East Africa grain council, 2008).Kenya normally has a deficit in maize, which is filled by informal cross-border trade from Uganda and Tanzania.

In the moist mid-altitude zone of western Kenya, maize is an important crop grown by almost all households in at least one cropping season per year. Hassan (1998) reported that about 42.6 % of the total maize area in Kenya fall in the moist mid-altitude zone. A recent government study, the Kenya Integrated Household Budget Survey, shows that in spite of the negative effects of economic liberalisation and privatisation in the 1990s, most Kenyan farmers still rely on maize so much that 90 % of them regularly invest in this crop.

1.2 Background of the study area

The study focuses on Busia district in Western province of Kenya and in particular Bukhayo west. The district is home to various communities with Iteso, Luhya and the Luo being predominant. The district has a population of 488,075 and a population density is 330 persons per square kilometre (KNBS, 2009) where 70% of this population live in the rural area. From Nairobi city, it is approximately 431 Km by road. It has two border crossing points into Uganda namely Busia town and Malaba. Due to the proximity of Busia to both Kenyan and Ugandan capital cities (Nairobi and Kampala respectively); it has become a major trading ground for both countries.
The district is further divided into six divisions ; Busia Township, Budalangi, Nambale, Butula, Funyula and Matayos .It covers an area of 1,261.3 square kilometres, 137 square kilometres of the area is under permanent water surface - Lake Victoria. The mean annual rainfall for Busia is 800mm with some areas receiving between 1,270mm and 1,790mm (FAO, 2007). Agricultural production is the lifeline for the district's economy where the sub-sector contributes 36% of the household economy. Crop production is dominated by cultivation of maize, cassava, sorghum and sweet potatoes. According to the KNBS (2010) report on Kenya poverty maps, about two-thirds of the population are unable to meet their basic requirements. The area experiences two rain seasons, long rain in march/April and short rains in August/ September. The long rains are considered as the most important by the farmers. Though maize is grown in both seasons, the long rains are more considered as reliable for maize production. There are various local organisations working in the area of Busia, important among them is the Agro-Biodiversity Association (ABA).

Agro-Biodiversity Association (ABA) is a Community Based Organisation (CBO) registered with the Ministry of Gender, Sports, Culture and Social Services, Kenya. The organisation was formed by small scale farmers who understand their own community structure. The founders were motivated by the increasing absolute and relative poverty in the area of Busia, the degradation of natural resources such as soil as well as the issues of crop and human diseases which have affected the food security status of the farming households. Its key role is to articulate issues specifically affecting farmers and as well seek interventions on other livelihood strategies possible for the farming community in Bukhayo and Busia at large. ABA envisions an association of empowered small scale farmers who are able to make informed decisions for improved and sustainable livelihoods and food secure. To achieve this, the organisation seeks to engage various stakeholders for service provision, capacity building, lobbying and advocacy of farmers' interests in Busia. ABA has so far sought collaboration with Regional Institute for Social Enterprise (RISE), a local NGO that supports communities in areas of food security. RISE is involved in supporting income generating activities that help in improving households' food accessibility. Various members of CBOs have benefited from microcredit loans offered by RISE and boosted their small enterprises. ABA has also sought collaboration with Masinde Muliro University of Science and Technology (MMUST) and KARI-Kakamega research

institution. ABA is involved activities that address food security, environmental conservation and business development services. In order to have a base for engaging stakeholders in addressing the issues of food security, the association seeks to establish a baseline study and document the factors that are affecting maize production (the main staple food in the area) for the small scale farmers of Bukhayo west. This will help in seeking sustainable interventions to improve productivity and look for other possible alternatives for subsistence and income generation.

Figure 1: Map of Kenya highlighting the location of Busia
Source: Maps of the world.com

1.3 Definition of terms

Small scale farmers
Smallholder or small scale farmers is used more generally to describe rural producers, predominantly in developing countries, who farm using mainly family labour and for whom the farm provides the principal source of income Morton (2007).This category of farmers is not easy to define though, because they exhibit non homogenous characteristics, they produce both for subsistence and commodity, Normally majority practice mixed farming where they keep livestock and poultry beside crops and can either rely on rain-fed or irrigation. Small scale farmers normally have small portions of land averaging 1-10hectares.
For the purpose of this study, small scale farmers will refer to those farmers in Bukhayo west who derive their livelihood from crop production mainly maize and other crops such as millet, cassava and legumes. They may or may not have livestock and have access to land size of up to 5.0 hectares.

Factors: These are circumstances, elements, components or influences that contribute to a result or outcome. In the study the term factors is used to components and circumstances that have produced the results of low maize yields in Bukhayo west location. These circumstances may be technical, social-economic or natural.

Socio-economic factors: These are used in the text in reference to the effects of population increase, access to land, and other inputs such as seeds and fertilizers, labour and diseases affecting labour.

Natural factors: These are physical and biological factors that have effect on production. They include climate, pests and diseases, species, soils and water. In this study the term natural factors has been used mainly to refer to pests and diseases on maize production.

Technical factors: These are technologies applied by the small scale farmers in maize production. They include the cropping systems, how the small scale farmers improve their land soil fertility and knowledge impacted through extension services.

Household: This is defined as a domestic unit consisting of the members of a family who live together along with nonrelatives such as servants, the people living together in one house collectively or a social unit living together**.** For the purpose of the study, the word household will be used to refer to a domestic unit consisting of members of either nuclear or extended family and may include nonrelatives who are living in the unit and may share meals together.

1.4 Research Problem

Farming has been the main source of livelihood for the Bukhayo west community where initially the farmers concentrated with the cultivation of traditional crops (Cassava, Millet and Sorghum), and cotton as a cash crop. As a result of the collapse of cotton industry in the area and changes in lifestyle, the farmers changed to maize as the principal crop to serve as both cash and food crop. However the production of maize has been undergoing declines over the years (Odendo, Groote and Odongo 2001) and food production cannot meet the population demand (FAO report, 2007). Keeley (2008) reports that though majority of the population (55%) are farmers, they still suffer from food shortage and are unable to feed themselves satisfactorily. Early 2011,a group of small scale farmers in Bukhayo west location formed an association, Agro-Biodiversity Association (ABA) to seek help from professionals and research organizations through participatory approaches. The association which is a means of interaction with professionals and research organizations require to establish baseline information on the factors affecting food production in the area. The information will be useful in engaging various stakeholders in looking for sustainable interventions in improving their food security. The association however has inadequate documented information on the factors affecting maize production in the area and the implications of these factors on food security for the community necessitating the need for this research.

1.5 The Research Rationale

Maize is one of the main staple crops in Kenya and Busia district as well. Understanding how it contributes to the food security of the small scale farmers in the area of Busia is therefore of great importance. This is because any clear and practical interventions and tangible implementation to improve the food security status of a population will not be possible without relevant and comprehensive information. It is for this reason that there is need to provide information on factors affecting maize production in the area of Bukhayo if meaningful interventions are required. More also in areas where maize productivity has been a success, the factors that affect its production had to be assed and interventions have been built around these factors. The findings of this study will therefore contribute to looking for clear and practical interventions through stimulating and directing public, local, private and donor interventions towards improving the food security in Bukhayo west.

1.6 Research Objective:

The main research objective of this study is to assess the contribution of maize crop production in food security for the small scale farmers of Bukhayo west so as to identify interventions for improvement for food security.

1.7 Research Questions

The following are the main and sub research questions for the study.

Main research questions:

1. What are the factors affecting maize production for the small scale farmers in Bukhayo West Location?
2. What other livelihood opportunities exist (that increase food security) and which interventions (e.g. by local organisations) are possible to improve food security for the small scale farmers of Bukhayo west?

Sub research questions (Question 1)

1. What are the cropping patterns practices and maize production levels for the small scale farmers?
2. What are effects of pests and diseases on maize production?
3. How have the human diseases affected household farm labour in maize production?
4. How do the small scale farmers source the inputs for maize production?

Sub research questions (Question 2)

1. What other livelihood activities do the small scale famers in Bukhayo west engage in?
2. What role do various local organisations and institutions play in enhancing the maize production of small scale farmers in Bukhayo west?

CHAPTER TWO: LITERATURE REVIEW

This chapter outlines the tools used in the study; theories about food security, maize production and other important crops , experiences and cases within the region, country and other countries that can be useful for interventions for the small scale farmers of Bukhayo west.

2.1 Food security and Maize production

Food security is a term used to describe whether people have access to sufficient quality and quantity of foods. The definition for food security has evolved for more than 50 years, Gross et.al (2000). The starting point was food availability to balance unequal food distribution regionally and nationally. The first concept contained "secure, adequate, and suitable supply of food for everyone" adopted in 1943.Gross further explains with the acknowledgment that food aid could be a barrier of development for self-sufficiency, in the 1960s, there was institutionalisation of food for development leading to creation of World Food Programme. In the 1980's the definition was broadened to in-cooperate both physical and economic access to food. According to FAO (2001), at the individual, household, national, regional, and global levels, food security is achieved when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for a healthy and active life. The components of food security as outlined in Parliamentary Office of Science and Technology report (2006) therefore include:

1. Availability : This is the amount of food that actually exists (local production and other sources);
2. Accessibility: This refers to people's physical, economic and social access to food (the capacity to produce/buy/acquire food), and the
3. Stability of access over time;
4. Utilisation the quality or nutritional adequacy of that food; and people's ability to utilise this food, including the patterns of control over who eats what and the physical ability to absorb nutrients

In Kenya like other developing countries, these components of food security both at national and individual level may be affected by factors such as poverty, health, food production, political stability, infrastructure, access to markets, and natural hazards. Agricultural production may lead to increase or decrease of food production affecting the people's physical access to food. As stated earlier Kenya's economy is agriculture based with food and horticultural production. Important crops include beans, cassava, potatoes, maize, sorghum, millet and fruits.

From the national policy level to the individual household level, maize security has come to be equated with food security. They are seen as one and the same. According to Economic and Social Research Council report on Environmental Change & Maize Innovation in Kenya (n.d), without maize, many Kenyans believe they do not have 'food'. It is from this reasoning that maize has found its way into multiple farming and livelihood systems, even in places where other crops might be more suitable. Thus, achieving food security is the incentive for many to allocate a disproportionately large part of their land to maize, leaving little area to other crops.

Maize is said to have been introduced in Kenya as early as 1496 by the Portuguese when they arrived at the coast of Kenya among other food crops that the Portuguese had discovered in Brazil. These included bananas, pineapple, chillies, peppers, and sweet potatoes (McCann, 1999).In1930s; there were investments by the colonial government and European settlers in the

maize research that radically transformed the production in Kenya. The British settlers regarded maize crop as suitable for mixed farming because it required less capital investment and technical skill than did cash crops (e.g., cotton and tobacco). As investments in maize research and development have grown, so too has the Country's dependence on the crop as its primary staple replacing millet and sorghum. Today, maize covers nearly 80% of the total cereal area of the country and the average Kenyan citizen consumes well over 90 kg/yr. of maize. According to McCann (1999) the introduction of hybrid maize in Kenya first began in 1955 (two years after the end of the Maumau emergency .The Kenya government officially released Kitale H611in 1964, just after Kenya gained independence. The success of the Kitale programme was followed by similar success in a later, parallel crop research program in *Katumane*. By the time the British left Kenya at her Independence in 1963, hybrid maize was the major source of calories, especially in Western Kenya having been promoted sometimes coercively. It was also the major food for urbanites, and government institutions, including boarding schools (Smale &Jayne, 2009).

Maize production as an aspect of food availability

Food availability is a function of both home production and imports. It involves own production, markets and donations. Producing own food requires inputs such as labour, land, seeds and fertilizers .Maize among other crops involves activities such as land preparation, planting weeding and harvesting. A variety of social-economic, technical and natural factors determine these activities (Ericksen, 2008). At household level the farming households are the key actors, others include the input and service providers, land owners and labourers. The inputs used in maize production and the above mentioned factors will therefor determine the availability of food not considering others aspects of distribution and exchange.

The conceptual frameworks

This study focuses on the food availability dimension of food security. Availability refers to sufficient quantities of food of appropriate quality, supplied through domestic production, purchase or donation. More specifically the study looks into the production aspect and narrows down to maize production in Bukhayo west location of Busia Kenya (Figure 2).
In order to understand the contribution of maize production in food security, the conceptual framework in figure 3 has been adopted where focus will be on the socio-economic, technical and natural factors that affect maize production as they are explained in the sub headings 2.3 of this report.

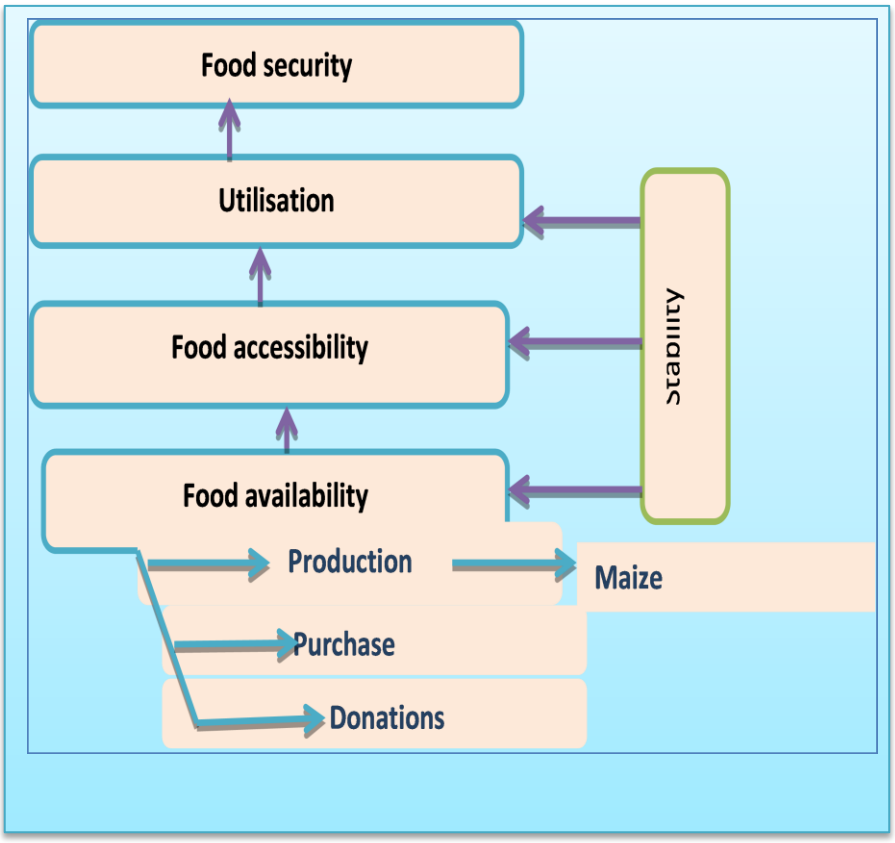

Figure 2: Food Security Conceptual framework
Source: R.G (2000).Nutrition &Food security

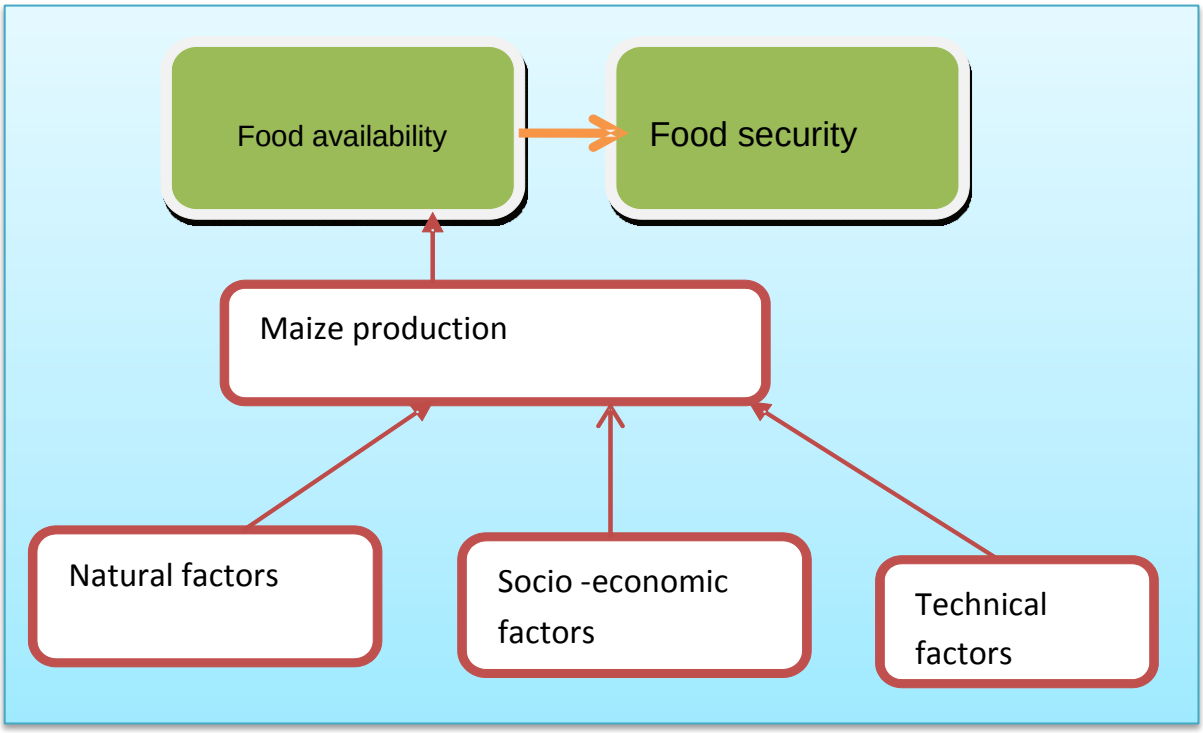

Figure 3: The conceptual framework for research
Source: Formulated by researcher

2.2 The farming systems and food security in Busia.

A system is defined as any set of elements or components that are interrelated and interact among themselves. A farming system is the result of complex interactions of a number of interdependent components (Hildebrand, 1986). At the centre of these interactions are the farming households. Farmers increase their food productivity by adopting various farming systems to improve their food security (IFPRI, 2010). Mixed farming dominates the farming system in most parts of western Kenya. In Busia, farmers keep livestock, mainly indigenous breeds of cattle (zebus), chicken, sheep and goats (MoA, 1999) but crop husbandry dominates the agricultural activities. The small scale farmers are mainly involved in intercropping various cereal, tubers and legumes such as maize, sorghum, cassava, sweet potato, arrow roots, banana, ground nuts, finger millet, beans, cow pea and green-grams. The crops serve for both subsistence and cash. In regard to food security and food production, small scale farmers have different prioritised objectives. They strive to achieve adequate food supply for their households through farming (food availability through own production), generate some cash for their domestic use and as well achieve prestige in the society (Achieng et.al, 1999). The cash enables them access other foods of preferences and thus self-sufficiency. Unlike commercial farmers, their priority objectives are arranged from consumption, stocking then selling. The farming systems of the small scale farmers is influenced by natural, technical and socio-economic factors .

2.3 Factors affecting maize production

The factors affecting maize production have been divided into three categories: the socio-economic, natural and technical. In this sub-section, each of them is discussed.

2.3.1 Socio-economic factors

Various socio-economic factors important in maize production are discussed here under:

Land size, ownership and access

Land is one of the important socio-economic factors in maize production. Land ownership is one of the main indicators of socio-economic status among the Kenyan communities (Landesa, 2010).According to the Kenya National Bureau of Statistics report on 2009 census in Kenya, the urban population in Busia is16.4%. Therefore over 80% of the population are based in the rural area where farming is the main activity and thus land size plays a big factor in their livelihoods. Among the Luhya community the sons inherit land from their fathers, on the other hand the women in this community only have access but not ownership to land. Decisions on how to use the land and the crops to grow may be affected by whether one owns the land. More also the size of land a small scale farmer has will determine how much is apportioned to what crop. Farmers with bigger land plots may practice shifting cultivation as a way of soil management or put more land to maize production. Research has shown that farmers put relatively more land and inputs for the maize crop production during the long rains According to Hassan (1998), the area under maize in Busia which lies in the moist mid altitude zone during the long rain season is 47% more than that of the short rain season.

Inputs for Maize

Inputs such as quality maize seeds, pesticides and fertilizers are a requirement for maize production. It is argued that Kenya has the highest cost of production in the region, compared to Uganda and Tanzania. While Kenya has a high rate of fertilizer usage, compared to what is common in the region, its output is not very much commensurate with the inputs. Subsidised and adequate inputs for small scale farmers have been observed to improve maize production. Research by Chibwana and Fisher (2010) on the impacts of agricultural input subsidies in Malawi has shown that farm input subsidy on maize (hybrid maize seeds and fertilizers) boosted maize production in the year 2008/2009. Denning et al.(2009) records that Malawi the production of maize in Malawi almost tripled from a deficit of 43% to 53% surplus within a period of two years (case study, Box 5). Other research (Smale, Byerlee &Jayne, 2011)has shown that adequate availability of inputs for farmers leads to high yields of maize where improved production enhances availability and thus improving the food security of the farming households. In Busia the small scale farmers use both local and hybrid varieties of maize. According to Odendo et al, (2002), local varieties for instance *Jowi Jamuomo*, (a charging buffalo) and *Ke-Buganda* varieties are widely grown in Busia District, since they are perceived to survive harsh environment, including *Striga*, low soil fertility and drought. The small scale farmers exhibit complex criterion of selecting their varieties .Among the criteria include high yield, early maturity and tolerance to Striga, low cost of seed, tolerance to diseases and ability of a variety to perform reasonably without application of fertilizers and resistance to insect pests. Mateete (2010) cites that small scale farmers rely upon locally collected rather than purchased farm inputs because their field practices are driven by subsistence rather than market-oriented agriculture. Sanginga, et al (2010) supports packaging of fertilizers in smaller packs, awareness and improved distribution as an enhancement for the small scale farming households to have access to fertilizers.

In Sauri village of Nyanza province where productivity was increased form 1ton per hectare to 5.0 tons/hectare, it is documented that the farming households were provided with hybrid seeds and mineral fertilizers (Nziguheba et al,2008).

Labour and diseases that affect human labour

Food production maize inclusive among the small scale farmers is heavily dependent on human labour mainly the family labour. Some farming households can afford animal draft power in ploughing however most of the land preparation, weeding and harvesting is done with human labour. Human labour is faced with several challenges as outlined under.

- **HIV/AIDS:** While food insecurity worsens the HIV/AIDS condition among the infected, the illness has direct impact on food security since it affects the household labour where either there is loss of labour as a result of illness, care giving or death. The scourge does not only affect the labour but also the household composition and income which may in turn affect accessibility to farm inputs and capitals as supported by Rugalema (2000).According to DFID report (2003) ,loss of labour due to illness or death may lead to households relocating labour such as removal of children especially girls from school, increased reliance on orphan labour; Shifting in composition of crops from labour intensive to less labour intensive; Late planting; Compromising critical land conservation and soil protection activities and abandonment of weed and pest control.

  HIV/AIDS has been rated as a major cause of mortality in Busia district. The National Aids Control Council (NACC) report of 2010 indicates that the prevalence rate in the Busia district is higher (7.4%) than the country's (6.3%) rate .This impacts negatively on farm labour reduced labour force in the farming households.

- **Malaria:** Over 100 million people are exposed to the malaria causing parasite each year in Africa and over 500 million are classified as at risk (Nyamongo, 1998). In addition to deaths, morbidity from malaria causes great economic harm. Cases of malaria in Busia are more experienced during the rainy seasons March and July when farm activities are more intense and labour is in high demand .Busia lies in the border of Kenya and Uganda thus any efforts to control malaria should be initiated from both countries otherwise effort on one side of the border may not be effective in combating malaria. When a productive member of the household contracts malaria, it may permit an otherwise slack labour-force within the household to be more efficient and this would reduce the income effect of malaria (Wang'ombe and Mwabu, 1998)
- **Rural to Urban migration:** Urbanization is defined as the process by which an increasing proportion of a country's population lives in urban areas over time. Kenya is one of the Sub-Sahara Africa whose urban population has been observed to increase significantly over the last 30 years. (Crush, Frayne and Grant 2006).Being at the border the residents of Bukhayo west may migrate to the cities in Kenya or Uganda. Some of the reasons that may necessitate cross border migration include search for employment, Business, Buy and sell goods or visit families. Crush explains that when urban migration deprives rural areas of labour and impacts negatively on production, then it is likely to increase the food insecurity of rural populations.

2.3.2 Natural factors

Pests & Diseases and Weed

Prevention of pest-induced food crop losses at pre- and post-harvest stages is an integral part of the Millennium Development Goal to ensure food security and poverty reduction (IFPRI, 2003).Documented literature indicates that pests and diseases may lead to losses of between 42-100% of the yield (IPMF, 2009).The main important pests and diseases in maize production include stemborer, Striga and maize streak. In western Kenya, termites have been identified to contribute to crop losses (Odendo et al, (2002).

The stem borer: As cited by DeGroote (2001) in Mulaa (1995), in Kenya, the most important species of stemborers are the spotted stemborer *Chilo partellus* (Swinhoe), which are mainly found in the warmer and lower areas, and *Busseola fusca,* found in the cooler and higher altitudes. The former is therefore attributed to causing damage on maize yields in the Western Kenya region. The stemborer causes initial damage by feeding on the leaf tissues, then the makes a tunnel and feeds from the stem and sometimes the maize cobs. According to Kfir, et al (2002), as cited by Khan, et al., (2007), Stemborer damage causes grain yield losses estimated at 10–80% of the potential grain output, depending on the pest population density and the phonological stage of the crop at infestation.

The Striga weed: The parasitic weed Striga causes devastating losses in cereal yields in sub-Saharan Africa. *Striga hermonthica* is the most socio-economically important weed in eastern Africa (Khan, et al., 2007). It is not clear when the weed became a problem in western Kenya but research has shown that the weed has been in existence since the early 1990s. The parasite lifecycle is intimately linked with its host via a complex interchange of signals (Scholes and Malcolm, 2008). *Striga* has been recognised as the greatest biological constraint to food production in Africa as nearly 100 million hectares of the African savannah are infested annually

with Striga. Maize millet and sorghum are the highly infested crops by the parasite. Scholes and Malcolm (2008) explains that it is important to understand the molecular basis of host resistance to *Striga* for the identification of genes for improving crop yield via biotechnological or marker assisted breeding strategies. According to a report from African Agricultural Technology Foundation, the weed is a parasite that sucks nutrients out of the crop and devastates maize, sorghum and other cereals. The situation is worsened by the fact that the weed has enormous reproductive ability. It has been observed to produce up to 200,000 seeds and also can stay in the soil for up to 20 years until they are stimulated to germinate. In a report appearing in one of the Kenyan local newspaper, The People Daily of May 13th 2009, the MOA reported that maize production for the farmers in western Kenya had declined to 0.7 tons/hectare due to the Striga weed infestation yet the region has potential of producing up to 5.2tons/hectare. The report further said that the country was losing about Kshs 5.5 billion as a result of the weed, a threat to the country's food security. The African Agricultural Technology Foundation (AATF) supports different technologies for eradicating Striga weed such as push-pull, use of striga resistant maize and suicide germination where ethylene gas from fruits is used on soils infested by weed (www.wssa.net.)

Table 1 below gives some of the main pests and diseases that have been reported by Blackie and Gibbon (2003) as affecting the main cereal crops maize included.

Table 1: Pests and diseases in cereal crops

Food crop	***Constraint***
Maize	*Striga hermonthica*, stemborers, phosphorus uptake
Sorghum	*S. hermonthica*, anthracnose, phosphorus uptake
Millet	*S. hermonthica*, head miner, downy mildew
Cassava	Root rots, green mite

Source: Blackie & Gibbon, 2003.

2.3.3. Technical factors

Soil Fertility: Degradation and declining productivity of agricultural soils causes serious threat to production of maize and other crops as cited in the Parliamentary Office Science and technology report (2006) on food security in developing countries. Until recently, farmers' wealth of knowledge about soil fertility was grossly underestimated by soil scientists (Brokensha et al.,1980;Richards,1985;Fairhead,1992), as cited by Nandwa and Bekunda in their article on Agriculture Ecosystems and Environment (1998) . The adoption of participatory technology development approaches and participatory rural appraisals have increasingly shown that farmers clearly perceive and articulate differences in the levels of fertility of their farms and farm plots. Nandwa and Bekunda (1998) supports that farmers are able to judge their farm soils and soil fertility empirically, through crop growth and yield trends. Other indicators that are commonly used include the appearance of plant species which thrive only under low soil fertility, differences and changes in soil colour, texture, ease of cultivation, and incidence of weeds such as *Striga hermonthica*. Most of Africa's ability to produce food is determined by access to inherently fertile soils. In a survey carried out by Crowley and Carter (2000), soil fertility was cited as the major reason for decline in crop yield for sorghum, millet, maize, vegetables, and

cassava in Vihiga district, western Kenya. In Maseno, Nyanza province of Kenya, foliage of tithonia, cultivated in hedges or contours was observed to increase soil nutrients for small scale farmers plots with maize crop in a study carried out on effects of senna and tithonia to soil fertility (Ayuke, et al. 2004)The study realised that senna can be incorporated into the soils much before sowing maize crop to synchronize nutrients release with the crop needs. This can help the farming households in this era where increased demand for land due to population pressure has made shifting cultivation that allowed for adequate restoration of fertility during the resting phase impossible. However Jama, et al. (2000) cautions that tithonia is labour intensive and only applicable to small plots of lands that are planted crops with high returns.

Intercropping: This is one of the main cropping systems practiced by small scale farmers. Mainly the farmers intercrop maize with beans. The small scale farmers normally practice intercropping for various reasons. Such include maximum utilisation of the available inputs especially the fertilizers and for weed control.

Extension services: The extension service is one such programme under the Ministry of Agriculture (MOA) that is charged with the responsibility of ensuring food production that is sufficient for domestic use and for export (Olubandwa, Kathuri and Wesonga, 2011). One of the objectives of the extension service is to transfer agricultural technology to the farmers that will increase their production. Cropping systems, use of fertilizers and quality seeds are advisory services for maize production that the extension service providers need to transfer to the farming households

2.4 Other important crops in Busia

Cassava: On a worldwide basis, cassava is ranked high among the top 10 most significant food crops produced in developing countries. It is one of the major staples of the communities in western Kenya and the coastal region. It provides 9 percent of the total calories in the diet of Kenyans where 60 percent of the country's production comes from the western region(Obiero,et al, 2007). FAO report (2006) indicates that cassava is the second important food security crop in western Kenya after maize. The crop can be consumed as a snack when it is raw, or cooked and taken as breakfast starch and also when dried, it is ground to flour and mixed with millet or sorghum flour to make a thick paste which is known as *ugali.* The leaves of cassava nutritious if well prepared making it one suitable crop for improving food security among the developing countries. According to Obiero, et al (2007) Cultivation and production of cassava crop in western region is constrained by biotic and abiotic factors. The most devastating abiotic factor in the recent years is cassava mosaic disease (CMD).

Millet and Sorghum: Millets and sorghum are extremely important in the African SAT (semi-arid tropics). They form part of the indigenous crops of western Kenya. According to Obilana (1998) these crops have good strategies for responding to the needs and welfare of the poor including food security, nutrition and health, poverty alleviation, potential markets and dry environment enhancement. One most significant importance of these indigenous crops is the low input requirements but they require more labour for keeping away the birds. They provide farmers with the best available opportunity for a relatively reliable harvest, food and nutrition in environments with erratic and scanty rainfall, and low soil fertility levels, (Obilana, 1998).

Beans: The *Phaseolus vulgaris L*. Known as the common bean is the most important legume grown in Kenya and also in western Kenya. The western province accounts for 22 percent of the

country’s total production (Katungi, et al, 2009).Farmers are known to choose the varieties depending on maturity, yield, labour intensity and suitability for intercropping with maize.

CHAPTER THREE: THE RESEARCH METHODOLOGY

This chapter gives a brief description of the study area and describes the procedures used in this research. In particular it explains the following; research design, sources of data, selection of respondents and key informants and how the data was analysed to arrive at the results. It also gives the limitations of research.

3.1. The Study area

The study was carried out in Bukhayo West location in Busia district, Western Kenya. The location is situated in Matayos division and it is seven kilometres to the Ugandan border. The location is divided into three sub locations; Mundika, Bugeng'i and Esikhulu and has a population of 36,988 and 6,188 households. Altitudes in the region vary from 1128 to 1500 metres above sea level. The district falls within the Lake Victoria Basin and receives a mean annual rainfall of 800 mm. Mean annual maximum temperatures range from 26° C to 37° C and mean annual minimum temperatures fall between 14° C and 22° C. Crop cultivation mainly maize, animal husbandry and non-commercial fishing are the main economic activities in the area.

3.2 Research design

The research employed both qualitative and quantitative approaches. A survey was undertaken because the researcher wanted to understand the overall situation of maize production in the area and also because this was a baseline study and in-depth studies are to follow. The survey drew respondents from the three sub-locations. One focus group discussion was carried out to acquaint myself with the expectations of the organisation (ABA), crop production in the area and the factors affecting crop production as a whole and maize in specific.
Desk research was carried out to obtain information on maize production and the factors that affect its production, success stories and interventions in other regions and countries. This was done to help in formulation of the research questions and look for possible alternatives that can be applicable to the small scale farmers of Bukhayo west. Study materials included reading books, journals, articles and reports mainly from the Government of Kenya, Food and Agriculture Organization (FAO) International Fund for Agricultural Development (IFAD) International Food Policy Research Institute (IFPRI).

3.3 Primary Data Collection

Permission was sought from the chief for Bukhayo west location where the letter of introduction from my University was presented. Through the help of the chief of the location i was able to access the area where the three sub-chiefs from the respective sub-locations were notified of my presence and the research i was carrying out. A list of households was issued by the chief that enabled me to randomly pick thirty (30) respondents with the help of the sub-chiefs. A semi structured questionnaire which had been pretested earlier was administered to each of the thirty respondents. The information obtained from the respondents was triangulated with responses from the interviews with the key informants who included the Chief of West Bukhayo location, The chief was selected because he is in contact with small scale farmers and he has records of the daily happenings of the location; Mr Lennox Barasa, the chairman of ABA, the rationale of

choosing the chairman is that he is one of the founding members of the organisation and is able to give information on why the organisation was formed and what it would like to change in terms of improving the food production of the small scale farmers' households of Bukhayo west. Other key informants included a representative of Kenya Orphans Rural Development Programme (KORDP) which was selected because of its involvement in the project of food distribution; REFSO, an organisation that has been working to provide the small scale farmers with the cassava and sweet potatoes seeds. Last but not least, to be interviewed was the director of One World Development Foundation, an organisation working in Busia with People Living With AIDS (PLWA) to improve their food security.

Focus group discussion

One focus group discussion was carried out with the small scale farmers who are members of the Agro Biodiversity Association to get an overview of the factors that affect crop production for the small scale farmers in the study location. The members were not part of thirty respondents .The information obtained from the focus group discussion assisted in triangulation of the individual interviews that were carried out in the location. All the findings are summarized in the next chapter. The discussion took place in one of the weekly meetings that ABA holds in their office in Mundika and lasted for a period of one and half hours. The members of ABA who attended the meeting included the committee members and ordinary members of the organisation however the information obtained was treated with researcher's awareness that it may not have been a representative opinion of all the members of the organisation since those that did not attend the meeting may have had different opinions.

Informal discussions and observations

Informal discussions were held in the homes of various families that invited me for meals. Being the first time to visit the study area, it was important to understand the farming households' way of life. Sharing meals with the farming households provided me with an opportunity to get more information on the farming systems of the farming households. During these meetings the family members discussed how lifestyle had changed in terms of food habits and their interactions with the neighbouring Busia-Uganda. The field study was conducted at a time when farmers were still harvesting their crops. There was green maize, groundnuts and indigenous vegetables in the farm fields. This means that most households had something to eat and share with visitors. Therefore though these informal meetings were not part of the data collection tool, they provided basis for triangulating other obtained information. Observations were made during formal and informal discussions as well as walking around the area during the days or hours when there were no interview activities in my schedule. Through observations i was able to see how the farms were infested with the striga weeds since the weed is very conspicuous (purple in colour), other crops in the fields other than maize, the animals, sources of drinking water, types of houses, the shopping centre and even socialisation among the community members.

3.4. Data analysis

The quantitative data that was collected from the respondents through the use of questionnaire was subjected to Statistical Packages for Social Scientists (SPSS). The questionnaires were numbered 1to 30 and the responses from each question coded. The SPSS output was used in getting the frequencies, tables and charts. This gave rise to information such as the household size, land size, age of the respondent, education level of the respondents crop pests and diseases, usage of crops cultivated, the factors considered during crop production and the number of small scale farmers involved in off-farm activities. Qualitative data is presented in descriptive form. This involves data on resources available for the farming households, the roles of local organisation in the area. Information from the key interviews is captured in boxes (See annex 3 of this report).

3.5 Limitations of the study

The study was carried out in an area that I was not familiar with. Though Swahili is spoken across the country, not all are able to speak Swahili. This necessitated for an interpreter when such respondents were being interviewed thus it was not possible to get full information. It was also difficult to obtain accurate information on the yields produced since the respondents may not put into account quantities that are either sold in bits or given to neighbours and friends. One of the key informants for the research, The District Agricultural officer(DAO) for Busia was not reachable for information and was contacted by phone which may not give adequate information as face to face interview.

CHAPTER FOUR: FINDINGS AND RESULTS

This chapter describes the findings of the study that were obtained from the analysed data. These findings are organized according to socio-economic, natural and technical factors that affect maize production in Bukhayo west, as well as opportunities to improve food security in the area. In addition, the chapter also describes the roles of various local organisations in maize production and food security and off farm activities the small scale farmers of Bukhayo west engage in to enhance their food security. Sample size= 30 respondents drawn from all the three sub-locations of Bukhayo west.

% total = total number of respondents from all clusters who gave that response* 100/30

(See annex 2 for the raw data)

4.1 Demographic Information

This covers the household size, age, gender and the level of education of the respondents in the study area. Secondary data from either same district or neighbouring district is also provided to help in checking if the results may be representative.

a). Sex of the respondent

A higher percentage of the small scale farmers involved in the study were male (table 2). This was so because the study was carried out during harvesting. Among Luhya community harvesting is an activity for the women thus more men were available than women.

Table 2: The sex of the respondents

Sex	Frequency	Percent
Male	17	56.7
Female	13	43.3
Total	**30**	**100.0**

Source: Field study 2011

b). Level of education

Education enables individuals to acquire information for example through reading and listening. In Kenya, apart from on- farm visits, information and knowledge on farming can be obtained through radios, televisions and pamphlets which are in English and Swahili. This means that farmers who are able to read and write may have access to more information. This study found out that only 40% of the respondents had attained O-Level education as illustrated in figure 4. This means the number of respondents who can read and write in the study area are few and this may have effects on decision making in the crop production. Education is also important when one is considering possible interventions.

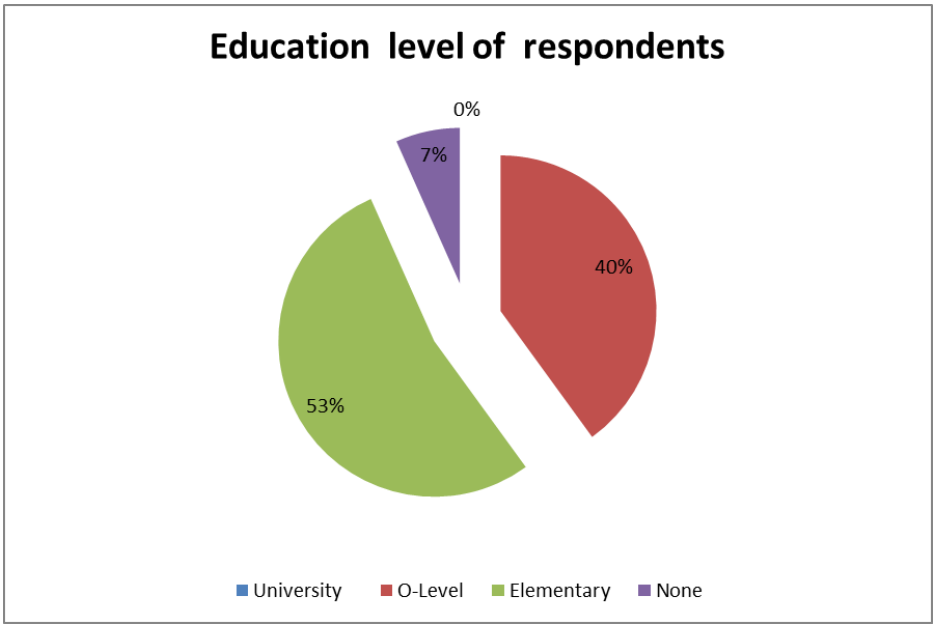

Figure 4: The education level of respondents.
Source: Field study 2011

c). **Age of the respondents**
Of the small scale farmers that were involved in the study, 50% were aged between 30-45 years. This shows that a majority of the productive population is involved in maize production. The mean household size was six (6) members.

Table 3: Age of respondents

Age	Frequency	Per cent
below 30yrs	1	3.3
30-45yrs	15	50.0
46-60yrs	14	46.7
Total	30	100.0

Source: Field study 2011

The results corresponds to those of a study by Khan, et al (2008) where the average age of the respondents (farmers) was found to be 42 years. There were no respondents who had college education in the survey (table 4)

Table 4: Secondary data on demographic characteristics of respondents in western Kenya

Summary of household characteristics of farmers in six study districts of western Kenya

Household characteristics	Bungoma	Trans Nzoia	Kisii	Suba	Vihiga	Busia
1. Age of household head (years)	50.4	55.2	41.7	48.8	44.2	42.0
2. Farming experience of head of household (years)	23.2	23.4	18.7	19.1	14.0	–
3. Number in household	11.2	7.4	7.1	7.6	6.3	–
4. Household members giving labour on farm	5.7	2.2	3.1	3.2	2.5	–
5. Size of study plots in m^2	809	2225	884	600	728	900
6. Farm size in hectares (ha)	2.8	1.5	–	4.1	0.8	1.8
7. Education level of household head (%)						
No education	16	16	–	16	–	3.8
Primary education	40	40	68	36	48	42.3
Secondary education	36	32	24	16	44	53.8
College education	8	12	8	32	8	–
8. Gender of head of households (%)						
Female headed household	4	16	20	24	8	38.5
Male headed household	96	84	80	76	92	61.5

–, Data not available.

Source: Khan, et al. (2008)

4.2. Gender role in maize production

Understanding gender roles in the household decision making process and crop production is important in a baseline study .This is helps when planning for interventions. From the study 67% (20) of the respondents indicated that women played a key role in deciding what to be planted. Upon probing the women said they had to make these decisions because they were mainly involved in acquisition of the inputs. Women said they played this role because either their spouses were out in the cities while others lamented that men spent most of their time in Busia-Uganda where alcohol drinking unlike in Kenya is not restricted before 1700 hours. Both men and women do the ploughing and planting while women and children do most of the weeding and harvesting. While making these decisions the small scale farmers put various factors in to considerations as ranked in order of priority in the table 5 below where one (1) is the highly prioritised and 10 is the least prioritised. This table is generated from responses in question 16 in the questionnaire (see annex)

Table 5: Factors considered in decision making

Factor	Ranking
Availability of inputs	1
Family food needs	1
Customer needs	5
Labour	2
Rain seasons	4

Source: Field study 2011

1= the most important (Highly considered)

Table 5 shows that availability of seeds and fertilizers as well as household food needs are highly considered. Customer needs are least prioritised because the farming households produce mainly for subsistence use but they sell the surplus. The farmers depend on rain-fed

agriculture and they have no much considerations to rains because they plant maize in both the two rain seasons.

4.3. Human diseases mainly affecting farm labour

Malaria is one of the main diseases that affect labour in Busia. The disease out-break is common during the rainy season when labour is highly required. On the other hand HIV/AIDS prevalence in Busia is higher (7.4%) than the national prevalence rate (6.3%) The researcher sought to know the overview of which among the above two, the respondents felt was affecting household labour more.

Malaria was rated to affect household labour more (54%) than HIV/AIDS as depicted in figure 5. This was so because Malaria occurs during the rain seasons when the households need labour for planting and weeding. However the respondents said HIV/AIDS had a greater impact when the infected person suffered from the opportunistic diseases for it would cause labour to be used in caring for the sick rather than in food production. The director of One World Development Foundations an organisation whose activities involves giving support to HIV/AIDS affected households shares the same sentiments in Box 4 in the annex 3.

The research revealed that sickness did not only affect household labour but the whole community labour since farming households have merry-go-round labour groups which provide labour from one household at one time, and to another after. It is against the rules of the group to fail to attend or send one of the household members to this merry-go-round. Therefore in case of sickness, women or girl children may be bound to abandon work or school to take care of the sick as well as provide for the group labour.

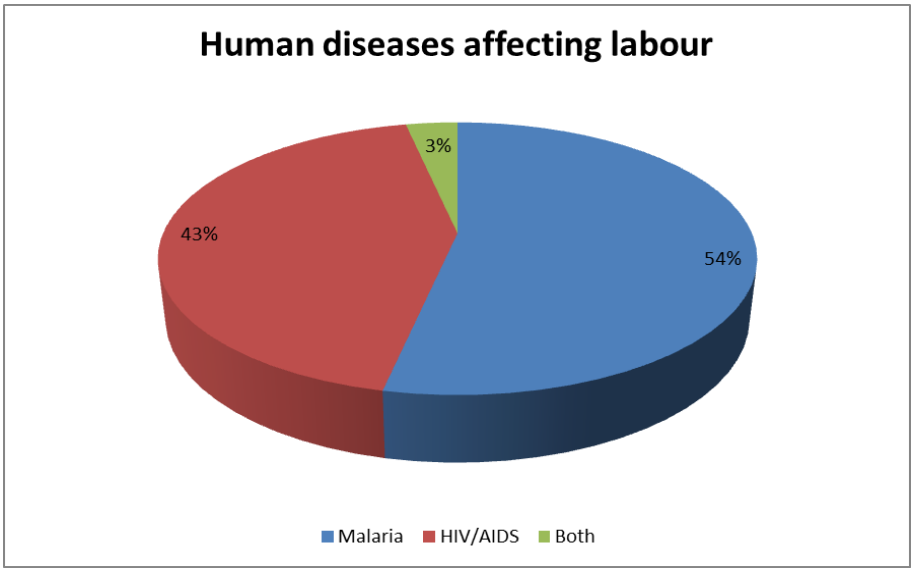

Figure 5: Human diseases that affect household labour in maize production
Source: Field study 2011

4.4.Land size and access.

All the respondents in the survey indicated that have plots of land. Majority (93%) have access to land for crop production of between least 0.5- 2.0 hectares (table 6). All the respondents

indicated that they own the land where only 20% said they acquired the land through buying and the rest explained that the land was an inheritance. Only 26% of the respondents said they had at least 0.5 -1.0 hectares of land that was not currently under crop production. Of these, 67% said the other plots of land was lying idle due to lack of farm inputs while 20% indicated that the other plot of land was for livestock purposes and the rest said the land was rented to neighbours. Table 4 gives an average of 1.8 hectares as land size for Busia farmers.

Table 6: Land size for the farming households

Land size	Responses on land size Under crop cultivation (n=30)	Responses on land size not under crop cultivation (n=30)
Up to 0.5 Hectare	7	4
1.0 Hectare	10	3
1.5 Hectares	5	1
2.0 Hectares	6	0
2.5 Hectares	0	0
3.0 Hectares	0	0
4.0 -5.0 Hectares	2	0
Total	**30**	**8**

N = is the number of respondents with the corresponding numbers of Hectares

The hectares given in the table does not depict the exact figure given by the respondents but has been rounded to the nearest 0.5 or whole number.

4.5. Source of maize inputs

From the field study, it emerged that few respondents (34%) (Figure 6) obtained their seeds from agro vets (Hybrid seeds) while 25% bought from cereal shops (stock grains for food consumption). When asked why they planted seeds from own harvest or from the cereal shops, the respondents said that when the rains comes and they cannot afford to purchase the hybrid seeds from the agro vet shops, they are left with no other alternative than to plant they can afford. Only a few of the respondents who planted seeds from own previous harvest explained that they trusted their own local varieties, which according to them was doing well than the *western seeds (Hybrid)* variety.

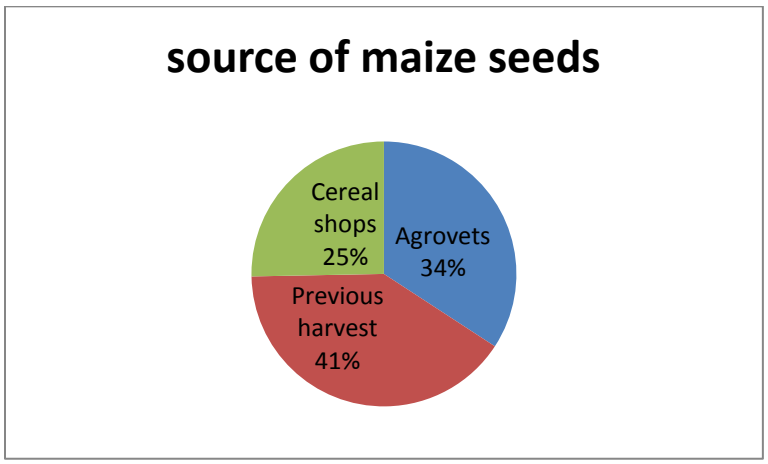

Figure 6: Chart showing where the farmers source their seeds.
Source: Field study 2011

The improved maize variety seeds commonly planted by the farming households in the study area include 511, 513,and 515 while local varieties include *ongeti, Jowi-Jamuomo,Sipindi* and *imodi.* According to the information given by Rural Energy Food Supply Organization (REFSO) representative in box 2 (annex) failure by farmers in the study area to use certified seeds (Hybrid) and fertiliser may be due to the sparse distribution of input stockists in the District and also high cost of the inputs. This information is also supported by the views of the chief of the location in Box1 (annex) and another key informant from the Kenya Orphans Rural Development Programme(KORDP) who stated that certified seeds and inorganic fertilizers are expensive for the small scale farmers. The price of the improved seeds currently is Kshs 450 for 2kilograms (Kgs) of maize and Kshs 500 for 2Kgs of beans while a 50Kg bag of Diammonium Phosphate (DAP) costs Kshs 3500 (Wanyama, telephone communication). When using the improved seeds, the farmers should use 25Kgs of maize and 50Kgs of DAP per one hectare (Mavuno, division agricultural officer, personal communication).

4.6. Cropping Pattern

4.6.1Crops Cultivated by the Small Scale Farmers

The results below in table 7 were generated from the question 6 in the questionnaire where the respondents were asked which crops they were cultivating and the purpose for which they were cultivating them for. The results show that maize is an important crop cultivated by majority (97%) of the respondents. Maize and Cassava are for both cash and subsistence use while beans is mainly for home consumption. The farmers also grow millet, groundnuts and bananas. Besides the above listed crops the farming households grow indigenous vegetables such as cow peas and pumpkins. Other crops that were found growing in the area from observations include, simsim, sun flower and arrow roots. Through probing, the respondents alleged that sale of the crop produce is done to obtain tuition fee for their children, clothing, healthcare services and other family need. On average the respondents said they harvested 0.45 and 0.6tons of maize per hectare for the March-May rain season. Apart from crop production, the farming households keep livestock though a few. These include goats, pigs, sheep and chicken. Of the respondents interviewed, only three (3) had a cow each but all had at least a chicken.

Table 7: Crops grown by the farming households and their usage

			The Responses	
Crops grown	**Yes**	**No**	**Home consumption**	**For sale and home consumption**
Maize	**29**	**1**	**15**	**14**
Cassava	**24**	**6**	**11**	**13**
Beans	**23**	**7**	**16**	**7**
Sorghum	**12**	**18**	**8**	**4**
Sweet potatoes	**10**	**20**	**5**	**5**
Millet	**8**	**22**	**3**	**5**
Ground nuts	**6**	**24**	**4**	**2**
Bananas	**5**	**25**	**3**	**2**

Source: Field study 2011.

4.6.2 Intercropping

Intercropping was being practiced by the small scale farmers who were involved in the study. At least 90% were practicing intercropping (figure7). Maize was mainly intercropped with beans. Cassava was also intercropped with beans or groundnuts. The respondents said that they had to maximise the small pieces of land they had in crop production and thus they would plant maize in one row and beans or, groundnuts on the spacing between the two rows of maize or cassava. The legumes would benefit from the manure or fertilizers that is applied to the main crop which is mostly maize. Intercropping with legumes was also used as a way of improving soil fertility.

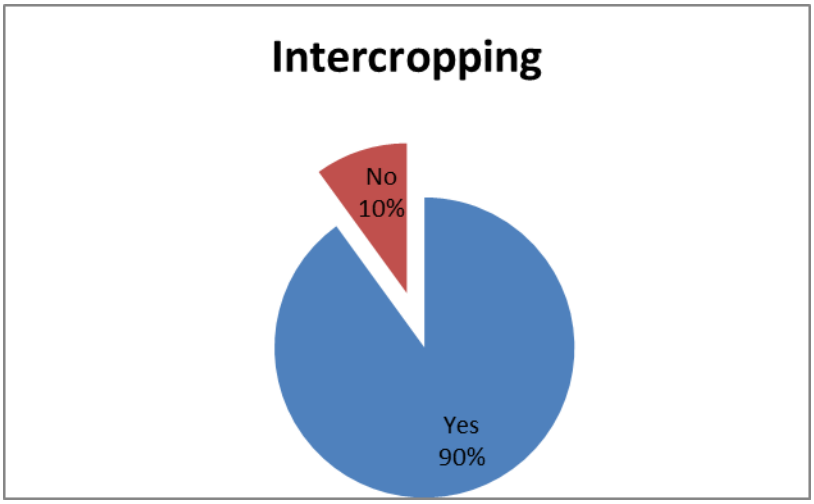

Figure 7: Intercropping practices
Source: Field study 2011

4.6.3. Use of manure and fertilizers

At least 70% (21) of the respondents were using manure (from compost and livestock) Application of livestock manure was being done by of either scattering these on the surface of the land or placing manure in seed holes at the time of planting. This is important in maintaining soil organic matter levels for the crops .On the other hand 45% (14) indicated usage of inorganic fertilizers for their crops. For those who were using manure, 58% (12) were sourcing the manure from their own animal wastes (goats, cows and chicken) while 40% (8) were using compost and the remaining 2% (1) bought from neighbours. Of those who said they had used inorganic fertilizers 40%(6) had obtained the fertilizers from a donation the government distributed at the beginning of the rain season while the rest 60% (8) was bought from the agro vet shops. The respondents who indicated using fertilizers said they had to make a choice when applying fertilizers and consider maize as a priority during application. The respondents mentioned high prices and lack of funds as the reason for not using inorganic fertilisers.

4.7. Agricultural Extension Services

Agricultural extension officers are government officers under the MOA who are charged with the responsibility of offering advice to the farmers. When the respondents were asked if they were receiving any services from the agricultural extension officers, 84% (25) alleged they were not receiving the services. This may be because the extension services are not able to reach all the farmers. There are only two agricultural extension officers in the Matayos division which covers five locations (Mavuno, Matayos DAO, personal communication)

4.8. Pests and Diseases Affecting maize and other crops in the Location

The respondents gave a list of pests and diseases that were affecting the various crops they plant in table 8.

Table 8: Pests and diseases

	Diseases/Pests (n=30)						
Crop	Maize streak	Weevils	Stem borers	CMD	Monkeys	*Striga*	Termites
Maize	20	15	24	-	20	29	21
Beans	-	14	6	-	6	-	15
Cassava	-	-	-	18	10	-	5
Sorghum	-	10	7	-	10	12	10
Millet	-	2	5	-	3	5	4

N= the number of responses
(-) Indicates the disease/pest was not mentioned

As depicted in the table above, maize crop is not only faced with threats of Striga and stem borer but also termites and monkeys. There were also indications that sorghum and millet is also affected by the Striga weed. The cassava crop was affected mainly by the cassava mosaic disease and monkeys. The respondents said that monkeys mostly damage crops that are grown near the swampy areas. At least 10 of the respondents said they would spray their crops with insecticides if infested with diseases.

4.9. Off-Farm Activities

In order to substitute for the family needs, 50% of the respondents were involved in off-farm activities. Women are involved in trading activities such as selling of cereals, fish and second hand clothing while men run barber shops and transport business locally known as *bodaboda* which is ferrying people from one place to another by use of bicycles and motorbikes. The respondents said that they normally divide their time carefully to ensure that their farms are not left un attended. However, when asked if they could abandon farming for their other small enterprises, all of them alleged that it was not possible. This also explains that the respondents value farming as an activity.

4.10. Resources important for livelihood activities.

In order to identify possible alternative sources of livelihood for the farming households of Bukhayo west and interventions, the resources available in the area were identified as indicated in table 9. The format of grouping the resources or assets is borrowed from the sustainable livelihood framework.

Table 9: Available resources for the farming households of Bukhayo west.

Natural resources	Social resources	Human resources	Physical resources	Financial resources
land, water, crops, chicken goats cows and pigs	families, networks, community based organisations, merry-go-round groups, good relationships	Skills and, Knowledge in farming ,trading	Roads, hospitals, bicycles, motorbikes, Houses, shops	Income from non-farm activities

Source: Field study 2011

4.11. The role of organisations important in crop production

In order for ABA to engage various stakeholder in improving the food security of the small scale farmers of Bukhayo west, the organisations and institutions working in the area have to be identified. It is also important to understand the role of each organisation to know how to engage them. The table (10) outlines some of the organisations working in Bukhayo west in areas of crop production. The information was obtained from the focus group discussion and interviews with key informants.

Table 10: Important organisations in Bukhayo west and their roles

Organisation	Role/Responsibility
Ministry of Agriculture (MOA)	• Provide extension services to the farming households • Supply subsidised inputs (improved seeds and fertilizers)
REFSO	• Distribution of cassava cultivars to farming households through self- help groups • Promotion and distribution of orange-fleshed sweet potatoes • the organisation is working closely with KARI- Alupe which is researching on diseases resistant cassava crop.
KORDP	• Food distribution to HIV/AIDS affected households (maize, beans and millet) • Distribution of inputs to the HIV/AIDS affected households (maize, beans and fertilizers)
One world development foundation	• Distribution of milk goats • Promoting vegetable growing in the area (tomatoes and kales) • Target groups are women and youth.

Source: Field study 2011

The interviewees also mentioned WFP, and International Child Support as playing a role in food distribution while Heifer international organisation was mentioned to have supplied some households with cows in the area.

CHAPTER FIVE: DISCUSSION

This chapter discusses the results obtained in chapter four above. It explains how the interaction of the three factors (socio-economic, technical and natural) contribute to increase or decrease in maize production and other crops in the Bukhayo west. The chapter also discusses the implications of these contributions to the food security of the farming households.

5.1 Maize and the cropping systems

Maize, beans, cassava and sorghum are popular in the cropping systems of western Kenya. The study revealed that maize is an important crop cultivated by the farming households of Bukhayo west. The farming households practice intercropping system where maize is intercropped with legumes such as beans and groundnuts. Intercrops can smother weeds in cereal crops and improve the overall productivity. Even though the small scale farmers explained that it was a way of maximising the plots of land, scientists advise that intercropping be used also as a measure of mitigating weeds especially *Striga* weed which has become a problem in Busia (Odhiambo & Ariga, 2001).

Food habits and the food patterns of a population or community are closely associated with the society and country of which they are part of (Hartog and Brower,2006). The socio-economic dynamics of a society and country will have an impact on cropping system and lifestyle. In the area of study ugali made from maize meal is the main dish, served with either vegetables or meat. Maize and beans are boiled and consumed as a main dish (mixed and boiled) especially for breakfast. This explains also the reasons for intercropping maize with beans. Most small scale farmers practice mixed farming where they keep livestock besides crop production to enhance their food security where the animals can provide income or serve as protein dish. However, there were few livestock in the study area. This can be partly attributed to population pressure which demands for more land for cultivation leading to steady loss of grazing lands and a decline in the size of livestock herds. Individual tenure and land scarcity have led to a decline in common lands that were once open for all families to use for grazing animals. The farming households are not used to the tethering system or the zero grazing methods especially for cows which explains the low number of cows found in the area. Chicken on the other hand are allowed to roam around and look for food. Their shelter can be the kitchen or a small housing made from timber and roofed with grass or iron sheets. Because they are not labour intensive, it makes easier for the farming households to rear. They are also easy to dispose for income in case of a household need.

5.2 Maize production and its constraints

In Bukhayo west, the farming communities had cassava, millet and sorghum as the indigenous crops as the chief of the location explained in Box 1(annex 3). The tubers of cassava are fermented, dried, ground to flour which is mixed with millet or sorghum flour and prepared to *ugali*. Change of lifestyle has contributed to change in production and consumption of these indigenous crops. The government of Kenya over a time has promoted maize production (section 2.2 of this report) and as a result the indigenous crops have been side-lined in this Busia. Another reason that has made the farming households switch from their indigenous crops to maize is the lack of cash crop in the area. Initially they used to grow cotton, sugarcane alongside cassava, millet and sorghum but the ginneries were closed down and thus farmers opted to grow maize for subsistence and sell surplus for cash. Since sugarcane industries

require the farmers to set aside one hectare of land for the crop as explained in box 1, this has been difficult for the farmers considering the small plots of land found in the area. Even though the farming households focus on maize as the main crop, the crop has been faced by many difficulties leading to low production and subsequently affecting the food availability of the farming households. These are discussed below.

Land size: Land is a main factor of production. The size of land is a constraint in Bukhayo west as the field results shows that more than 50% of respondents rely on up to one hectare of land for crop production to feed an average of six members of households. The situation is worsened by the high cost of land, Kshs 180,000 per hectare. This makes it difficult for the farming households to acquire more land contributing to the small plots of land. There is no doubt that the small scale farmers in this area will have to rely more on yield improvement than area expansion for future increases in maize production.

Inputs acquisition and usage: Availability and access to high quality maize seeds is a prerequisite for high maize productivity (Nyoro, 2002). The study revealed that a large proportion of small scale farming households used seeds from either local maize seeds. Most of these non-hybrid seeds are not certified neither are they cleaned or treated. This has contributed to the poor maize production overall which affects the food availability of the farming households and consequently food security in the area. From the research, it emerged that most of the farming households would require not less than Kshs 10,000 for inputs but Jayne (2003) reasons that besides price levels and household resource endowments, education levels also influence farmer's decisions about fertilizer and hybrid seed use.

Soil Fertility : From the observations and the information gathered in the field this research agrees with Vanlauwe and Giller (2006) that poor soil fertility is one principal constraint to food production in smallholder farming in Africa. One of the indicators of low soil fertility is emergence of Striga weed (Nandwa and Bekunda,1998) as it was evident in the study area. The soils in Bukhayo West have been weakened by farmers repeatedly using the same pieces of land to cultivate various crops. This is because the former practices of shifting cultivation is long gone due to the increased population that has led to more demand for land and food production. One of the ways of enriching the soils was use of manure, which is now minimal as a result of decline in livestock keeping among the farming households. A few farming households are able to keep one or two cows which is not enough to provide for farm manure. The soil cover has also been reduced by lack of vegetation since the farming households clear the vegetation to plant the crops. The small scale farmers are not able to afford inorganic fertilizers to boost the fertility of the soils.

Pests and Diseases

The constraints of small plots of land, inputs acquisition and reduced soil fertility are worsened by pests and diseases. The maize crop is destroyed by monkeys, termites and also affected by maize streak disease. Another important pest in the area is the stem borer which is locally known in the community as *tsingetsa.* The symptoms of stemborer are not as conspicuously observed by farmers compared to symptoms and effect of *Striga*. However the farming households and the International Centre of Insect Physiology and Ecology (ICIPE) identifies it as a serious pest that reduces maize yields in Busia (Khan, 2008). The most important constraint in this category from the findings is the Striga weed (*Striga hermonthica)* locally known as kayongo. Unlike sorghum and millet when the maize crop is infested with striga the yields drop highly. This is because the traditional crops have evolved together with striga for a time and have built up a natural resistance as explained by Andersson and Halvarsson *(*2011) in

their report on *'The economic consequences of Striga hermonthica in maize production in Western Kenya.* The weed competes for nutrients with the maize causing retardation on the plants. This explains the low yields obtained by the farming households in the study area. The situation is degenerated by the low use of improved seeds that are resistant to the weed. This can be attributed to their cost and also usage of fertilizers since the improved varieties requires adequate use of fertilizers (Woomer and Savala, 2009).There is very minimal practices of the various methods scientists have recommended (Annexes, Box 6) that farming households are carrying out in combating the threat of Striga weed. This is contributed by the low extension services that the farmers access.

Research and Extension services: According to Doss, et al. (2002) as cited by De Groote et al.(2002), extension is one of the main variables which is highly correlated to the use and management of improved seeds and fertilizers by the small scale farmers. The study revealed that the extension services were inadequate in the area. This is also supported by the MOA's Strategic Plan (2008-2012) which stated that 'the performance of research and extension has not been efficient due to low Government investment, restrictions on staff recruitment and weak research-extension linkages'. The DAO of Matayos mentioned inadequate staff as one reason for low extension services. The success stories in the various regions and countries on maize production have shown that farmers work closely with agricultural extension workers in area of adopting usage of improved inputs and fight against the Striga weed. Wokabi (n.d) emphasises technology transfer through training, education and raising the knowledge of the small scale farmers. This will help in adoption of the technology and thus increase the maize yields. In Sauri village one of the success stories in maize production for millennium development projects (www.millenniumvillages.org), the agricultural extension officers had to be empowered with transportation and laptop computers, in order for them to train farmers in the latest knowledge.

5.3 The implications of maize production in food security

According to the Kenya's Food and Nutrition Security Strategy report (2008), household food availability is influenced by own-production, production by other households (which influences the availability of loans and gifts), and food markets. Production levels are, in turn, influenced by the productivity of the resources (inputs) available. The resources may be natural, physical, human, technical and financial. The study shows how these resources have been constrained and the productivity of maize is low in the area of Bukhayo west. The small plots of land are inadequate to produce for an average household of six members as revealed in the study (4.1 of this report).With adequate resources, one hectare of land can produce up to 5.2 tons of maize(Denning et al.,2009).This is not the case in Bukhayo where the respondents registered production of below half a ton per hectare per harvest. This is attributed to factors that have been discussed in section 5.2 above. In Kenya it is estimated that average maize consumption is103 kg/per capita (De Groote, 2001). The yields of maize produced in Bukhayo west is therefore way too low to meet the food needs of an average household size of six members . This is especially so if there are few or no other means of accessing food. Since maize in Bukhayo west serves for both subsistence and cash the recurring low production makes the farming households poor and poorer. This limits their ability to access financial resources for hybrid seeds and fertilizers to boost production and the cycle of low yields continues. According to Soule and Shepherd (2000) as cited by Marenya and Barrett (2006), the farmers' inability to access mineral fertilizers has adverse consequences on soil fertility and incomes as witnessed in the study area. This research results agrees with the government of Kenya's report where the government recognises the importance food security at the household level and attributes food insecurity to factors such as poor access to productive resources like land (including pasture),

seeds, water, technology and affordable credit facilities. The human resources which include the agricultural extension services essential for knowledge and technology transfer are minimal in the area while human diseases such as malaria, HIV/AIDS among others may reduce availability of family labour which assumes a great importance given that low incomes due to low yields constrain financial liquidity for hiring wage labourers.

Another major component of household-level elements of food security is production of farm and non-farm outputs, using the resources available such as land and labour. The study revealed that at least 50% of the respondents were engaged in other economic activities. These activities provide the farming households with income that is used to obtain food during the lean period. However with the low production of maize and other crops in general ,the lean period is expected to be long for most of the farming households. This means the income may not be enough to secure adequate food from the market. The income obtained from the off-farm activities is also not entirely spent on food but also tuition fees, clothing, health services among other needs. The Government Office for Science report on Global Food and Farming Futures captures the food security situation of the farming households of Bukhayo in explaining that people can be food insecure but not hungry at a moment either because they have sufficient access to food today but at risk of loss in the future. The farming households have food to eat immediately after harvest but the yields are low to last for long. Going as per the definition of food security this report adopted, the food security status of farming households of Bukhayo west is insecure.

5.4 Opportunities and possible intervention for small scale farmers of Bukhayo west

From the results obtained, there is need for interventions to be sought in order to improve the food security status for the small scale farmers of Bukhayo west. In looking for possible areas of interventions the resources available in the area are put into considerations. In a report for AATF on '*Empowering African farmers'*, Woomer (2009) recognises the importance of farmers organisations in voicing out constrains faced by small scale farmers and their participation in seeking for solutions. The small scale farmers of Bukhayo west therefore have made a step in forming a farmers organisation (ABA).This gives an impression of farmers who are willing to participate in looking for solutions to maize production constrains. The organisation therefore has to engage various stakeholders for interventions. The results shows that the farming households practice mixed farming and are also involved in off-farm activities. The interventions have to be based on crop production, livestock and non-farm activities.

Crop production

The farming households of Bukhayo have potential to improve their crop production both maize, indigenous crops and also vegetables. The millennium project in Nyanza Kenya and the AATF report (Annexes, Box 7) have shown that small scale farmers are able to improve their maize yields if facilitated with inputs. The case of Malawi (Annexes ,Box 5) has also proven that farmers can increase their yields if provided with subsidised and adequate inputs. Therefore one area on intervention is to source subsidised inputs for the farming households of Bukhayo west. The maize seed varieties have to be striga resistant.

In an area like Bukhayo west where maize crop is performing poorly, encouraging farmers to plant other crops will help increase food availability for the households. REFSO in conjunction with the Kenya Agricultural Research Institute (KARI) are doing research on improved disease resistant cassava cultivars and sweet potatoes. These crops have already been supplied to some groups in the study area. Increasing production of indigenous crops in the area will therefore reduce the dependency in maize and boost the food security. This is because the crops can be sold to obtain income or be consumed by the farming households. From the study, one of the respondents was not cultivating maize (4.6.1, table 7). The respondent indicated that cassava is the main crop cultivated by his household. The planting is done in intervals so as to ensure all year round production. The respondent also cultivates vegetables for income generation for the household. This shows that there is potential of cultivating other crops in the area. For the interventions to be successful, the agricultural extension services have to be incorporated.

Livestock

The research revealed that the respondents practice mixed farming, one of the characteristics of most small scale farmers. The findings show that at least every farming household was keeping chicken. An intervention that involves resources already available for the farming households may be more appropriate. A project on rearing indigenous chicken for organised groups of small scale farmers as an income generating activity will boost the food security for the households. This assumes that the income earned through sale of eggs or the animal will be used in the households though this is not always the case. The chicken will also provide some manure that can be used in boosting the soil fertility of the small scale farmers. Some parts of western province have registered successful implementation of indigenous poultry projects (annex 4, box 8).

Non-farm activities

It is evident that own production for the farming households of Bukhayo is not adequate for their food availability. This means there is need to source food from markets. Sourcing from the market requires income. Off-farm income provides an additional access to food through purchases from markets (Marenya and Barrett 2007).Previously it had been assumed that rural population derived their livelihoods from farming but research has shown that apart from farming the rural population have other sources of livelihoods. This is evident in the research carried out in Bukhayo west, Busia. The research has shown that members of the farming households were involved in off–farm activities. Off-farm activities are those livelihood activities carried out outside the farm. The respondents said that they knew how to balance their time properly so that both farm and off-farm activities were well attended to. These activities can be improved to increase income for the households to access food. Provision of micro-credit loan services may boost the small scale farmers trading enterprises. The Regional Institute for Social Enterprise (RISE) which has success stories (http://risekenya.org/) in the area of micro-credit loans and other organisations that offer microcredit services may be suitable for consultations.

CONCLUSION AND RECOMMENDATION

Conclusion

The farming households of Bukhayo west practice mixed farming system. Crop production is the dominant activity of the small scale farmers though they keep livestock such as cows, pigs, goats and chicken. Maize is grown by over 90% of the farming households for both home consumption and for sale. Other crops in the area include cassava, sorghum, millet and sweet potatoes. Legumes such as beans and groundnuts are intercropped with maize, cassava or millet. The legumes are mainly for home consumption. Most of the small scale farmers in the study area have to produce food from plots less than two hectares of land to feed on average six members per household. The farmers have witnessed yields of less than a ton of maize per hectare which means they are still struggling to achieve self-sufficiency in maize production. With this low production, own production is not adequate thus income is required to access foods from the market. Otherwise the households are food insecure.

Farming households experience low maize yields due to socio-economic, technical and natural factors. Many farmers are still planting uncertified local varieties which may not be resistant to pests and diseases. Usage of mineral fertilizers is also minimal and this is attributed to high costs of inputs. With the area being constraint by low soil fertility, maize production require farmers to use hybrid seeds and DAP to increase their yields. This has been witnessed as reported in Malawi and the millennium villages projects. The situation of low production is further worsened by pests such as weevils, stemborer, destruction by monkeys and a great extent the striga weed (*Striga hermonthica)* locally known as *Kayongo.* Striga is the main devastating weed that has marginalised the small scale farmers' capacity in maize production in Bukhayo west. The parasitic weed which is known to compete with the crops for nutrients has threatened the household food security for these farming households due to its vast geographic spread and economic impact. Worse still for these farming households is the low access to agricultural extension services which helps in advancing knowledge on inputs use and methods of controlling pests and diseases.

The study has also established that farmers own production in Bukhayo west can cannot meet the food needs for the households. The small scale farmers engage in non-farm activities to generate income that can be used to buy food during lean periods. The income is also used in tuition fee among other household needs. Main non-farm activities in the area include transport services (bodaboda), barber shops, trading in the open market, retailing shops and tailoring.

There are various organisations involved in activities such as food distribution, research and promotion of indigenous crops but there is a lot to be done to ensure food security for the farming households of Bukhayo west. For ABA to achieve its goals, the organisation will have to engage stakeholders who can provide the small scale farmers with subsidised and adequate maize inputs as a starting point, technology on striga weed and also promote cultivation of indigenous crops which are diseases resistant and early maturing varieties. Livestock projects and off-farm activities can also be boosted to enhance income generation that can be used to access food from the markets.

Recommendation

Based on the findings of this research, the following recommendations are made:

- ABA needs to engage stakeholders who can facilitate the small scale farmers with mineral fertilizers and striga resistant maize seeds so as to improve maize production for enhanced food security. Important stakeholders will include among others, MOA, KARI, AATF and donor funding agencies.
- There is need for ABA to engage MOA to recruit post and empower extension officers through: training, provision of transport services and training materials. These extension officers will in turn offer training and education on the various methods of combating striga weed (see annexes box 6).

- There is need also to engage the government to either tame or eradicate the monkeys that have been destroying crops in Bukhayo west.

- With the help of REFSO, KARI and other organisations that promote indigenous crops, ABA needs to sensitize the farming households on importance of indigenous crops in enhancing food security. They need to promote and distribute the already existing disease resistant and early maturing cultivars of cassava and sweet potatoes to the farming households of Bukhayo west.

Further research need to be carried out on:

- The possibility of improving off-farm activities for farming households through training and introduction of micro-credit loans for increased household income. This will enhance household food access.
- Promotion of livestock keeping especially the small animals such as indigenous chicken as income generating activity to enhance the food security of the farming households.
- The extent to which soil fertility of the area has been affected to enable proper use of fertilizers and other soil management practices.

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ANNEXES

Annex 1: Data collection tool

The Questionnaire

1. Gender of the respondent [M] [F]
2. Age of the respondent in years [Below 30] [30-45] [46-60] [Over 60]
3. Level of education of the respondent _____
4. How many people (children included) live in your homestead?
5. Do you sell your produce to the market? Yes/No

   If Yes which time of the year do you sell your produce?

   _____

6. How big is the size land you are using for crops?

   _____

7. Do you own the land? Yes/No

   If No, how do you access the land?

   _____

   If Yes, do you have other plots of land you are not cultivating any crops? Yes/No
   If yes how big is the plot/plots?

   _____

8. What do you do with the plots that you are not using?

   _____

   _____

9. List the crops that you plant in your farm?

		Use of the harvest (tick either)		
	Crop	**Eaten by household**	**sold**	**Eat and sell**

1.				
2.				
3.				
4.				
5.				
6.				

10. Do you use manure for your farm? Yes/ No

If yes where do you get the manure?

11. Do you use fertilizers for your farm? Yes/ No

If yes where do you get the fertilizer?

If no why?

12. Do you choose the crops you apply fertilizer to? Yes/ No

If yes, what do you consider when making this choice?

If No why?

13. Do you do intercropping? Yes/No

If yes what crops do you intercrop?

14. Where do you get your seeds?

15. How does being in the border affect your acquisition of the inputs?

16. List the pests and diseases affecting your crops

	Crop	Pests / Diseases
1.		
2.		
3.		
4.		
5.		
6.		

How do prevent your crops from being attacked by pests or diseases?

What do you do if your crops are infested by pests or diseases?

17. Who decides what crops to plant?

18. What type of seed varieties do you plant?

19. Choose in order of priority (Scale of 1 -10 where 1 is the highly prioritised),what you consider when deciding the crops in grow?

	1	2	3	4	5	6	7	8	9	10
○ Availability of seeds	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
○ What customers want	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
○ The family food needs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
○ Labour	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rain season (short or long)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
○ Any others (please specify)										
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

20. Do you get advice from the Agricultural extension workers concerning growing crops? Yes/ No

If yes, what advice do you get?

_____

_____

If No why?

_____

_____

22. Between Malaria and HIV/AIDS which one would you say is affecting household labour much?

_____

Why do choose this disease?

_____

23. Other than the two mentioned diseases above, what other common human diseases are affecting the household labour?

---

24. Apart from farming are you or a member of your household working elsewhere for money? Yes/No

If **yes** where do you or the member work (employment sector)?

What is the other activity?

---

25. How much time do you allocate for this other activity?

---

26. Do you belong to any farmers' group? Yes/No

IF Yes what activities do you do in your group?

If No why?

Thank you for your time.

Annex 2: Raw data from the excel sheets

Respondent	**GENDER**	**AGE**	**No. of people per househ**	**Selling of Produc**	**Time produce is sold**
1	male	46-60yrs	9	Yes	after harvest
2	female	46-60yrs	4	No	when in need
3	male	30-45yrs	7	Yes	after harvest
4	male	30-45yrs	4	Yes	after harvest
5	male	46-60yrs	6	Yes	after harvest
6	female	46-60yrs	5	Yes	after harvest
7	male	46-60yrs	2	Yes	after harvest
8	male	46-60yrs	4	Yes	after harvest
9	female	30-45yrs	6	No	N/A
10	female	below 30yrs	4	No	N/A
11	female	30-45yrs	3	No	N/A
12	male	30-45yrs	8	No	N/A
13	female	46-60yrs	10	No	N/A
14	male	30-45yrs	9	No	N/A
15	male	30-45yrs	18	Yes	when price rises
16	female	30-45yrs	3	No	N/A
17	female	46-60yrs	8	No	N/A
18	male	46-60yrs	10	No	N/A
19	male	30-45yrs	8	No	N/A
20	male	46-60yrs	6	No	N/A
21	male	30-45yrs	8	Yes	after harvest
22	male	46-60yrs	10	No	N/A
23	female	30-45yrs	7	No	N/A
24	female	30-45yrs	4	No	N/A
25	male	46-60yrs	11	No	N/A
26	male	30-45yrs	6	Yes	after harvest
27	female	46-60yrs	9	No	N/A
28	female	30-45yrs	9	Yes	after harvest
29	male	46-60yrs	10	No	N/A
30	female	30-45yrs	7	No	N/A

Respondent	size of land in Hectares	Ownership	other plots of land	Size of the plot (HA)	use of other plots	Maize
1	0.5	Yes	No	NA	NA	both
2	0.5	Yes	yes	0.5	livestock	both
3	1	Yes	No	NA	NA	both
4	1	Yes	No	NA	NA	both
5	4	Yes	yes	1	livestock	both
6	2	Yes	No	NA	NA	eaten by household
7	1	Yes	No	NA	NA	NA
8	2	Yes	No	NA	NA	both
9	0.5	Yes	No	NA	NA	eaten by household
10	1	Yes	No	NA	NA	eaten by household
11	3	Yes	No	NA	NA	eaten by household
12	1	Yes	No	NA	NA	eaten by household
13	1.5	Yes	No	NA	NA	both
14	1	Yes	No	NA	NA	eaten by household
15	5	Yes	yes	0.5	livestock	eaten by household
16	2.5	Yes	No	NA	NA	eaten by household
17	1	Yes	No	NA	NA	eaten by household
18	5	Yes	No	NA	NA	both
19	1.5	Yes	No	NA	NA	eaten by household
20	0.5	Yes	No	NA	NA	eaten by household
21	2	Yes	yes	1	livestock	both
22	3	Yes	yes	1	rent to others	both
23	2	Yes	No	NA	NA	eaten by household
24	1	Yes	yes	0.5	rent to others	both
25	5	Yes	No	NA	NA	eaten by household
26	2	Yes	No	NA	nA	both
27	1.5	Yes	No	NA	NA	eaten by household
28	2.5	Yes	yes	1.5	livestock	both
29	3	Yes	No	NA	NA	eaten by household
30	2	Yes	yes	0.5	rent to others	both

Respondent	beans	Cassava	Fingermi	sorghum	groundnut	sweetpot	bananas
1	both	both	both	NA	both	both	NA
2	eaten by household	eaten by household	eaten by household	NA	NA	NA	NA
3	both	both	both	both	NA	both	NA
4	both	both	NA	NA	NA	both	both
5	NA	both	both	NA	both	NA	NA
6	NA	both	NA	NA	NA	NA	NA
7	NA	both	NA	NA	NA	NA	NA
8	NA	eaten by household	NA	eaten by household	NA	NA	NA
9	eaten by household	eaten by household	NA	eaten by household	NA	NA	NA
10	eaten by household	eaten by household	NA	NA	NA	NA	NA
11	eaten by household	NA	NA	NA	NA	NA	NA
12	both	both	both	both	NA	NA	NA
13	eaten by household	both	NA	eaten by household	NA	NA	NA
14	eaten by household	eaten by household	NA	eaten by household	NA	eaten by household	NA
15	both	eaten by household	NA	NA	NA	NA	NA
16	eaten by household	eaten by household	NA	NA	eaten by household	eaten by household	NA
17	eaten by household	eaten by household	NA	eaten by household	NA	NA	NA
18	both	both	NA	both	NA	NA	NA
19	eaten by household	NA	NA	NA	NA	both	NA
20	eaten by household	eaten by household	NA	eaten by household	eaten by household	eaten by household	NA
21	eaten by household	both	NA	NA	NA	NA	eaten by household
22	eaten by household	both	NA	NA	NA	NA	NA
23	NA	NA	NA	NA	NA	eaten by household	NA
24	NA	both	eaten by household	eaten by household	sold	NA	NA
25	NA	NA	NA	eaten by household	eaten by household	eaten by household	NA
26	both	NA	both	eaten by household	NA	NA	both
27	eaten by household	eaten by household	NA	NA	NA	sold	eaten by household
28	eaten by household	both	NA	NA	NA	NA	NA
29	eaten by household	eaten by household	eaten by household	NA	eaten by household	both	eaten by household
30	eaten by household	NA	NA	NA	NA	NA	NA

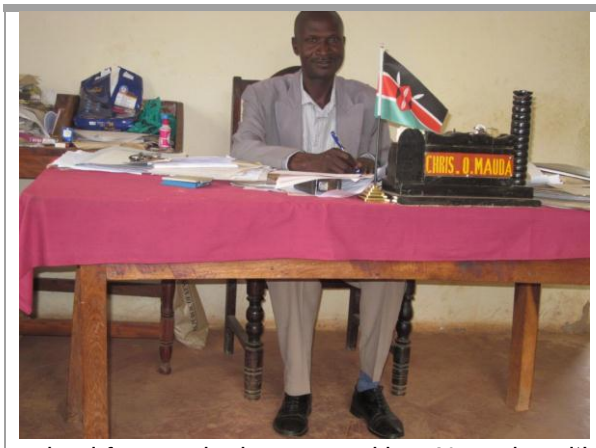
Respondent	manure	source of manure	use of inorganic fe	source of fertilizer	Whynot	Choose	Whychos
1	yes	compost	no	NA	NA	yes	soil fertility
2	yes	own animals	yes	buy from agrovet	NA	yes	to get good yields
3	yes	compost	no	NA	lack of funds	yes	to get good yields
4	yes	buy	yes	buy from agrovet	NA	yes	soil fertility
5	no	NA	yes	donation	lack of funds	no	NA
6	yes	NA	no	NA	lack of funds	yes	to get good yields
7	no	NA	yes	buy from agrovet	NA	no	NA
8	no	NA	yes	buy from agrovet	NA	no	NA
9	yes	compost	no	NA	lack of funds	yes	to get good yields
10	yes	compost	yes	buy from agrovet	NA	yes	soil fertility
11	no	NA	no	NA	lack of funds	yes	to get good yields
12	no	NA	no	NA	lack of funds	yes	to get good yields
13	yes	own animals	yes	buy from agrovet	NA	no	NA
14	yes	buy	yes	buy from agrovet	NA	yes	to get good yields
15	yes	own animals	yes	buy from agrovet	lack of funds	yes	soil fertility
16	yes	compost	yes	buy from agrovet	NA	yes	soil fertility
17	no	NA	yes	buy from agrovet	NA	yes	soil fertility
18	yes	own animals	yes	buy from agrovet	NA	yes	soil fertility
19	yes	own animals	no	NA	lack of funds	no	NA
20	no	NA	yes	buy from agrovet	NA	no	NA
21	yes	compost	yes	buy from agrovet	NA	yes	to get good yields
22	yes	own animals	yes	buy from agrovet	NA	yes	to get good yields
23	no	NA	yes	buy from agrovet	NA	yes	to get good yields
24	yes	compost	yes	buy from agrovet	NA	yes	to get good yields
25	yes	own animals	no	NA	lack of funds	no	NA
26	yes	own animals	yes	buy from agrovet	NA	yes	funds
27	yes	own animals	yes	buy from agrovet	NA	yes	funds
28	no	NA	no	NA	lack of funds	yes	funds
29	yes	own animals	yes	buy from agrovet	NA	yes	funds
30	yes	own animals	no	NA	lack of funds	yes	soil fertility

Respondent	intercro	crops intercroppe	source of seeds	prevention o	decision	seed variesties	AES	Human Diseases
1	yes	maize and beans	previous harvest	spraying	both family members	local variety	Yes	malaria
2	yes	maize and beans	shops	None	respondent	western seed	No	malaria
3	yes	maize and beans	shops	spraying	respondent	local variety	Yes	malaria
4	yes	maize and beans	agrovet	None	respondent	local variety	No	malaria
5	yes	maize and beans	shops	None	both family members	western seed	Yes	malaria
6	no	NA	shops	None	respondent	local variety	No	HIV/AIDS
7	no	NA	previous harvest	spraying	both family members	local variety	No	malaria
8	yes	maize and beans	shops	spraying	both family members	western seed	No	malaria
9	yes	maize and beans	agrovet	None	respondent	katumani	No	malaria
10	yes	maize and beans	agrovet	None	respondent	western seed	Yes	malaria
11	yes	maize and beans	shops	None	respondent	western seed	No	HIV/AIDS
12	yes	maize and beans	previous harvest	spraying	respondent	western seed	Yes	malaria
13	yes	maize and beans	agrovet	None	respondent	western seed	No	HIV/AIDS
14	yes	maize and beans	shops	spraying	both family members	western seed	No	malaria
15	yes	maize and beans	agrovet	spraying	respondent	western seed	Yes	HIV/AIDS
16	yes	maize and beans	previous harvest	None	respondent	katumani	No	HIV/AIDS
17	yes	maize and beans	previous harvest	scarecrow	respondent	local variety	Yes	malaria
18	no	NA	agrovet	None	respondent	local variety	No	HIV/AIDS
19	yes	maize and beans	agrovet	None	respondent	western seed	No	malaria
20	yes	maize and beans	agrovet	None	respondent	local variety	No	HIV/AIDS
21	yes	maize and beans	shops	None	both family members	western seed	Yes	malaria
22	yes	maize and beans	previous harvest	None	respondent	western seed	Yes	both
23	yes	maize and beans	agrovet	None	respondent	western seed	No	HIV/AIDS
24	yes	maize and beans	agrovet	spraying	respondent	local variety	No	HIV/AIDS
25	yes	maize and beans	previous harvest	apply cowdur	respondent	local variety	Yes	HIV/AIDS
26	yes	maize and beans	agrovet	cleaning the f	farmer and agric officer	local variety	Yes	malaria
27	yes	maize and beans	previous harvest	spraying	respondent	local variety	No	HIV/AIDS
28	yes	maize and beans	shops	None	respondent	local variety	No	malaria
29	yes	maize and beans	agrovet	spraying	respondent	western seed	No	HIV/AIDS
30	yes	maize and beans	previous harvest	None	respondent	local variety	No	malaria

Respondent	Non-farm act.	The non-farm a	Organisation
1	Yes	casual labour	no
2	No	NA	no
3	Yes	casual labour	no
4	Yes	shop	no
5	No	NA	yes
6	No	NA	no
7	Yes	Boda	no
8	No	NA	no
9	No	NA	no
10	Yes	casual labour	no
11	Yes	trading	no
12	Yes	Boda	yes
13	Yes	trading	no
14	Yes	barber	no
15	No	Boda	yes
16	Yes	businessman	no
17	Yes	casual labour	no
18	No	NA	no
19	Yes	Boda	no
20	No	NA	yes
21	No	NA	yes
22	No	NA	yes
23	Yes	trading	yes
24	Yes	trading	yes
25	Yes	Boda	yes
26	No	NA	yes
27	No	NA	yes
28	No	NA	yes
29	No	NA	yes
30	No	NA	yes

Annex 3: Information obtained from key informants

Box 1: Cropping patterns by the Chief of Bukhayo west location



My name is Chrisantos Mauda I am the chief of Bukhayo west location. I have lived in this location since I was born. My father gave me a piece of land where I cultivate maize, beans, cassava and some sugarcane. There before, we used to grow millet, sorghum, cassava and sweet potatoes, maize was never valued in this region it was used for porridge. This has changed over time, many people prefer planting maize yet they cannot afford the seeds and the fertilizers that are required for maize production. The population is also growing at a high rate leading to land fragmentation thus we do not have enough to eat. The people depend on food from Uganda. We also do not have cash crop anymore. Cotton used to be grown in this region, farmers were able to sell their cotton and obtain money for school fees and other necessities. Nowadays it's difficult to grow sugarcane since the sugar company insists that farmers should have at least one hectare of land set aside for the cane growing. This is very difficult considering that the average number of farmers own not more than 1 hectare of land. The main challenges facing crop production in this area is the *Kayongo* (Striga), the weed, when it grows in the farm, farmers cannot harvest anything. It is very expensive for small scale farmers to acquire inputs, they end up planting their local varieties which are not yielding much. Cassava is also infected with diseases. Our local varieties used to do well but they are now extinct. We are now planting Magana from Uganda which is yielding low due to rotting. Some farmers can harvest good yields from their farms near the swamp but the monkeys are a big threat. Farmers are forced to keep dogs to act as security.

Source: Field study 2011

Box 2: **Recorded interview with a key informant from REFSO**

Researcher: What is REFSO and does REFSO do?
Francis : This is a NGO which was formed in 1996 to address the problems of food insecurity and natural resource management. It is working in Busia Kenya and Busia Uganda. Our organisation does technology transfer from research institutions. We are working with KARI– Alupe which specialises on maize, beans, cassava sorghum, millet, sweet potatoes among others. Our main interest is on cassava and sweet potatoes.
Cassava has been faced with Cassava Mosaic Diseases in this area since 1999.Together with KARI we are trying to provide groups of farmers with already developed diseases resistant cassava cuttings. The farmers are doing the bulking then they will divide the cuttings among the group members. The sweet potatoes came into picture when the cassava diseases became a problem. Of course we are encouraging the orange fleshed. This is funded by ASEREKA.
Researcher: So why cassava and sweet potatoes?
Francis: We have realised that our small scale farmers cannot afford the hybrid seeds for maize and fertilizers. The cost is too high and cassava is what these farmers used to grow before maize came into the picture. There are also few stockists in the area that supply certified maize seeds and fertilizers. If we can manage to restore cassava in the area, there is a big potential. The varieties we are distributing take six to nine months to mature.
Which varieties are these?
Francis: We give Mijera, SS4 and H95/183.

Source: Field study 2011

Box 3: Kenya Orphans Rural Development Programme- Program officer

This organisation was formed in 1995 in central province then stretched its activities to Busia. We are involved distributing food to HIV/AIDS affected households. Also KORDP has Early Childhood Development centres (ECDs) for the orphaned children. We distribute maize and beans.
The food is not bought from farmers within because they do not have much. We also have some farms where we plant our own maize. Of course we are an organisation. We can afford to purchase the hybrid seeds and fertilizers. The farmers are not able to afford these inputs. Their yields are low because they plant low quality seeds and they cannot boost the fertility of the soils because they lack funds to buy the fertilizers.
Well maybe with time we may need to change our strategy because food distribution is not sustainable

Source: Field study 2011

Box 4: Interview response from One World Development Foundation

Activities: The organisation is involved in promoting vegetables; Kales (sukuma-wiki) and tomatoes and constructing toilets. These are activities for the HIV/AIDS affected households. We are doing rice farming in the neighbouring Budalangi district.
On the achievements I would say that i have seen crimes reduce in this area because we engage the youth in our activities and increased household incomes generated from the sale of vegetables.
The women and the youth are out target groups. The women are more affected by HIV/AIDS than men and also they spent most of their income on household needs.
The main challenges I would say are HIV/AIDS ,Pests and diseases, monkeys, Striga Bacterial wilt in the soil which makes it difficult to plant tomatoes, overpopulation, reduced soil fertility, lack of indigenous varieties for the traditional crops, lack of seeds in the time of planting or the finances to purchase seeds, reduced productivity, lack of technology, no cash crops. The attitude on the traditional crops has changed, People prefer to plant maize.

Source: Field study 2011

Annex 4: Success stories on maizeprodution

Box 5: Case of Malawi subsidies on inputs

Box 1: OPVs versus Hybrids

In Malawi and throughout Africa, there is debate about the relative merits of OPVs and hybrid varieties of maize [45]. Smallholder maize production in Africa has traditionally been based on the use of OPVs, whereby the seed is retained from year to year. Over time, through farmer selection, these traditional OPVs, known as landraces, become well adapted to the particular farm environment. Improved OPVs have been bred and selected for special characteristics such as drought tolerance and disease resistance. Seed can be recycled by farmers for a maximum of three years without significant yield loss. OPVs typically yield 10%–25% less than hybrids [45].

Hybrid maize is produced by crossing two genetically unrelated inbred parents. The resulting seed exhibits hybrid vigor, but recycled hybrid seed will not breed true in subsequent generations, and can result in yield losses of 30% or more, reducing and perhaps eliminating any yield advantage in subsequent planting [45]. Hybrids are more uniform and generally higher yielding than OPVs. The Government of Malawi launched a hybrid breeding program in 1950, following a severe drought in 1949 [46]. The first hybrids were released in 1958 and by the 1990s were adopted by about a quarter of Malawi's smallholders. Research indicated a consistent yield advantage of hybrids over local maize varieties at all levels of fertilizer use, including in a drought year [22,47]. This yield advantage of hybrids remained even under low soil fertility and drought conditions.

On balance, the yield advantage of hybrids appears robust for smallholder maize production in Malawi. However, the choice of hybrids versus OPVs is constrained by a complex set of factors including the higher seed cost and the often poorer storage and processing characteristics of hybrids [47]. During the second year of the Malawi input subsidy program, voucher recipients were given a choice of OPV or hybrids: 2 kg of hybrid seed or 3 kg improved OPV, depending on supplier costs. Based on coupon redemption, 76% of farmers chose hybrids over OPVs [29]. Thus, in Malawi, there is clearly a strong farmer preference for hybrids over improved OPVs provided that the prices of seed and fertilizer are subsidized.

Hybrid seed is generally more expensive than OPVs because of the higher cost of seed production and private sector control over supplies. Farmers in lower potential environments often find it difficult to recover the costs of hybrid seed and fertilizer. In the absence of deep subsidies to both seed and fertilizer, risk perceptions of small-scale farmers, especially in low potential rainfed environments, have been shown to constrain adoption of hybrid maize [47,48].

Source: Denning,et al.2009

Box 6: Methods of combating Striga weed

Advantages and disadvantages of different *Striga* control technologies

Control	Advantages	Disadvantages
IR maize	Improves maize yield while reducing *Striga* biomass and seed bank in the soil	Proprietary germplasm requires negotiated access, seed must be coated with herbicide
Tolerant varieties	Maintains maize yield under modest *Striga* infestation	Does not reduce *Striga* infestation, overwhelmed under severe *Striga* infestation
Push-pull	Compatible with IR and tolerant varieties, reduces stem borer, lasts several seasons and provides livestock feed	Difficult and slow to establish, more difficult to weed, no opportunity for grain legume intercropping, lowers net return
MBILI	Compatible with IR and tolerant varieties, increases options for intercropped pulses	More difficult to plant and weed, requires several accompanying technologies
Legume Smother	Produces higher value oil seed, reduces *Striga* biomass and its seed bank in the soil	Requires large amounts of legume seed and maize must be grown in rotation, increases P requirement
Herbicide application	Compatible with IR and tolerant varieties, kills *Striga* shoots, suitable for different cereal crops	Expensive, seed bank unaffected, precludes legume intercropping, requires several accompanying tools and technologies
Trap cropping	Low cost, *Striga* lifecycle disrupted, seed banks reduced, provides livestock feed	Shortens crop growing season, larger labour requirement, little economic return

Source: AATF report, 2009

Box 7: IR maize against Striga in Vihiga district

Teresa Lubusi, Vihiga. *I stopped growing maize for three years because of poor yields resulting from* Striga. *Before that time, I would harvest only 60 kg of maize from my 1.5 acre plot causing my family to endure severe food shortages. Since the introduction of IR maize, I now produce enough maize to feed my family. Last season, I harvested 135 kg of maize from only one kg of seed planted on one-tenth acre* (400 m^2). *My neighbours were very curious about the sudden improvement in my farm and I encouraged them to plant IR maize too.*

IR maize (left) permitted Teresa Lubusi to re-establish maize on her Striga-infested smallhold in Vihiga.

Source: AAFT report 2009

Box 8: Indigenous poultry project

Most indigenous poultry flocks average less than 20 birds per household (Okuthe, 1999; Okitoi *et al.*, 2000; Staal *et al.*, 2001). Inputs into this system are limited. The investment cost of establishment is small since young or breeding stock are often provided as gifts or on loan and housing is limited to shutting the birds up in the household kitchen at night. Thus capital and recurrent costs are very low. This system is therefore well suited to very poor households where women or children are normally entrusted with poultry keeping. The occasional sale of birds involves little or no additional marketing cost

The Indigenous Poultry project was implemented by scientists in KARI-Kakamega in Western Kenya using technologies developed at KARI-Naivasha. Gender concerns were identified and incorporated into the project right from the problem diagnosis-implementation. Participatory rural appraisals were conducted to identify major constraints to this enterprise. These constraints include: disease outbreaks, death of young chicks, predators menace, lack of veterinary assistance, inputs, capital for purchasing supplementary feeds and constructing housing for birds. KARI and its key partners intervened by training farmers on the protection of young birds, brood management, housing, supplementary feeding technologies, development of affordable technologies and an elaborate, sustainable disease control programme. Gender analysis showed that women played the major roles in the indigenous poultry enterprise and as such there was need to target all household members in the project activities.

Purchases and vaccination of birds were done in a group to safe on cost and ensure proper timing. The Ministry of Agriculture's recommendations on poultry house was replaced by an improvised mud-walled and grass-thatched house with sticks instead of wire mess for ventilation. Supplementary feeding requirements included home-made rations of the locally available cereals, fish meal and termites.

Box 8: Poultry project
Source: http://www.fao.org/DOCREP/ARTICLE/AGRIPPA/557_en.htm

Annex 5: PHOTOS

Photo: Group photo with members of ABA after the focus group discussion

Photos depicting various situations in the area

1. maize felled down by termites
2. Millet which has no Striga Infestation
3. Maize Infested with *Striga* weed
4. Arrow roots planted near the swamp area.