

**FOOD PRODUCTION AND FOOD SECURITY OF SMALLHOLDER FARMERS
AND THEIR SUPPORT BY THE COUNTY GOVERNMENT OF SIAYA, KENYA**

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DECLARATION

This research project is my original work and has not been presented for award of degree in this or any other university.

Signature..... Date.....

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This research project has been submitted with my approval as the university supervisor.

Signature..... Date.....

PROF. PRESTON CHITERE

DEDICATION

This research project is dedicated to my sister Pamela Odunga, my Wife Nancy Atieno and my in-law Julius Odhiambo for their sacrifice, love, support and encouragement throughout this course.

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ABBREVIATIONS AND ACRONYMS

CIDP:	County Integrated Development Plan
FAO:	Food and Agriculture Organization
GDP:	Gross Domestic Product
IFAD:	International Fund for Agricultural Development
KARI:	Kenya Agriculture Research Institute
KGs:	Kilograms
KSH:	Kenya Shillings
MoA:	Ministry of Agriculture
UNEP:	United Nations Environmental Program

ABSTRACT

Over the years, smallholder farmers in Kenya have been facing several challenges that have contributed to reduced crop production and food security among them. In Siaya County there is food deficit due to reduced crop production. The purpose of this research was to establish food production and food security of smallholder farmers and their support by the county government of Siaya, Kenya. The study objectives were to assess level of food crop production in the study area, to examine the farmers level of crop husbandry and associated yield, to establish the effects of farmers characteristics on their food production and food security and to examine the county government's extension service level of support of the farmers and its influence on food production and food security. The research design employed in the study was cross sectional descriptive survey which sought to obtain data that were to describe the existing status of household food security and coping strategies among the smallholder farmers. A total of 116 smallholder farmers' households were randomly sampled from the total population of 580 smallholder farming households in the sub-county. Additionally, data was collected by use of structured questionnaire, observation, and key informant interview guide. Data analysis was done using SPSS (Version 21.0) computer software program. Frequency tables and bar graphs were used to present the findings of the study. The results revealed that farm husbandry remains a problem to many smallholder farmers in Siaya County with only 24.1% were considered to have adopted farm husbandry; this may be attributed to the cost of farm inputs in the area and low extension services. Also, most farmers do not attend field days and only 17.2% have access to credit. Majority of farmers (58.6%) were not food secure and 41.4% were food secure. Reduction in size of meals was the major coping strategy. The county government should avail subsidized seeds and fertilizer in good time and make it accessible. Proper sensitization should be done by county extension officers to all smallholder farmers about the available extension services and county government should provide sufficient facilitation to county extension officers to promote extension services. Farmers should be encouraged to form groups in order to access credit services for their produce and acquire farm inputs collectively.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Food security is the accessibility of enough quantity of food. A home is regarded food secure when its inhabitants do not live in or fear starvation. According to FAO (2010) food security, at the family, community, national, and world levels is obtained when all individuals, at every times, have economic and physical access to adequate and healthy diet to meet their diet wants as well as diet preferences for active and a healthy life. Agriculture remains the source of livelihood of many households in Kenya. Almost 25% of Gross Domestic Product (GDP) of Kenya depends on agriculture as the central income for almost 85 % of the rural population in the regions (MoA, 2009). Hence the segment has the major role in food security (IFAD report, 2009). The main crops grown in Kenya for consumption are fruits, beans, maize, potatoes, millet, cassava and sorghum. These are seven commodities (maize included) that build the base for food in Kenya as well as agricultural policy (Gitu, 2004). For several years, the Government of Kenya has been working towards achieving national and individual food security. Maize as the most vital staple food crop has declined in demand whereas the overall yearly on-farm production of food crops has trailed behind ingestion, causing food shortage, and thus inhibiting the attainment of ambition of food security in Kenya (KARI Report, 2011).

Maize is amongst the leading worldwide cereals that feed the world (Shiferaw et al., 2011). Maize, together with wheat as well as rice, dictate the diet of humans (Ignaciuk, 2014) and offer a minimum of 30% of the food calories of more than 4.5 billion persons in 94 developing nations. The first maize sufficiency in Kenya was achieved during the 1970's when production was high and the excess was exported. Recent tendencies demonstrate that the nation is struggling to achieve autonomy in key staples primarily, maize (AATF report, 2017). Muyanga (2007) associates the poor production to a number of factors including high incidence of pests and diseases, lack of enhancing technologies, erratic climatic conditions and hitches in accessing credit by the small farmers.

The reduction in productivity is also due to the widely practiced conventional production system that has contributed to intensified soil erosion, pollution of the environment and degradation as well as loss of indigenous crop variety and poorer health in the population (UNEP-UNCTAD-CBTF, 2010). Productivity could be improved through the use of necessary inputs; the costs of inputs, coupled with the low value market crops grown commercial pressures and marketing obligations have consigned rural populations into a poverty trap (UNEP-UNCTAD-CBTF, 2010). The Other factors contributing to poor farming systems are lack of community engagement, retrogressive cultural practices especially among the communities, environmental factors and economic factors among others. Experts are of the view that if Kenyan's farmers have access to water supply, fertilizer and seed, they would feed the whole country. Data indicates that over 36% of the Kenya people live below the poverty line, and three quarters of these people are found in the rural setup whose lives depends on maize farming in the country.

A study by Olwande et al, (2009) indicates that education, age, existence of a cash crop, credit, and distance to marketplace as well as agro-ecological apparent considerably influenced production of maize by smallholder peasants. Wanyama et al., (2009) in Kenya revealed that extension officers visit to peasants, household head, land size under production of maize, and agricultural training meaningfully affected the probability of farmers embracing farm machineries in production of maize. Maize is the leading staple food of over 85% of Kenya's population. The per capita consumption arrays between 98-100 kgs which converts to at least 2700 thousand metric tons, per year (Nyoro et al., 2004). Small-scale production accounts for about 70% of the total production. The outstanding 30% of the output is from large-scale money-making producers (Export Processing Zone Authority, 2005). Small-scale manufacturers primarily cultivate the crop for subsistence, holding up to about 58% of their entire output for home consumption (Mbithi, 2000). Poor climate is liable for the low maize output in some years. However, harvests have also stayed at an average of 2 tons per hectare below the imaginable 6 tons per hectare a state accredited to insufficient absorption of recent production technologies like high yielding maize assortments and fertilizers due to absence of access to credit, high input costs, and scarce extension services to small-scale manufacturers (Kang'ethe, 2004).

1.2 Statement of the Problem

Food crop farming has been the leading source of income for the inhabitants of Siaya County where formerly the farmers focused on the farming of traditional crops (maize, sorghum, cassava and millet) as food while cotton and sugarcane was their cash crops. The sugarcane and cotton industry collapsed in the region hence modifications in the lifestyles of the farmers in the area, since then the farmers have been concentrating on maize as the main crop to function as both food and cash crop. According to the Ministry of Agriculture and Extension Services, farmers are expected to observe certain criteria for better yield. They include early preparation of land, ensuring proper drainage, utilization of fertilizers, weeding in time and crop rotation. Farmers who observe these guidelines obtain more than 20 bags (90 kilograms each) of maize per acre. Similar guidelines are recommended for other crops such as sorghum, beans, millet and barley. However, small scale farmers rarely observe these guidelines hence steady decline in the production of food crops which cannot meet the needs of the population (FAO report, 2007). Over 70% of Siaya county population fully or partially depends on maize as a staple food. The reduction in food crop production has further been influenced by the fact most of the young people prefer white collar job to agricultural activities.

The Government and other development agencies have been spending huge sums of money to address food security concerns through projects and programmes but minimal success is realized. For instance, the government of Kenya has been increasing budgetary allocations to the agriculture sector from Kenya shillings 10 billion in 1992 to 104 billion in 2012 (BPS 2012). This increased funding to the sector is geared towards the improvement of access to inputs (seeds and fertilizers), expansion of irrigation schemes and post-harvest management. In the 2017/2018 financial year budget, the Government of Kenya allocated Kshs 70 billion to fund existing and new irrigation projects around the country in an endeavor to address food security. At the same time, the ministry of Agriculture sought Kenya Shillings 3 billion from the treasury to import maize from other countries to boost the country's strategic grain reserves for relief food security measures (BPS, 2018), an indication that the food security initiatives are not succeeding.

For instance maize productivity in Siaya County has declined over the last two decades and poverty levels have intensified (Ministry of Agriculture Report, 2014). On average maize yield is 8 bags per acre in Gem Sub-County compared to the average yields of 15 bags per acre in Alego Usonga. The challenge of decreasing maize is overblown by the fact that the population continues to grow yearly at a rate of about 4.3% resulting to reducing per capita consumption with a population density of 363 people per km². This reduction in food production has also brought about by the low support offered by the county government and agricultural departments. Therefore increasing maize productivity in Siaya County is of dire need and one of the essential means of improving food security. Even though it appears that there are many factors influencing food security, this study sought to investigate the factors influencing food production and food security among smallholder farmers and their support by the county government of Siaya, Kenya.

1.3 Research Questions

This research pursued to answer the following questions:

- i. What is the level of farmers' food security in the study area?
- ii. What is the influence of farmers' characteristics on their food production?
- iii. What is the level of food husbandry and its production in the study area?
- iv. What support has the county government provided to farmers on their food production?

1.4 Main Objective

The overall aim of this research was to evaluate the contribution of food crop production in food security for the smallholders in Siaya County.

1.4.1 Specific objectives

- i. To assess the level of food security of the farmers in the study site
- ii. To establish the effects of farmers characteristics on their food production and food security.

- iii. To assess level of food husbandry and food production in the study area.
- iv. To examine the county government's extension service level of support of the farmers and its influence on food production and food security.

1.5 Justification of the Study

It was expected that the result of this study, was to help in reviewing national and local food security policies particularly in the accuracy, design and implementation of food security initiatives and rural development projects. The study also expected to assist decision makers particularly on the funding policy modes to review the policies to target the resource to the poor, vulnerable groups and appropriate areas and ways of implementation of projects in addition to exploring other ways of funding projects. Finally the study results hoped to enable policy makers to formulate, design and implement policies that would create enabling environments for sustainable project successes and private sector involvement in food production projects. To the general public in Kenya the findings of this study will provide information on their role in food security and the importance of small-scale farmers in the country in relation to food security.

1.6 Scope and Limitation of the Study

This study focused on food production and its effect on food security among smallholder farmers in Siaya. Even though small scale farmers engage in other food production activities, this study will focus on staple food crops such as maize, millet and beans.

1.7 Definition of Key Concepts

Cost of production: These are inputs used in maize production such as labour and finances employed.

Extension services: education programmes by various stakeholders to help farmers increase their maize production

Farm husbandry: This is the practice of growing crops, managing a farm, and breeding animals.

Farmers' characteristics: These include factors such as gender, age, family size, size of farm.

Food security is described as the accessibility of food and one's access to it. A home is regarded food secure when its inhabitants do not live in or fear starvation.

Input Subsidy: A benefit given by the government to groups or individuals usually given to remove some type of burden for example to reduce the cost of production. In this study it refers to the certified seeds or planting materials and commercial fertilizers given to farmers to boost their farm productivity.

Resource allocation: The framework within which resources are allocated to the farmers.

Small scale farmers: Those farmers practicing their farming activities in less than 5 acres of land.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter reviews the already existing literatures based on the objectives of the study. It commence with empirical literature, identification of knowledge gaps, theoretical framework and then conceptual framework.

2.2 Agricultural Extension Services in the Study Area

Extension services are meant to bridge the gap between the farmers and the sources of information or knowledge. Such sources included organisations or institutions generating knowledge and technologies such as research centres, universities and administration.

This was based on what Comptom (1989) called traditional model or technology transfer.

Research —————> Extension —————> Farmer

Semana (1998) explained the understanding of extension concept as based on three premises namely being educational, having a philosophy and scope with responsibilities. The educational element of extension is two folds: being informal and formal and providing extension information based on the setting and condition of the farmer for better conceptualization. Agricultural extension is very vital for the smallholders in developing countries such as Kenya.

Agriculture sector is the backbone of the Kenyan economy. It contributes approximately 29% to the GDP directly and another 27% indirectly via links and services with other subdivisions. The sector accounts for 65% of the country's export earnings; offers 18% of formal and 80% of informal employment in rural areas. The sector has been supported by agricultural extension and advisory services which have been undergoing continuous changes in dissemination delivery approaches. The Kenyan agricultural sector predominantly consists of smallholder producers, processors and marketers. These characteristics of the sector have important implications for the extension and advisory

services in terms of approach and content. Extension services have a vital role in delivery of knowledge to smallholders GoK Report (2017).

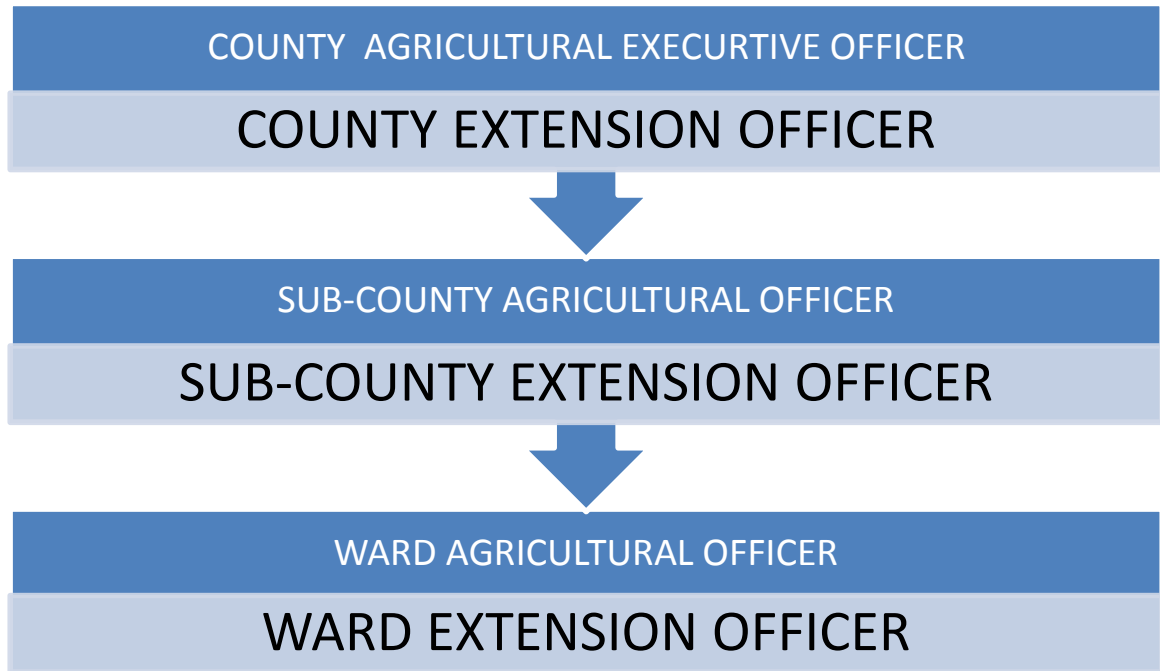
Agricultural extension services refer to the practice of working with peasants or societies to support them obtain relevant and beneficial information and skills to upsurge farm competitiveness, food security among the farmers. Siaya County being populated with smallholder farmers, agricultural extension is vital to all the households carrying out agricultural activities. Even though extension services are important to crop production and farm husbandry, these have not been as comprehensive as it should be expected.

According to Siaya County CIDP (2017) some of the objectives of the extension service are:

- a. Create a conducive environment for agricultural growth through review of the recent policy and legal framework;
- b. Facilitate increased productivity as well as agricultural output through advisory support services, improved extension, and technology application;
- c. Promote product and market development by embracing a value chain approach;
- d. Promote environmental conservation and natural resources through sustainable land use practices;
- e. Restructure and privatize non-core functions of the ministry and its institutions and toughen private–public collaborations;

The Siaya County extension services are organized as shown in the figure below

Figure 1: Organization of extension services in Siaya County



From the above organogram the extension services are managed from county level to the ward level. Each level has extension officers who are responsible for advising farmers on agricultural practices expected of them.

Some of the functions that agricultural extension officers carry out in Siaya County according to CIDP (2013-2017) are as follows:

- a) Knowledge and information transmission: County extension officers have been using various means to pass information to the smallholder farmers. They do this through capacity building of the farmers and giving them technical skills expected to help them manage their farms.
- b) Facilitate the access of credit and inputs: This function has been for a long time carried out by private extension officers from certain NGOs such as One Acre Fund which has managed to help smallholder farmers obtain good harvest from their farms. According to last harvest, most farmers who benefited from such services managed to get up to 15 bags of 90 kilograms per acre.

- c) Enforcement of County Policies and declarations for instance soil erosion and tree planting. The county extension officers have been assisting farmers by building gabions and dykes along the river banks. They also freely give tree seedlings to the farmers. This helps to maintain soil fertility.
- d) Advocate and lobby on issues of county, national, regional and international interest in relation to agriculture. This is done through Farmer Field School ‘*classroom without walls*’ method is quite effective in imparting skills and knowledge to farmers. They are taken through the full cycle of an agricultural enterprise that is the whole farm husbandry process.
- e) Farmers education: Agricultural shows, field days and exhibitions are group approach extension methods that increase and improve efficiency in the delivery of extension services through showcasing technological innovations, best practices and optimal use of resources for improved agricultural and land productivity. This has been happening every year at the county headquarters and most smallholder farmers do not attend due to distance and entry fee which sometimes is charged on individuals.

Even though the county government provides the above function through extension officers most farmers have not accessed them due to distance and cost involved which they may not afford. Some of them also consider attending agricultural shows and demonstrations as not helpful to them. The extension officers also lack facilitation to reach out to the smallholder farmers who are the majority in the region but instead they attend to large scale farmers.

2.3 Food Security and Food Production

Food security is a concept that implies the ability of people to having access to plenty of quantity and quality food. The description for food security has continued to be relative for over fifty years, (Gross et.al, 2000). The opening theme was food accessibility to balance uneven food supply regionally as well as nationally. The main model contained “adequate, suitable and secure supply of food for everybody” adopted in 1943. Gross further expounds with the understanding that aid in form of food could be an obstacle of progress for self-

reliance, in the 1960s; there was food institutionalization for growth resulting in the creation of World Food Programme. During the 1980s, the meaning was widened to accommodate both economic and physical access to food. According to FAO (2001), at the individual, family, national, regional, and international levels, food security is realized when individuals, at all times, have social, economic and physical access to adequate, safe, and nourishing diet to meet their nutritional wants as well as food preferences for an active and robust life. The features of food security as delineated in Parliamentary Office of Science and Technology report (2006) as a result include: availability, accessibility utilization of nutritional products and availability both locally and at all other levels.

Maize was introduced in Kenya by the Portuguese in 1496 when they reached the coastal Kenya amid other food crops that they had learnt in Brazil. These comprised of pineapple, chillies, bananas, sweet potatoes and peppers, (McCann, 1999).

2.4 The level of food crop production in Siaya County

In Kenya, food insecurity has remained a challenge. For instance, between 2004 and 2008 about 33% of Kenya's population experienced chronic food insecurity (FAO, 2005; FAO, 2011). Food insecurity continued to deteriorate and by 2012, about 10 million people were food insecure (IFPRI, 2012; WFP, 2009). Inadequate food has been singled out as one of the most important causes of food insecurity and is attributed to among other factors; insufficient domestic production and imports. This has been due to low crop productivity and high poverty rate which limits access to food because households have no sufficient means to pay for the required food (Glopolis, 2013; FAO, 2006). Several research works associate household food security status to household social and economic factors such as education level of household heads, household size and size of land owned (Walingo *et al.*, 2009; Volege, 2005). Grimm (2012) also found that factors causing food insecurity in Central and Western highlands of Kenya were multi-dimensional and included high prices of agricultural inputs, poor marketing structures, poor agricultural practices, inaccessibility to credit and extension services.

The attainment of national food security is a fundamental objective in the sector of agriculture. Food security in this case is well-defined as “ a state in which all persons, at all times, have social, economic and physical access to adequate, safe and nourishing food which meets their nutritional needs and food preferences for a healthy and active life” (Kenya Food Security Steering Group, 2008). In the current years, and particularly beginning from 2008, the nation has been facing adverse food insecurity problems. The problems are portrayed by a high proportion of the populace having no access to food in the precise quality and amounts. Official estimations point out over 10 million individuals is food insecure with most of them living on food aid. Families are also experiencing vast food bills due to the high food costs. Maize being staple food due to the food preferences is in short supply and most families have restricted choices of other food stuffs.

The current food insecurity difficulties are credited to numerous factors, including the regular famines in most areas of the country, displacement of many peasants in the high potential agricultural regions succeeding the post-election violence which happened in early 2008, high worldwide food fees, high costs of domestic food production due to high prices of inputs particularly fertilizer, and low buying power for large proportion of the populace due to high level of poverty (KARI, 2008).

There is a main shortage of food for majority of inhabitants in Siaya. Siaya County harvests food that can last for a period of nine months in a year. The three months variance is obtained from the adjacent counties and even from Uganda. This production is nevertheless not steady and hence food breaches go up to eight months in deprived seasons. The main reason for this poor production has been restricted space under food crops, poor crop husbandry, and high post-harvest losses which have been fueled by bad timing and the traditional storing amenities universally used by the community (CIDP 2017). Siaya County has abundance of land for agriculture of up to 2059 km², high irrigation potential and set market for agricultural produce. With all these advantages, Siaya County is still food insecure due to inadequate funds to facilitate extension services, absence of interventions for vulnerable homes to embark on agricultural activities, high cost of farm inputs, unpredictable rainfall and many other factors.

2.5 County government extension support and its influence on small scale farmers' food production

According to 2010 constitution agriculture is one of the devolved functions. Each and every county therefore, is expected to carry out extension in collaboration with other agencies to ensure food sufficiency in their respective counties. They avail various resources to extension services availability of resources is one of the main factors in implementation of agricultural activities, (Amade, Ogbonna and Kaduru, 2010). Agricultural activities may fail because they are poorly funded or given short period for funding. The project manager in agriculture sector must be experienced. Using inexperienced project groups with poor practical skills result in low quality of project delivery and design (Kaduru, et al, 2010).

The extension service is one of the programmes under the Ministry of Agriculture (MOA) and the county government that is responsible for guaranteeing production of food that is enough for subsistence trade (Wesonga, 2011). The aim of the extension service is to transmit skills and knowledge to the farmers to raise their production. Use of fertilizers, cropping schemes and certified seeds are essential for food crop production that the extension workers must transfer to the farming families.

Access to extension services is essential in encouraging acceptance of new agricultural production skills because it can counter balance the undesirable effect of privation of years of formal education in the general choice to embrace some technologies (Yaron *et al.*, 1992). Access to extensions services hence forms the stage for procurement of the appropriate information that endorses adoption of technology. Access to information through extension services decreases the distrust about the performance of a technology therefore may alter people's assessment from purely subjective to objective over time thereby enabling adoption. Interrelated to this is access to extension services which was also found to be positively linked to the adoption of recent agricultural production technologies and was found to be significant at 10% level. This means that farm houses are more likely to embrace new agricultural production technologies in case they have access to extension services. Extension services are one of the major movers of the agricultural

sector and have been considered as main means of dissemination of technology. Visits by extension agents to peasants and participation of the latter in tours, field days, seminars or agricultural shows are cost effective means of reaching out to farmers with modern maize technology. Regarding the visits, which were paid by extension agents, 41% of homes in western Kenya professed getting at least one visit by extension agents. About 78% were adopters and only about 27% were non-adopters demonstrating the low output of extension services which perhaps impacted adversely on adoption decision (Mignouna *et al.*2010).

Inputs like pesticides, fertilizers, and quality maize seeds are a necessity for food production especially maize farming. The debate has been that Kenya has the exorbitant production costs in East Africa, as opposed to Tanzania and Uganda. With high manure usage rates in Kenya, equated to other countries in the region, its output is not commensurate with the inputs. Subsidized plus sufficient farm-inputs for smallholder farmers have helped to improve food production. Study by Chibwana and Fisher (2010) on the impacts of agricultural input subsidies in Malawi has revealed that farm input subsidy on fertilizers and certified seeds enhanced crop production in the year 2008/2009. Denning *et al.* (2009) accounts food crop production in Malawi almost grew three times from 43% to 53% surplus in two years period. A study by Smale (2011) has revealed that ready accessibility of fertilizers and seeds for farmers' results in an improved crop yields and thus improving the security of food of the farming families. In Siaya the smallholder farmers use both hybrid and local maize seeds. According to Odendo *et al.*, (2002), local seeds for example *Jowi Jamuomo*, (a charging buffalo) and *Ke-Buganda* are broadly planted in Gem sub-county, since they are alleged to survive in low rainfall area and low soil fertility. The smallholders disclose various ways of choosing their seeds.

Among the ways used, include timely maturity as well as resistance to drought, high yield, seed prices, ability to resist diseases and capacity of the seed to perform well without fertilizers usage plus resistance to pests. Mateete (2010) mentions that smallholder farmers depend on locally available manure and seeds, rather than bought farm inputs since their urges to produce food crop are driven by subsistence view rather than commercial agriculture. Sanginga, *et al* (2010) suggested that fertilizer packaging should be in smaller

quantity which are affordable to the low income farmers and creation of awareness and constant distribution as an improvement for the smallholder farmers to have access to fertilizers.

Siaya county government has put in place 3.6 million towards extension work and subsidy for the farm inputs for the period 2013 to 2017 (CIDP, 2013-2017). Even though such resources have been allocated by the county, the community is still food insecure due to lack of knowledge of the best seeds to plant and where to solicit for help in case of diseases attacking their crops. This shows a problem of extension services which has been accessed by many farmers. At the same time, county government has not come up with the credit plans for the smallholder farmers within Siaya County. In Bar Sauri village of Gem sub-county where output was improved from 1.0 to 5.0 tons/hectare, it is recognized that the smallholder farmers were given chemical fertilizers and certified seeds Nziguheba et al, (2008).

2.6 The effects of farmers' characteristics on the food production

Socio-economic circumstances of farmers are the most stated factors prompting adoption of technology. The variables most frequently included in this classification are education, age, and landholding size, size of the household and additional factors that point out farmer's status of wealth. Peasants with larger land holding size are presumed to have the capacity to buy developed technologies and the ability to bear risk if the technology fails (Feder *et al.*, 1985). This was confirmed in the fertilizer case by Nkonya *et al.*, (1997) the past researches have displayed that availability of services plus resources such as credit differ by individual gender and the family head. It was hypothesized that this could negatively or positively impact on the usage of fertilizer and soil attrition information technologies, Hassan *et al.*, (1998).

Level of education of a farmer is very vital as it defines the technology adoption by the individual farmer. Education boosts the capability of decision-makers by allowing them to reason critically and apply sources of information ably. Highly educated farmers should be cognizant with sources of information, and efficiently interpret and evaluate information

about innovations than those with low level of education (Wozniak 1984). Education was found to positively affect taking on of improved crop varieties in Tanzania (Nkonya *et al.*, 1997).

Similarly, Association of Farmers' Organizations create awareness on the part of the smallholders in relation to existing and modern methods of cultivation. With high level of awareness of the availability of upgraded farm inputs tied to information on their applicability, the adoption level and intensity usage of fertilizer would rise. These interpretations have also been stated by Chukwuji and Ogisi (2006).

Farming of large farm sizes makes it more cost-effective for smallholders to apply fertilizers. Furthermore, the larger the size of farm cultivated and therefore output produced, the more commercialized the farm would be. Increased education levels among peasants and contacts with extension agents result in improved knowledge of input usages and their application since unacquainted of the uses and misuses of inputs in crop production could dishearten peasants from using them. These results are in line with the reports of Daramola and Aturamu (2000) who discovered that contacts with extension agents as well as attainment of formal education exposes the peasants to the availability and knowledge of innovations and upsurges their interest for acquiring them. The high and positive effect of off farm incomes on the farmers' adoption indices is an indication that they need improved fiscal bases to embrace better farming technologies. Similarly, gender issues in agricultural production and adoption of technology have been examined for quite some time. Most of such studies demonstrate diverse evidence about the diverse roles males and females play in adoption of technology. Doss and Morris (2001) in their study on factors influencing improved maize technology adoption in Ghana, and over field and Fleming (2001) studying coffee production in Papua New Guinea illustrate insignificant effects of gender on adoption.

2.7 Farmers level of husbandry and associated yield

Husbandry deals with the countless phases of crops from seed planting, on field and off-field processes, gathering, threshing, and storage and selling of the products. Agriculture

today is facing overwhelming challenges even though there have been tremendous achievements in science and agricultural production (FAO, 2011). First are the challenges connected with the Green Revolution of the 1960s in developing countries which used the industrial model to increase productivity (International assessment of agricultural knowledge, science and technology for development [IAASTD], 2009). The Green Revolution model used high-yielding varieties of crops, agrochemicals, irrigation and new management techniques to intensify crop production but this intensification was accompanied by unintended consequences like land degradation, over-extraction of groundwater, salinization of irrigated areas, buildup of pest resistance, increased costs of production, erosion of biodiversity, and the disintegration of economic and social conditions in rural communities (Gerald and Olofinbiyi, 2011). A second challenge facing agriculture is the increasing number of under nourished people in the world (FAO, 2011), majority of them being found in rural areas of developing countries (UNEP, 2012). A third challenge is the increasing demand for food and feed crops as driven by growing world population, changing urbanization trends, income growth in developing countries which is changing consumption styles, the usage of agricultural commodities in the production of biofuels and increased demand for cereals to feed livestock (Food and Agriculture Organization of the United Nations [FAO], 2013). A fourth challenge is the necessity to adapt to climate change, which through changes in temperature, pest incidence and precipitation will affect which crops can be grown and their potential yields (ICARDA, 2012).

Maize production from land preparation to the final stage when the produce is taken to the market involves a number of operations that impact on the profitability. The farming techniques touch on how land is prepared, the time planting is done, seed and fertilizer selection and usage, weeds and diseases control techniques, harvesting and storage etc. A migration from the tradition methods across the entire cycle to modern technology guarantees better sustainable yields. According to Jain et al., 2009, Agricultural technologies consist of all forms of improved practices and techniques which affect the growth of agricultural output. As Challa, (2013) notes, there is a relationship between inputs used and yields and those farmers who embrace improved agricultural technologies

realize improved production which results in overall socio-economic development. Adoption of enhanced agricultural technologies has been linked with: improved nutritional status; higher earnings and lower poverty; lower staple food prices; earnings for landless laborers as well as increased employment opportunities (Kasirye, 2010).

Use of traditional maize harvesting, drying, packaging and storage lead to losses before and after harvesting the maize crop. According to Compton, 1992; Republic of Kenya, 2004; Azu, 2002. Maize grain losses contribute to insecurity of food and low farm earnings not only in Kenya but also in other sub-Saharan African nations. Maize losses are witnessed at different stages including during staking, de-husking, transportation, drying, shelling, and storage. Timely harvesting also prevents attacks by weevils, rotting and theft. In addition, farmers need to embrace modern practices to manage acidity in soil which is one of the leading hindrances to maize yields in high potential areas.

The Kenya Government came up with distribution of subsidized fertilizer through the National Cereals and Produce Board to ensure small scale farmers access fertilizer to boost maize production. Studies carried out in Malawi indicate that there is an average growth in maize yields by accessing subsidized fertilizer. Chibwana et al. (2011) found that in the Machinga and Kasungu districts of Malawi, the average increase in maize yield from accessing subsidized fertilizer and subsidized maize seed is 447kg/ha for hybrid maize and 249kg/ha for local maize. Ricker-Gilbert and Jayne (2011) in their study findings point out that in Machinga and Kasungu.

Districts in Malawi, by accessing subsidized fertilizer, the average increase of yields per hectare is 447 Kilograms for hybrid maize and 249 Kilograms for local maize. According to Dorward (2009), a major worry with input subsidies relates to the magnitude of diversion and leakages of subsidized inputs away from their anticipated use. World Bank Report point at inefficiency and diversion such that real benefits to farmers were often very limited (World Bank, 1981).

2.8 Theoretical Framework

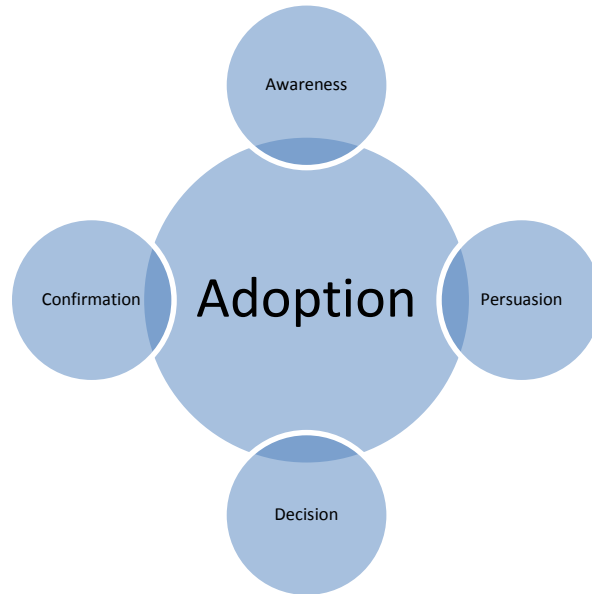
This study was based on the adoption theories of agriculture.

2.8.1 Adoption and Diffusion Theoretical Framework

Adoption theory of agricultural innovations can be classified into a variety of schools of thought, most prominently ‘learning and capacity building’, ‘innovation diffusion’, ‘participation and empowerment’, ‘farming systems’ and ‘farming styles’ theories. This study concentrated on innovation diffusion, learning and capacity building and participation and empowerment, and consider the implications of them for the adoption of agricultural innovations and the design of extension programs.

The method through which an innovation is passed through various networks over time among social system’s members is known as diffusion (Rogers and Shoemaker 1971). There exist three elements to the theory. The first element is a description of the process that individuals follow in making a choice about whether or not to adopt an innovation. The second element is a description of the innovativeness of persons and the spread of innovation through a population. The third element relates to the innovations characteristics that influence their relative adoption speed and diffusion. Rodger and Shoemaker (1971) proposed four models which farmers observe in order to adopt a given new technology. These stages include awareness, decision, persuasion and confirmation. In the awareness phase, the person has access to new ways hence develops knowledge some understanding of it. In the persuasion stage the individual gathers sufficient information to form an attitude, either favourable or unfavourable, toward the innovation. In the person seeks confirmation that they have made the correct decision. This illustrates how the agricultural training may be adopted by the smallholder farmers through creation of awareness, persuasion, decision and confirmation of the skills given to them.

Figure 2: Theoretical framework



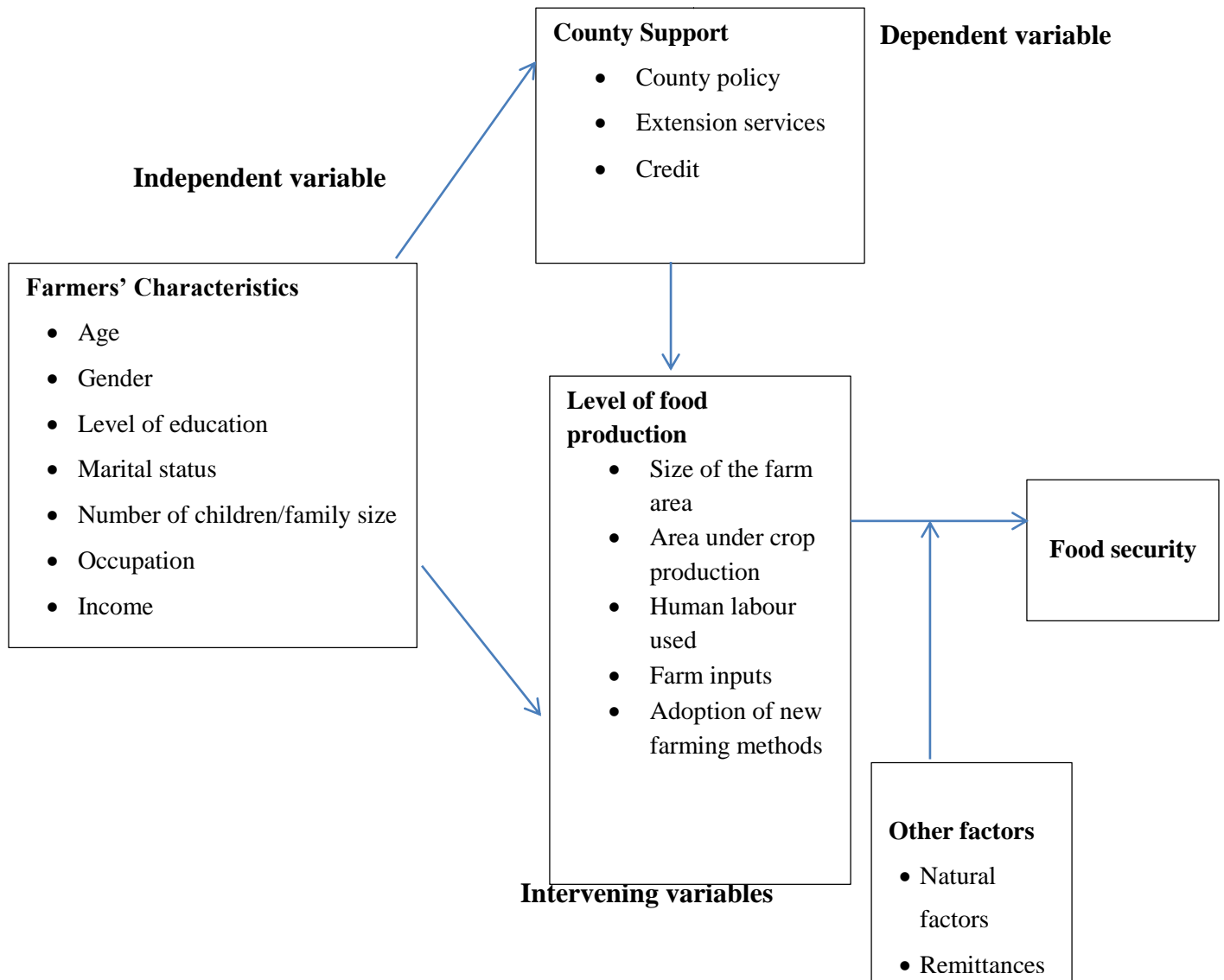
2.8.2 Theory of change

The study was also grounded in the Theory of Change by Mackenzie, M. and A. Blamey (2005). The change theory looks at an issues relating to credit, extension services. Many stakeholders in the smallholder support societies working at various stages of the agricultural value chain, through this they create a shared objectives for how these efforts combine to promote agricultural activities among the smallholders and environmental preservation, and recognizes that trust and shared value among smallholders is a major contributor to food security. According to the theory of change proponents, people are not passive but active participants and therefore have to actively play their role for the success of programs. In addition, understanding the context is very important in determining the causes. This research looks at food production and food security among small scale farmers. The study examines factors influencing food security in Siaya County with study site being Gem Sub-county. The study looked at how farmers characteristics, level of farm husbandry and county government support influence food security. A shift by farmers to a combination of use of certified seeds and organic fertilizer, modern farming techniques such as use of tractors and improved post- harvest management, incentives to farmers and favorable weather conditions have capacity to unlock small scale farmers food security.

2.9 Conceptual framework

Conceptual framework is a graphic exemplification of variables in a study, their operating definition and how they network in the study. It displays how the independent variables influence the dependent variable of the study. Below is a framework that illustrates possible underlying factors influencing food production and its security amongst small-scale farmers.

Figure 3: Conceptual Framework



Farm husbandry such as proper use of fertilizer, labour and land preparation, have a correlation to food crop production like Maize, Sorghum and Millet. Food crops production depend also on population features of the community of concern.

These may include gender, age, marital status, family size, income, occupation and education level of the farmer involved. County government support which includes extension services, policies and credit accessibility also had an influence on food security

which in this study was the dependent variable especially on adoption of new methods of farming and acquisition of farm inputs. Other factors like weather conditions will also influence the study's dependent variable.

2.10 Operational Definition of variable

Table 2.1: Operational Definition of Variables

Type of Variable	Indicators
Independent Farmers Characteristics	<ul style="list-style-type: none"> • Age measured in years lived • Gender as male and female • Level of education measured in years of formal education. • Marital status • Size of the family • Occupation and income
Intervening Variable Food crop husbandry and production	<ul style="list-style-type: none"> • Size of the farm owned by the farmer in acres • Area under crop production in acres • Labour used in the farm • Farm inputs which were seeds and fertilizers • Adoption of new farming methods
Intervening variable Extension services	<ul style="list-style-type: none"> • County policy • Extension education services • Credit
Dependent variable Food security	<ul style="list-style-type: none"> • Access to quality and enough food

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

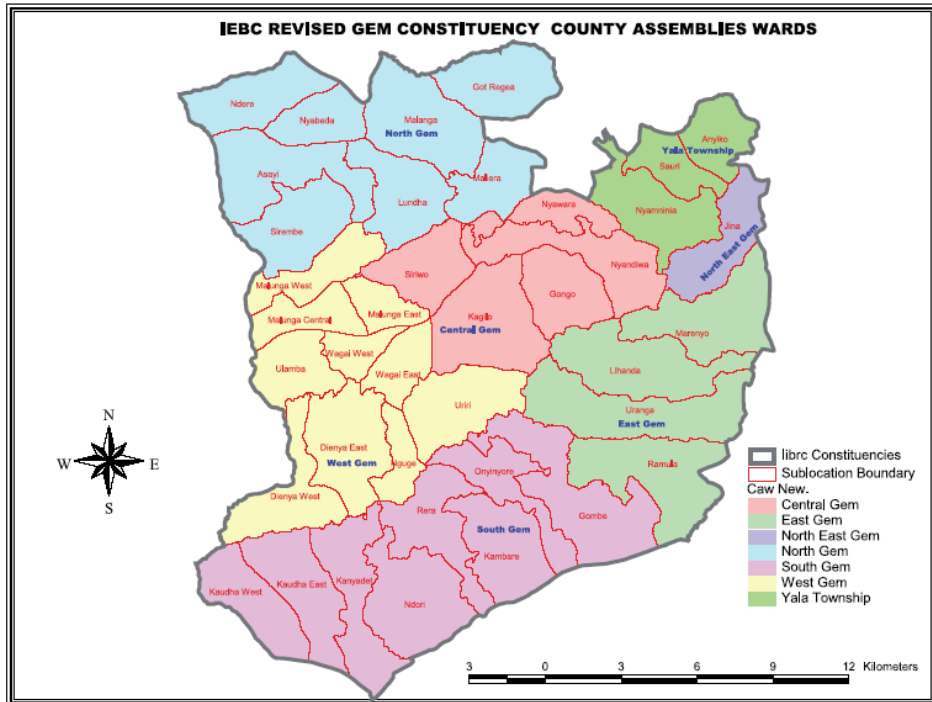
The chapter defines the methods which were used by the researcher. It emphasizes on: location of the study, research design, and procedures of sampling, research instruments and collection of data as well as analysis of data.

3.2 Study Site

Siaya is an administrative county in Kenya. It has six sub-counties namely: Alego Usonga, Gem, Bondo, Rarieda, Ugunja and Ugenya. It borders Busia county and Lake Victoria to the West, Kakamega to the North and Vihiga to the East. The county has a height above sea level of 1400 - 1400 meters. According to the population census of 2009, Siaya County had a population of 842,304 with 50.5% females and 49.4% males. The total number of households was 213,500 with a populace density of 332 people/km². Siaya County is primarily occupied by the Luo ethnic group. It covers an area of 2,530 square kilometers (Kenya National Bureau of Statistics, 2012). It has small scale farmers who plant various food crops. These small scale farmers have faced several challenges which have led to low food production resulting to issues of food insecurity compared to neighbouring counties where smallholders are able to sustain food security for their households. It is therefore necessary to study food production and food security of smallholder farmers and their support by the county government in Siaya County.

Out of the six, Gem sub-county has relatively high population of the small scale farmers with significant part of which is poor. It has about 41% of its population depending on agricultural activities. Apart from being with a high number of smallholders, farm husbandry is still an issue with a majority of the farmers not embracing modern ways of farming thus causing food insecurity in the area. This study will therefore be relevant to the Sub-county because the recommendations will help the small scale farmers to improve their farm activities by embracing appropriate farm husbandry.

Figure 4: A map of Gem Sub-county showing research sub sites



Source: Independent Electoral and Boundaries Commission (2013)

3.3 Research Design

The study collected qualitative and quantitative data. It employed cross-sectional design which is observational and descriptive in nature (Kothari, 2004). Cross-sectional research is mainly used to describe characteristics portrayed by a population, whereas, descriptive research design entails collecting data that describe a phenomenon. The data is then presented in visual aids such as graphs and charts.

In addition, descriptive research is designed to give an image of a phenomenon as it naturally occurs (Mugenda and Mugenda, 2003). In this study, descriptive research was employed to give a picture on the food production and food security of smallholder farmers in Siaya County.

3.4. Sampling frame

A sampling frame is that part of inhabitants under investigation from which a sample is obtained (Cooper & Schindler, 2003). This is referred to as a list of all characteristics in the desired population. The sampling frame was obtained from the population from which

the sample was drawn and to which the data from the sample was generalized. In this study, the sampling frame was small scale farmers.

Population is the full set of events or objects under study about which one desires to make inferences and the population of interest is homogeneous. In this study the population required was that of small scale farmers from Gem Sub-county living in Siaya County. According to the last population census of 2009, there were 4,398 households in the Sub-county (KNBS, 2010).

3.4.1 Subsites

Gem sub-county has five wards with each ward having more than 10 villages. These wards are West Gem, East Gem, South Gem, Gem Central and Yala Township wards. This study concentrated in West and South Gem wards which had unique characteristics of smallholders. According to KNBS (2010) West Gem had a population of 12,949 with the following sub-locations; Malunga West, Malunga Central, Malunga East and South Gem had a population of 10,532 with the following sub-locations; Wagai West, Wagai East, Uriri and Nguge. From the six sub-locations, a village was randomly selected for the study. These included Kanyibuop with 120 households, Nypiedho with 100 households, Sirembe with 80 households, Kanyimbok with 50 households and Ginga with 110 households respectively.

3.4.2 Sampling Procedure

The researcher went to the two chief offices who introduced him to the assistant chiefs who assisted in compiling the list of villages with the help of village elders who in turn gave the names needed of households in each village. Using the household lists the researcher used interval sampling technique to draw proportionate sub-samples from each village.

According to Mugenda and Mugenda, (2003), for descriptive studies, 10% to 20% of the available population is adequate for a sample. The researcher therefore took 20% of the population from each population stratum so as to allow the researcher to attain the desired representation from each stratum and also to ensure greater accuracy in the findings. Out

of each list, an interval of five was used to draw a sample of 116 respondents. The table below shows the name of each village sampled the number of households and the number sampled.

Table 3.1: Sampling Procedure

Villages sampled	No of households per village	No of Household Sampled
Kanyibuop	120	24
Nyapiedho	100	20
Sirembe	80	16
Kanyambok	50	10
Ginga	110	22
Kathomo	120	24
Total	580	116

The farmers were visited in their homes and interviewed 100 %, owing to support we received from village elders and agricultural extension officers.

3.4.3 Key informant

The study also used purposive sampling. This type of sampling technique denotes a procedure by which a researcher chooses a sample based on the expertise knowledge or experience of the group that is to be sampled. It was applied to select key informants who were extension officers within the Gem Sub-count on the basis of their stay in the area and experience level in the extension work. There were eight extension officers in the area and only five agricultural extension officers were selected since they were the ones with such set criteria required by the researcher.

3.5 Validity and Reliability

The above instruments of research were tested as follows;

3.5.1 Validity

Validity is about drawing warranted conclusion on a situation based on the data obtained from a study. An instrument is valid if the research design fully addresses the research questions and the objectives the research has set.

The entire research instruments depended on the aims of the research work to ensure that they were all relevant. To ensure validity the research used expert judgment of the supervisor in combination with the pilot testing of the instruments in which questions with the problems or which gave an unexpected answers were modified to avoid their misinterpretation. The final questionnaire was then developed on the basis of research objectives.

3.5.2 Reliability

Reliability refers to a measure of the consistency to which an instrument of study brings same findings (Mugenda & Mugenda, 2003). The researcher did a pre-test of the questionnaire for reliability in ten (10) randomly sampled households in two villages in Central Gem which were not included in the study.

3.6 Data Collection and Analysis

The researcher got an introductory letter from the University of Nairobi which he used to assist in self-introduction to the farmers and key informants while in the field. One hundred and sixteen (116) questionnaires were administered to the selected respondents in a 14 days interview program organized by the researcher and his assistant. The researcher administered the questionnaire by reading the questions to the respondents and then he filled the responses in the spaces in the questionnaires. The filled in questionnaires were later collected for data inputting and analysis.

The researcher employed descriptive statistical techniques to analyze the collected information. The questionnaires were cross-checked to make certain that the questions were all answered. Data was initially separated into themes and sub-themes before being analyzed. Percentages and frequencies were employed in the analysis and displayed in a

tabular form to improve data interpretation. The percentages and frequencies were employed to determine food production and food security of smallholder farmers and their support by the county government. Quantitative data were entered into excel sheet and then exported to SPSS. Data were analyzed as guided by conceptual frame-work.

The chi-square test of independence was commonly used to test statistical independence or relationship between two or more categorical variables. The tests of independence only assessed the relationship between categorical variables and could not give inferences about causation. The test used cross-tabulation to analyze data.

Test Chi-Square denoted as X^2 and computed as:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where:

O_i = Observed frequency

E_i = Expected frequency

X^2 = Chi-Square

The degree freedom (df) = (k-1) * (j-1)

Where “k” is the number of levels in the row (one categorical variable) and “j” is the number of levels in the column in the contingency table.

The expected frequency counts are computed separately for each level of the row and column. X^2 value is then compared to critical value from X^2 distribution.

3.7 Ethical Considerations

Studies by Mugenda and Mugenda, (2003) show how ethical considerations are vital for any study. Participation in the study was on voluntary basis and any farmer was free to withdraw from the study anytime. The researcher went ahead and guaranteed the participants confidentiality of any information that they gave during the interviews. A letter of introductory to meet the participants was obtained from the University.

No names were included on the data collection tools. The investigator sought the informed consent from participants by allowing them to read the letter from the University and the

individual researcher. The investigator ensured confidentiality of all the information provided by the respondents.

CHAPTER FOUR

RESEARCH FINDINGS, PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents the results of the study which was categorized and interpreted on the basis of each research objective. Since this was a qualitative research, descriptive statistics were applied namely frequency distributions and related percentages. Chi-square statistics was also used.

4.2 Characteristics of the Sampled Farmers

The first objective of this study was to establish the effects of farmers' characteristics on their food production and food security. Personal characteristics referred to: gender, age, educational level, Occupation and income.

4.2.1 Gender

The study examined the distribution of gender of the sampled farmers. Study of gender seeks to confirm whether males or females dominate in farming. The participants were asked to specify their gender and the results were recorded in Table 4.1.

Table 4.1: Gender Distribution of the Smallholder Farmers

Gender	Number		Percent
Male	73		62.9
Female	43		37.1
Total	116		100

The Table 4.1 shows that 62.9% of the respondents were men, while 37.1% were women. This showed that majority of those who were active in the research were male. During the study males were readily available and in most of the cases females preferred their husbands who were considered household heads to respond to the questions from the researcher. The study finding confirmed the observation made by the World Bank (2006)

which stated that, in Kenya men were the key decision makers in farming, yet women provided the greatest labour.

4.2.2 Age of the Respondents

The study sought to establish the age distribution of the farmers and the findings were presented in Table 4.2

Table 4.2: Age Distribution of Respondents

Age (Years)	Number	Percent
Under 29	13	11.2
30-39	33	28.4
40-49	42	36.3
Above 50	28	24.1
Total	116	100

The results in Table 4.2 show that most of the sampled smallholder farmers were in the age brackets of 40-49 and 30-39 years of age represented by 36.3% and 28.4% percent, respectively. They were followed by above 50 years of age with 24.1% and those under 29 years were 11.2%. This showed that most of the respondents were mature adult people. The modal age for respondents was 40-49 years, which showed a majority of farmers sampled were below the age bracket of 50 years.

4.2.3 Smallholder Farmers' Education

The study investigated the levels of education of the farmers so as to understand the level of comprehension and adoption of new technology in farming. The participants were asked their educational levels which included none, primary, secondary and post-secondary. The findings are indicated in Table 4.3.

Table 4.3: Smallholders' Level of Education

Level of education	Number	Percent
None	10	8.6
Primary	34	29.3
Secondary	48	41.4
Post-secondary	24	20.7
Total	116	100

The result shows that 8.6% of the smallholder farmers had not attended school, 29.3% had primary education, 41.4% had attained secondary and 20.7% had attained post-secondary education level. Thus, most farmers attained secondary education level and this showed that they could readily understand and adopt farm innovations.

4.2.4 Marital Status

The study sought to establish the marital status of the farmers. Married farmers tend to be food secure as they work hard to provide food for their families. The results are presented in Table 4.4 below.

Table 4.4 Marital Status of the sampled farmers

Marital status	Number	Percent
Single	20	17.2
Married	50	43.3
Divorced	16	13.8
Widowed	30	25.7
Total	116	100

The results shows that 17.2% were single, 43.3% were married, 13.8% were divorced and 25.7% are widowed. Thus majority of farmers were married and likely to be concerned with food production and security of their households.

4.2.5 Size of family

The study sought to establish the household size of farmers. The results are as presented in the Table 4.5 below.

Table 4.5: Number of children per household

No of children	Number	Percent
Less than 3	20	17.2
4-5	53	45.7
6-7	32	27.6
Above 7	11	9.5
Total	116	100

Most smallholder farmers sampled had a large family size of 4 and above members. This confirmed studies that rural people tend to possess huge families. The big family size may offer the desirable labour requirement for farming (Aturamu, 2000). Consequently, large family size may decrease the economic well-being of the household particularly when the proportion of dependent is high. The large household may impact negatively on the food security since the dependents consumption may be high.

4.2.6 Occupation of Smallholder Farmers

The study sought to establish the occupation of farmers. The results are as shown in the Table 4.6 below.

Table 4.6: Occupation of smallholder farmers

Occupation	Number	Percent
Farmer	54	46.6
Casual employer	22	19.0
Business	19	16.4
Wage employment	21	18.0

Total	116	100
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Table 4.6 shows that 46.6% of smallholder farmers depend on farming activities, 19.0% were labourers, 16.4% had businesses and 18.0% are employed on wages, respectively. This showed that the main occupation of the respondents was farming, followed by casual employment, wages and business activities.

Table 4.7: Farmers Level of off-farm income

Level of income	Number	Percent
No off-farm income	54	46.6
Less than 5000	30	25.9
5000-10,000	20	17.2
More than 10000	12	10.3
Total	116	100

From Table 4.7, farming was the primary occupation of the interviewed farmers for 46.6% had no off-farm employment and therefore had no off-farm income. They depend on their farms entirely for their livelihood.

Households with access to other income apart from farming could purchase more farm inputs at an appropriate time compared to low income or households without remittances. As such, smallholders with access to remittances are likely to be food secure than their counterparts without this source of income. Most farmers do not have such income and as such could not produce enough food crops. Those farmers with an off-farm employment, majority receive an income of less than ten thousand shilling per month and may therefore be economically constrained (Table 4.7).

4.3 Support by County Government Extension services

The researcher sought to examine the county government's extension service level of support to the farmers and its influence on food production and food security.

Agricultural extension officers are county government officials under the Department of Agriculture (DOA) responsible for presenting guidance to farmers. When interviewing an extension officer in Gem Northwest Ward, he said, *“We do not reach the smallholder farmers in time due to a few numbers of officers; for instance, Gem sub-county has only three extension officers. This hampers most of the service delivery to the smallholder farmers.”*

Table 4.8: Extension support of the farmers

When asked whether they had been supported by the county government the farmers responded as shown in Table 4.8

Extension support	Number	Percent
Yes	30	25.9
No	86	74.1
Total	116	100

Table 4.8, shows that most of the farmers at 74.1% did not receive extension support from the county government. Only a few at 25.9% received extension support. One extension officer observed that their services are not adequate though the farmers have interest in new technology but only a few manage to access them. Other challenges were not having enough funds for extension support to enable them facilitate their work like providing transport. One key informant said, *“Extension supports were vital to the smallholder farmers for their food security.”*

When asked about the sources of information that they had accessed, the farmers responded as indicated in the Table 4.9

Table 4.9: Farmers Access to extension services of information.

Type of information	Number		Number	
	Yes	Percent	No	Percent
Visited by the extension officer	10	8.6	106	91.4
Taken on extension trip	13	11.2	103	88.8
Attended field day	32	27.6	84	72.4
Attended demonstration	25	21.6	91	78.4
Listened to local radio program on farming	50	43.1	66	56.9
Provided brochures on farming by county extension officer	20	17.2	96	82.8

Table 4.9, shows that farmers obtained information from various channels with a majority listening to agriculture programs from the local radios. Only 8.6% obtained information directly from the extension officers through their farm visits. This indicates that most farmers did not have access to appropriate information for farming either because of inaccessibility or due to lack of direct access to extension services offered by the county government.

4.3.1 Farmers access to credit for crop production

Respondents were requested to show whether they had once received credit from the county government. The replies are displayed in Table 4.10

Table 4.10: Farmers response on their access to credit

Response	Number	Percent
Yes	20	17.2
No	96	82.8
Total	116	100

Table 4.10 shows that 82.8% of the farmers had not obtained credit from the county government of Siaya while only 17.2% had obtained credit in various forms. The reactions

indicated that most smallholder farmers did not obtain credit services for their crop production. This may be as a result of fear of defaulting to reimburse the loans, absence of information or lack of loans security. Most of the farmers' only received loan from NGOs such as One Acre Fund and informal sources such as suppliers and traders.

Table 4.11: Types of credit the farmers had received

Type of credit received	Yes		No	
	Number	Percent	Number	Percent
Monetary	0	0	116	100
Seeds	8	40	108	60
Fertilizers	2	10	114	90
Pesticides	3	15	113	85
Ploughing	7	35	109	65

Table 4.11 shows that none of the farmers received credit in form of money from the county government. While some obtained seeds, fertilizers and ploughing services on credit by the county government tractors, one of the key informants said.

“Due to scarce resources available it is not easy for the county government to offer monetary assistance to the smallholder farmers; rather the county government through partnership with other NGOs such as One Acre Fund which they work together to offer credit in form of certified seeds and fertilizer. A farmer is required to pay ten thousand shillings in installments and the One Acre Fund in collaboration with the county government gives each farmer who has asked for the credit, 5 packets of certified seeds and a 50 kilogram bag of chemical fertilizers. The farmer is required to pay that in 4 months.”

The County government had also purchased tractors for each sub-county hence farmers were able to access these services either in credit form or partially pay for and later complete the remaining amount. Smallholder farmers could not access these services due to inability to raise such minimum required amount of Ksh. 10,000 required by One Acre Fund in partnership with the county government, Siaya County Department of Agriculture (2017).

4.4 Food Production and Husbandry

The study sought to establish crop husbandry and food production by asking farmers about the size of the farm on which they planted crops in the last season. The indicators were acreage under crop production, type of labour used in the farms and size of land owned by the peasants.

4.4.1 Farm Size

The study sought to establish the size of farm owned by the farmers. The results are as shown in Table 4.12 below.

Table 4.12: Size of land owned by the farmers

Size of farm	Number	Percent
Less than 2 acres	64	55.2
3-5 acres	40	34.5
6-7 acres	8	6.9
8 acres and above	4	3.4
Total	116	100

Table 4.12 shows that a majority of the farmers had less than 2 acres of farm land. With 55.2% had less than 2 acres of land, 34.5% had 3- 5 acres, 6.9% had 6-7 acres and 3.4% had more than 7 acres of land. This shows that most of the farmers had very small parcels of land to carry out agricultural activities.

4.4.2 Farm area under food crop production

The farmers were asked about the size of the farm on which they planted crops in the last season. The results are presented in Table 4.13.

Table 4.13: Farm Area under Crop Production

Area (acres)	Number	Percent
Less than 1.0	26	22.4

1.1-3.0	39	33.6
3.1-4.0	38	32.8
5 acres and above	13	11.2

Majority of the farmers (33.6%) did crop farming in an area of about 1.1-3.0 acres of farmland. This was followed by 32.8% who carried out crop farming in 3.1-4.0 acres of farming land. The family mean acreage cropped was 2.8 acres. Farm assets were used as farmlands for farming crop and livestock keeping.

4.4.3 Mode of land preparation

The farmers were asked to state the mode of land preparation they used during farming. The findings were as shown in the Table 4.14 below.

Table 4.14: Mode of land preparation

Mode	Number	Percent
Hand hoe	63	54.3
Ox-plough	37	31.9
Tractor	16	13.8
Total	116	100

Table 4.14 shows that a majority (54.3%) of the farmers used hand hoe in land preparation, 31.9% used ox-plough and only 13.8% used tractor. This shows that most farmers depended on human energy to till their land. This contributed to small acreage under crops hence small harvest and likely to food insecurity among them. With only 13.8% using modern equipment like tractor, this was a clear indicator of many tracts of land remaining without being ploughed.

4.4.4 Human Labour Use in Respondents' Farm

Table 4.15 shows the human labour used on respondents' farms. The respondents were asked about the type of human labour used during the activities on their crop production.

Table 4.15: Labour used in Food Crop Production

Crops	Maize	Sorghum	Beans
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	Number	Percent	Number	Percent	Number	Percent
Family labour	60	51.7	57	49.1	46	39.6
Hired labour	20	17.2	27	23.3	40	34.5
Family + hired labour	36	31.1	32	27.6	30	25.9
Total	116	100	116	100	116	100

The Table 4.15 shows that maize production was highly depended on family labour. This was used by 51.7% of respondents and 17.2% used hired labour while 31.1% used mixed labour (family and hired labour). Sorghum production, family labour was used by 49.1% of the respondents, hired labour by 23.3% and mixed labour by 27.6%. For beans production, 39.6% of respondents use family labour, hired labour was used by 34.5% and mixed labour by 25.9%. The farmer interviewed mentioned that members of the family participate in the farm husbandry.

4.4.6 Farm input usage by smallholder farmers

The farmers were asked whether they used certified seeds, local seeds, chemical fertilizers and pesticides during the process of growing maize. Table 4.16 shows the findings.

Table 4.16: Farm input usage by smallholder farmers

Response	Improved seeds		Chemical fertilizers		Pesticides		FYM	
	Number	%	Number	%	Number	%	Number	%
Yes	40	34.4	54	46.6	20	17.2	32	27.6
No	76	65.6	62	53.3	96	82.8	84	72.4

Total	116	100	116	100	116	100	116	100
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The data shows that 65.7% of the farmers did not use improved seeds, implying they used local seeds collected from previous harvests. Only 34.4% of the farmers used improved seeds. Chemical fertilizers were used by 46.6% of the farmers and 53.3% did not use them instead they used organic manure from plants and animal wastes. From the above Table 4.16 most of the farmers had not adopted new technologies and modern ways of farming.

In the interview with the agriculture extension officer, challenges smallholder farmers in Siaya County face in accessing and using farm inputs like improved seeds and fertilizers include lack of funds to buy the inputs, unavailability of chemical fertilizers, and lack of awareness on the need to use improved seeds. In the interview with the County extension officer, he mentions.

“Farmers are faced with challenges that include availability of chemical fertilizers in agro-vets at expected time, expensive farm inputs, unpredictable rainfall patterns which results to an inadequate rains affecting planting time or rains disappear before crops fully mature. He further mentioned that farmers manage challenges in their farms by using local seeds, using animal waste manure, buying a few chemical fertilizers and applying them below the recommended rates or skipping fertilizer application procedures, especially top dressing to improve farm yields in the area, there is need to improve on input usage like improved seeds and chemical fertilizers. There is also need to use appropriate farming procedures, especially proper farm husbandry.”

4.4.5 Adoption of new methods of farming by smallholder farmers

Farmers were asked whether they had certain improvements in their farms in the following lines, borehole or spring water, own ox-plough, own tractor, improved grain store, maize Sheller and hired labour. These responses are represented in figure 4.4.

Figure 5: Farming methods

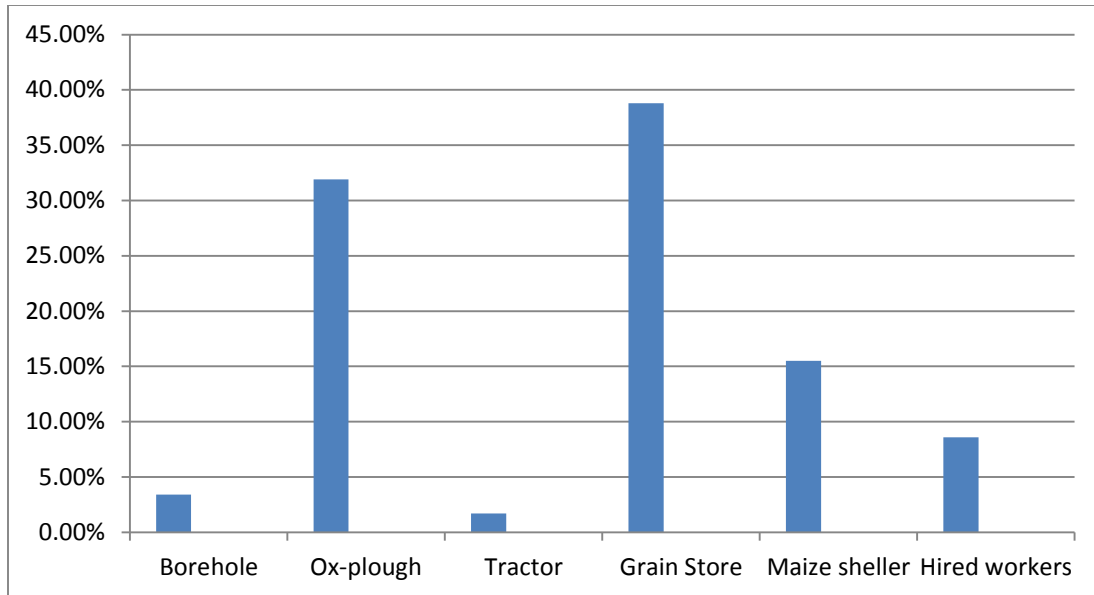


Figure 4.4 shows that most of the farmers had adopted the use of modern grain store at 38.8%, ox-plough 31.9%, maize Sheller 15.5%, hired labour 8.6%, borehole 3.4% and tractor 1.7%. The use of tractor was at 1.7% due to dependent on county government tractors which were placed in every two wards in the area. Accessing these tractors was very difficult due to many individuals since it was large scale farmers who were given first priority. With borehole at 3.4%, this shows most farmers had not adopted the modern irrigation methods but fully depended on rainfall which sometimes was unreliable. About 31.9% of smallholder farmers owned ox-plough which they used in tilling their land. This helped them prepare their seedbed in time.

The figure indicates that adoption of new methods and technology in crop production among smallholder farmers is still below the required level and this was likely to lead to low crop production and food insecurity among the smallholder farmers.

4.4.6 Adoption of new farming methods

The researcher used the parameters below to determine whether a given respondent was food secure or not secure. The indicators included: use of hired labour, improved seeds, chemical fertilizer, pesticides, FYM, extension services, grain store, credit, crop rotation, tractor and ox-plough. Those farmers who observed eight and above of the indicators were considered to be high adopters, those with five to seven were considered to be average and

below five were considered below adopters. High adopters were likely to be food secure while low adopters were likely to be food insecure Table 4.17 summarised the indicators of being food secure.

Table 4.17 Summary of Adoption of new farming methods

Farming Husbandry	Adopters	Percent	Non-adopters	Percent	Total
Hired labour	40	34.4	76	65.6	116
Improved seeds	40	34.4	76	65.6	116
Chemical fertilizers	54	46.7	62	53.3	116
Pesticides	24	20.7	92	79.3	116
FYM	37	31.9	79	68.1	116
Ox-plough	42	36.2	74	63.8	116
Tractor	24	20.4	92	79.3	116
Grain store	45	38.8	71	61.2	116
Crop rotation	68	59.0	48	41.0	116

Fifty nine percent (59%) of the farmers in the sample practiced crop rotation; most farmers rotated legumes with cereals and vegetables. This is an indication of high level of awareness of importance of crop rotation in nutrient recycle and organic pest management among the farmers.

Fifteen percent of the farmers interviewed had access to credit services from the county government and other sources. Those who did not access these services said that the terms of the loans were not favourable to them while some of them were either not aware of such loans or they did want to take such loans. Only 38.8% had grain store. This implied that most farmers did not have proper places to keep their produce hence exposing them to extreme weather conditions or pests such as weevils.

4.4.7 Adoption of new farming methods

As for adoption of all the eleven farming methods, only 10% of the farmers in the sample were found to have adopted new methods of farming as required. Adoption level was determined using formulae;

$$Y = f_1 + f_2 + f_3 + f_4 + f_5 + f_6 + f_7 + f_8 + f_9$$

Where; Y is adoption of the entire package, f1 is hired labour, f2 is improved seeds, f3 is chemical fertilizers, f4 is pesticides, f5 FYM, f6 ox-plough, f7 is tractor, f8 is grain store and f9 is crop rotation. From the table, the results show low level of adoption of the farm husbandry and crop production. Farmers were found to have adopted these farming methods at different levels. Table 4.18 shows the level to which farmers had adopted each method.

Table 4.18: Adoption level of farm husbandry

Level of adoption	Number	Percent
High	28	24.1
Average	40	34.5
Low	48	41.4
Total	116	100

These results show low level of adoption of new methods of farming, the results indicate that a majority of smallholder farmers do not observe the required husbandry for maximum food production hence food insecurity among them. They were therefore not found to be sufficient enough to draw a comprehensive adoption conclusion for the study area. The data was then classified as dichotomous whereby; adopters were taken to be those farmers who adopted above 50% of the package components. This was taken as satisfactory level of adoption. Non-adopters were those farmers who adopted four components and below, to the recommended level.

4.4.8 Amount of Farm Yield Obtained by the Farmers

When farmers were asked to state the amount of yield they obtained during that season of planting. The results were as indicated in Table 4.19 below.

Table 4.19: Amount of Yield per area under crop production

Area (acres)	Average yield in 90kg	Number	Percent
Less than 1	1 bag	26	22.4
1.1-3.0	4 bag	39	33.6
3.1-4,0	5 bags	38	32.8
5 acres and above	10 bags	13	11.2

Majority of the farmers (33.6%) had an average yield of 4 bags in an area of 1.1-3.0 acres of farmland. This was followed by an average of 5bags in an area of 3.1-4.0 acres of land. From the Table 4.19 it implied that most of the farmers had smaller yields which could not sustain them to the next harvest. Even though some of them could afford to have surplus produce due to smaller household size, farming area and the amount of yield needed to be improved among the smallholder farmers.

4.5 Food security situation of the farmers

The third objective of this research was to determine the food security level in the area under study and sampled farmers were asked to state whether their harvest was sufficient or not. The data were as displayed below.

Table 4.20: Farmers Responses on the state of their food self-sufficiency

Food Security	Number	Percent
Yes	48	41.4
No	68	58.6
Total	116	100

Table 4.20 shows that most of the smallholders were not food sufficient and the harvest they had could not be consumed till next season of harvest. About 58.6% of the interviewed

farmers were not able to have enough food to sustain them till next harvest while only 41.4% could have enough food to the next harvest season. According to one extension officer,

“Most smallholder farmers depend on the farm products to carry out other household needs such as paying fees for the children and other dependents. They sell their harvest to meet their bills hence reducing the storage ability of many of them thus food insecurity.”

Farmers were asked for how many months the harvest they obtained could take them, a majority answered as shown in Table 4.21 below.

Table 4.21: Number of months food crop harvested lasted

Number of months	Number	Percent
Less than 3 months	48	41
4-6 months	43	37
6-8 months	16	14
More than 9 months	9	8
Total	116	100

Table 4.21 shows that 41.% had food for less than three months after the harvest, 37% had sufficient food for 4-6 months while only 8% could be food sufficient for more than 9 months. Most of the farmers were not able to harvest enough food crops that could sustain them for more than six months. This implies that most of them depended on other sources of food after six months of harvest of their yield from the farm.

Figure 5: Access of food from other sources

The figure 6 below illustrates the other sources of food accessed by the farmers when their yields were exhausted.

Figure 6: Percent of farmers’ accessing food from other sources

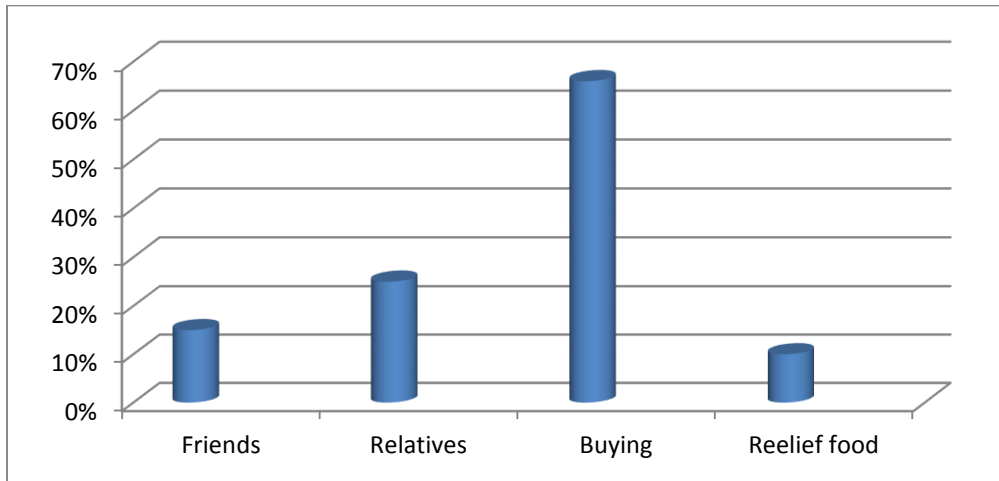


Figure 5 shows that most of the farmers when they exhaust their yield they turn to buying food from the market. This was indicated by 66% of the respondents who said they buy from the market, 25% depended on relatives, and 15% depended on friends while 10% depended on relief food from the county government.

When the food secure farmers were asked what they did with their surplus yield a majority sell them to buy other things such as chairs and paying school fees for their children. Others were giving them out to churches, schools and to friends who had less yields. Table 4.22 shows the number of bags sold by the farmers who had surplus produce.

Table 4.22: Surplus food sold by the farmers

90 kg bags of produce sold	Number of farmers	Percent
Less than 1	25	21.6
2-3	11	9.5
4-6	8	6.9

7-9	4	3.4
None	68	58.6
Total	116	100

Most of the farmers did not have the surplus produce which they could have sold, 58.6% did had surplus produce, 21.6% had less than 1 bag of maize which they sold. When asked about the income they earned from the sales of surplus maize, the farmers responded as shown below in Table 4.23.

Table 4.23: Income from surplus produce

Income earned (Ksh.)	Number of households	Percent
Less than 999	25	21.6
1000-4999	11	9.5
5000-9999	8	6.9
Above 10000	4	3.4
N/A	68	58.6
Total	116	100

Table 4.23 shows that most farmers did not have much surplus yield from their farms, 21.6% had less than Ksh. 999 incomes from the surplus produce, 9.5% had between ksh. 1,000-4,999, 6.9% had between 5,000-9,999 and 3.4% had above 10,000. This indicates that most farmers were food insecure.

4.5.1 Other factors affecting farming

While interviewing farmers on other factors affecting farming in the area, they responded as shown on the table 4.24 below.

Table 4.24: Other factors affecting farming

Factors	Number	Percent
Natural factors	50	43.1
Availability of farm inputs	40	34.5
Remittances	26	22.4

Total	116	100
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Most farmers cited natural factors as the major threat to availability of farm inputs at 43.1% followed by cost of production at 34.5% and remittances at 22.4%.

Most of the farmers fully depended on rain for their agricultural activities. Their food crops failed with the failure of rainfall. Due to climate change which has led to change in rain patterns, many farmers in the county continually make loss from their farms. While interviewing one of the respondents, he said the following;

‘last season we could not harvest enough beans due to excessive rainfall. Infact even for maize, it was out of lack that we got a little’

Table 4.24 shows that 34.5% of the farmers indicated that farm inputs are not always available in good time during planting seasons in their areas. As a result, some farmers indicated that they end up planting wrong variety of seeds because the preferred variety runs out of stock. They also cited long distances from their locations to stockiest in Siaya and Yala towns where quality seeds and chemical fertilizers were obtained. They associated inputs found at local retail shops with poor quality.

4.6 Relationships between Food Security and other Variables of Study

It was confirmed that only 22% of the smallholders had enough food and 78% of the smallholders’ household respondents were not having enough food. This finding concurs with the study by (Omoshe et al, 2006) who observed that two thirds of the rural small-scale farmers sampled in Kwara were food insecure. Food security of a given household also depended on the access to the extension information by the county government. The table 4.25 below illustrates the finding:

Table 4.25: Household Food Security versus Access to Extension information

Access to information	Secure	Not secure	Total	X²	P-value
More access	14	6	20	17.005	<i>p>0.05</i>
Some access	18	25	43		
No access	10	43	53		
Total	42	74	116		

There is positive relationship between access to information and food security. Those individuals who were able to access the county government extension information were able to use those resources in their farms. Extension education enabled the farmers to have appropriate knowledge which they used in their farms and hence improving their farm husbandry thus improved produce.

Table 4.26: The relationship between access to credit and food security

Food security	Access to credit		X ²	p-value
	Yes	No		
Secure	16	26	20.07	0.000044
Not secure	4	70		

There is positive correlation between credit and food security. Those individuals who were able to access the county government credit facilities were able to use those resources in their farms. Credit facilities enable the farmers to buy farm inputs and hence improving their farm husbandry thus improved produce.

4.7 Relationship between Farmers’ characteristics and food security

The first objective of this study was to establish the effects of farmers’ characteristics on their food production and food security. The key indicators were: age, gender, level of education, marital status, family size, occupation and income.

Cross tabulation and Chi-square test were used to establish whether there were any relationships between selected farmers’ characteristic variables and food security.

4.7.1: Gender and Food Security

The study hypothesized that that there was a significant correlation between gender of the smallholder farmers head and food security.

The study used chi-square test to test if there was any correlation between gender and food security. The test was conducted using the collected data particularly on the food

production and food security; after being scored on the eleven indicators on food security. The participants were grouped into not secure, somewhat secure and secure.

The following were the results of the test;

Table 4.27: Relationship between food security and Gender

Gender	Food secure	Not secure	Total	df	X²	p-value
Male	32	41	73	1	0.015	<i>p</i> >0.05
Female	16	27	43			
Total	48	68	116			

It was realized that gender had significant influence on food security at 5 percent level of significance. High level of food security was found among male farmers. Thirty two (32) of the farmers who were food secure were male while sixteen (16) were female. These findings do not confirm the norm that, females are disadvantaged economically and may not afford costs involved in new agricultural methods. Female farmers normally tend to be less curious in trying out new innovations unlike their male counterparts. They would therefore be expected to lag behind male farmers in adopting new agricultural methods which was not the case in this study. The calculated p-value of 0.903 is less than 0.05 significant level hence indication of no significant relationship between gender of the farmers and food security at 5% level of significance.

4.7.2 Age and food security

The study hypothesized that there was a significant relationship between age of the smallholder farmers and level of food security.

Table 4.28: Relationship between age and food security

	Age in years	Total	X²	p-value
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Food security	Under 29	30-39	40-49	50+			
Secure	3	10	17	18	48	26.89	<i>p>0.05</i>
Not secure	10	23	25	10	68		
Total	13	33	42	28	116		

The age of the farmers and food security had a significant positive relationship ($P \leq 0.0001$). This shows that households headed by young farmers were more food secure than those headed by old people. These results support Kalirajan and Shand (2000) who found out that young people had the ability to access the information hence quick absorption and application hence enhanced crop production. But this results disagree with Haluet et al. (2007) who indicated that there was a negative relationship between household heads age and food security in Ethiopia.

4.7.3 Level of Education and food security

The study hypothesized that that there was significant relationship between the level of education of the smallholder farmers and the level of food security.

Table 2.29: Relationship between level of education and food security

Food security	None	Primary	Secondary	Post-secondary	Total	X^2	<i>p-value</i>
Secure	4	11	28	17	60	11.628	<i>p> 0.05</i>
Not secure	6	23	20	7	56		

There was a significant relationship between education level of the household head and food security at 5% significant ($P = 0.008772$). This indicates that, farmers with higher education are likely to be food secure as opposed to farmers with lower or no education level. Education level of the farmer positively relate with the household food security. These findings agree with a study carried out by Kirimi et al. (2013), who realized that education improves knowledge and skills in decision making which may enhance

accessibility to good economic chances or good usage of skills including use of modern farming practices thus increasing food crop production.

4.7.4 Marital status and food security

The study hypothesized that that there was significant relationship between the marital status of the smallholder farmer and the level of food security.

Table 4.30: Relationship between the marital status and food security

Food security	Marital status				X ²	p-value
	Single	Married	Divorced	Widowed		
Secure	12	30	9	10	6.097	0.0106
Not secure	8	20	7	20		

Marital status significantly influence food security at ($P=.01$). Marriage has a bigger role in management of crop production hence improved food security. This is due availability of family labour, enhanced income thus leading to proper use of available resources. Researches by Grinstein-Weiss et al (2006) reported that marital status significantly influences household food security.

4.7.5 Family size and Food Security

The study hypothesized that that there was significant relationship between the family size of the smallholder farmers and the level of food security.

Table 4.31: Relationship between family size and food security

Food security	Family size				X ²	p-value
	Below 3	4-5	6-7	Above 7		
Secure	15	30	20	7	2.26	0.5202
Not secure	5	23	13	5		

There was no significant relationship between the number of children in a given household and food security ($P=.5202$). Lack of significance level may be due to dependency ratio among the rural people who usually associated with low income. When the family is large it will require more food to feed from as compared to those families with smaller size. These results are similar to those of Bogale (2009) in Ethiopia.

4.7.6 Income and food security

The study hypothesized that that there was significant relationship between the level of income of smallholder farmer and the level of food security.

Table 4.32: Relationship between the income and food security

Food security	Level of income				X ²	p-value
	Farming	Less 5000	5000-10000	Above 10000		
Security	34	11	10	8	6.074	0.0480
Not secure	20	19	10	4		

The relationship between level of income of the farmer and food security was sufficient ($P=.0480$) at 5% representative level. This implies that, those farmers with higher income level are likely to be having enough food as opposed to those with lower income. Thus income level of the household head determines the food security hence relationship between them.

4.8 Conclusion

The study's first objective was to establish the effects the farmers' characteristics and their influence on food security and food production. The indicators of the study included gender, age, level of education, occupation, marital status and family size. Most of the farmers according to the study were male gender with 62.9% aged between 30-49 years. This illustrates that a majority of farmers were of the middle age. Only 8.6% of the farmers interviewed did not attain any level of education. It is therefore deduced that most of the farmers could comprehend farming process and use appropriate information acquired from any source to do farming.

About 55.2% of the smallholder farmers owned less than 2 acres of land. This size of land encouraged the use of family labour because mechanization of such small piece of land may prove to be expensive. Very few farmers used improved seeds 34.4% this led to low harvest hence food insecurity among the farmers. As such many bought food from the local markets almost immediately after the harvest because their produce does not take them up to three months after the harvest seasons. The farmers also depended on unreliable rainfall which sometimes disappears in the middle of the season. Nearly 74% of the farmers had no contact with extension services offered by the county government and 82.8% did not access credit from the county. This showed lack of proper communication and sensitization of the farmers on the importance of extension services. It also showed that the county had allocated meagre resources that could not fully facilitate the program.

CHAPTER FIVE
SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND
RECOMMENDATIONS

5.1 Summary of the Findings

The research pursued to investigate food production and food security of smallholder farmers and their support by the county government of Siaya, Kenya. For a smallholder farmer to realize optimal crop production from their farms the type of seeds and use of chemical fertilizer plays a key role. In addition, the farming husbandry employed including land preparation, intercropping and crop rotation, harvesting and storage have impact on crop production and food security.

Farmer incentives including subsidized inputs, access to credit and availability of inputs at the right time and near the farms is crucial in boosting crop production and food security. Equally important is well distributed rainfall throughout the crop cycle.

5.1.1 Farmer Characteristics

The most vital demographic feature is the age which has influence role allocation in a family. Age defines duties in the family set-up thus greater impacts on making choices on issues relating to land tenure and food production. Participants were classified in age groups as less than 29 years who were 11.2%, 30- 39 representing 28.4%, 40-49 which was 36.3% and above 50 years 24%. From distribution of age categories 40-49 is the modal age group among the smallholder farmers. These results are similar to those of Kumba et al (2015) whose findings indicated that most of smallholder farmers in Kisii central Sub-county had an age group between 30 to 50 years.

Same results were found by Ogeto et al. (2013) in Nakuru County. The research is in agreement with Babatunde et al. (2007) whose findings showed out that middle aged farmers were energetic and could cultivate big tracks of farms and still go for off-farm duties to earn an extra income as opposed to elderly farmers. On the other hand young

farmers embraced new farming methods very faster than the aged ones. Older people attribute the fear of unknown and hence adoption of new technology in farming is not easy.

Another vital factor in farming is the gender due to the fact that it has a greater influence on farm organizations and income earning opportunities thus higher production food crop. This current research showed that 62.9% of the respondents were headed by males while 37.1% were females. More males are likely to be more involved in crop farming in the area this went against the World Bank Report (1989) that females constitute between 60-80% of the labour force and majority of them are involved in agricultural production. This showed that there should be more efforts directed at improving and empowering females in the area to increase food productivity and its security.

Education is key point of entry for adoption of a new sequence of changes, which benefits the smallholder farmer. A major effect of education on production is that it enhances the ability of a producer to acquire and understand information about the productive characteristics of new inputs. From the study findings 8.6% of respondents reported not to possess any form of formal education while 91.4% of the participants possessed education at various levels. This indicates that most of the smallholders were able to comprehend teachings from extension services but most of them had not obtained such services with only 25.9% having obtained the service. These findings coincide with Abebaw & Belay, 2001; Rogers, (2003) that states education is anticipated to boost decision-making as well as the espousal of agricultural technologies. The level of knowledge impacts adoption. Hence, education level among smallholder farmers is high. This may positively impact their farming habits as they may have swift access to information on improved production methods that can aid them improve productivity. Islam (1997) emphasized that primary education increases the productivity of the workers while secondary education motivates entrepreneurial action.

5.1.2 Food production and crop Husbandry

Food production and crop husbandry involves extensive work to be carried out by the farmer which entails type of labour used, area of farming, farm inputs and adoption of new

methods in the whole process. Land is regarded as a key production factor. The size of land is a major restraint in Siaya County as the findings demonstrate that over 50% of smallholder farmers depended on up to two acres of land for production of crops to feed an average of eight family members. This makes it difficult for the smallholder farmers to produce enough food that can sustain the household for whole season. There is no hesitation that the small-scale peasants in this region will have to depend more on new methods of farming rather than expansion of the area for future surges in crop production. Availability and access to farm inputs like improved seeds is an essential for high crop production (Nyoro, 2002). The research discovered that a huge portion of smallholder farming families applied seeds from either indigenous maize seeds. This has resulted to reduced crop production generally which influences the food security of the smallholder farmers and subsequently food safety in the region. Based on the study, it appeared that majority of the smallholder farmers would need a minimum of Kshs 10,000 for inputs.

Most smallholder farmers depend on family labour which sometimes may not be available especially in those households where a majority of them are school going hence less productivity in the farms.

Most of the farmers have very low incomes and therefore cannot afford to purchase farm inputs. This implied that the major source of income of smallholder farmers were own crop production. The finding is also comparable with that of The Siaya County Investment Development Plan 2013-2017, which demands that agriculture is the foremost backbone of the economy and income of the persons in Siaya County and, it is expected that 80% of the residents relies on agriculture (CIDP 2013-2017). In addition, a delay in availing inputs late in the season leads to late planting and low yields. Dorward et al, 2008 in his findings regarding the Malawi situation, noted that a number of operational challenges work against efforts of increasing fertilizer usage among smallholder farmers, he identifies delays in implementation and program design resulting in late inputs delivery in some parts, clumsy voucher redemption and processing structures, the need to advance sharing of program information with the anticipated beneficiaries and overall public and fertilizer deficiencies.

5.1.3 Food Security

The smallholder farmers of Siaya have the ability to increase their production of crops both sorghum legumes, vegetables and maize. The millennium scheme in Gem Sub-county as well as the AATF report has revealed that smallholder peasants have the potential to increase their crop production if properly availed with extension services and subsidized farm inputs. Thus one part on intercession is to source subsidised farm inputs for the smallholder of Siaya. The major crop produced in Siaya County was maize as compared to other indigenous crops such as millet.

Increasing local crops production in the region will therefore lessen the reliance on maize and increase the security of food. The reason for this is that the crops can be vended to get revenue or be consumed by the smallholder families. The respondents showed that the chief crop planted by his family is cassava. The planting is carried out in interims so as to certify production throughout the year. The participant also farm vegetables to generate income for the family. Agricultural extension services ought to be accessible for successful interventions to be realized.

CIDP, (2013) noted that 70% and 50% of Siaya County inhabitants draws their income from agriculture as well as livestock keeping, respectively. These findings concur with a research by Gitu (2004) which detected that constant land disintegrations in Kenya, some 87% of the families in the republic are living on farms below 7.0 acres, while 47% of families live on below 1.5 acres. This is similar with the findings of the research by Igholo (2016) on socio-cultural factors influencing food production by smallholder farmers which demonstrate all participants had farms sized 5 or less acres, and some 42.2% of smallholder farmers had below 2 acres of land. Though there were huge prospective farming lands, it was realised that the smallholder farmers never wanted to cultivate massive land which they were incapable of managing properly. For instance, on probing a respondent in Kathomo village on why he had a farmland as small as less than acre while he owned 3 acres of land, he responded thus: *“What is the need of cultivating a large portion and see how almost everything get consumed by weeds? See my grass thatched hut. Does it seem to belong to a rich person with money to hire labour for farming”* According to Alem and

Shumiye (2007), small size of farming land escalates susceptibility to household food insecurity since small farming land attracts low crop production.

5.1.4 Extension Services and Support by the County Government

Study by Doss, et al. (2002) as mentioned by De Groote et al. (2002), extension the foremost variable which is exceedingly interconnected to the management and use of enhanced seeds and chemical manures by the smallholder peasants. The research found out that only 25.9% have accessed the extension services while 74.1% had never obtained such services. This confirms the inadequacy of extension services in the region. This is also buoyed by the County Strategic Plan (2013-2017) which indicated that *the extension services by the county government has been inefficient due to few personnel, weak research-extension linkages and low investment*. One of the agriculture extension officer stated scarce workers as one reason for poor extension services to smallholder farmers. The victory stories in the different areas and counties on crop production have demonstrated that peasants work hand-in-hand with agricultural extension officials in the area of embracing use of upgraded inputs. Wokabi (2007) stresses transfer of technology through education, raising the farming techniques of the smallholder peasants and training. This will aid in embracing the technology and hence upsurge the crop yields. In the rural community of Bar Sauri, one of the triumph stories in production of maize for millennium progress projects (www.millenniumvillages.org), the extension officials had to be facilitated with laptop computers and transportation for them to educate peasants in the newest ways of farming. This shows that vitality of the extension work.

Only 17.2% had obtained credit from the county government and other NGOs such as One Acre Fund. These results match those from Wittlinger and Tuesta (2006) who discovered that smallholder peasants faced countless hurdles in obtaining credit. These categories of peasants need sure situations, tactical unions with members, reduced costs and conditional weather; since only in these circumstances these peasants can get access to credit.

Several factors determined access to credit by the county government according to the study most farmers are not able to access such credit due to the following factors; poverty, lack of information, fear of the unknown. For instance the credit offered by one acre fund

in collaboration with the county government requires the farmer to have a minimum of Ksh. 10000 which a majority could raise. The county has therefore enhanced the distribution of improved seeds and fertilizers at subsidized prizes.

5.2 Conclusion

Smallholder farmers' food security is very vital to the economic development of various rural areas in this country. Ensuring that crop production and food secure is not only a must on the side of county government but a policy to be fully implemented by. Factors such as farm husbandry, extension services and support by the county government are important to food production and its security among the smallholder farmers.

We observed that most farmers did not observe proper farm husbandry right from the seedbed preparation to storage of the yields.

Access to certified seeds and chemical fertilizer by smallholders has higher impact on crop yield. Farmers who plant improved seeds using chemical fertilizer realize better yields. Forty percent (40%) of smallholder farmers' plant improved seeds whereas 60% use traditional seeds.

Farming husbandry equally plays a big role in determining yields. Adoption of modern farming methods by smallholder farmers results into better farm yields. From the literature for instance farmers who use improved seeds and fertilizer realize better farm yields. In addition farmers who regularly attend extension education also ensure better yield (Wawire, 2015).

Farm incentives such as availability of inputs in markets near their areas of farming and in season of planting ensure farmers access the inputs at low costs. The study also shows farmers are unable to access credit from county government to fund production costs. Some of the major inhibiting factors to access such credit are the high cost of credit, poverty and unstructured loan products.

Weather conditions specifically rainfall reliability has great impact on the crop production among smallholder farmers in Siaya County. Siaya County experiences unreliable rainfall in terms of delays in relation to expected planting season in March and May. There are also cases of down-pour which sweeps away the crops in some cases the storms destroy the crop.

5.3 Recommendations

5.3.1 Policy Recommendations

- a) County extension officials should regularly conduct field days, well advertise them and ensure they are applicable to the needs of smallholder farmers particularly on farm husbandry to improve their acceptance. County governments should hire satisfactory extension officials and equip them sufficiently for them to disseminate farming information correctly to smallholder peasants through field visits. Similarly, peasants should constantly pursue the extension services. This will encourage adoption of modern farm husbandry behaviour and farmers will recognize higher crop production. Extension workers should help smallholder farmers on how to apply farm inputs, identify where to buy them, find credit as well as ways of saving money to purchase farm inputs for subsequent season or enlarge their initiatives. This will result to commercialization of crop production.
- b) National and county governments should revise the existing policies to address the issues of smallholder farmers in relation to farm inputs subsidy. They should be protected from the middle men who constantly exploit them of their produce and overpriced inputs.
- c) Youths should be motivated to totally embrace farming since they are able to adopt new farming methods compared to older people this will ensure higher crop production and food security among smallholder farmers. Also deliberate efforts have to be made by the county government to encourage people with higher education levels into farming given those farmers with higher education levels easily adopt modern farming methods unlike the one with lower levels.

- d) County government should avail tractors to smallholder farmers at an affordable fee. This will help smallholder farmers not over rely on unpaid family labour and animal draught power which are slow and may lead to late plantation. Smallholder farmers should be encouraged to use subsidized manure that is economical than purchasing from profit-making stores; this will allow them to put proper amounts of manure that will result in an increase in crop production.
- e) Smallholder farmers should organize themselves into smaller groups to assist them fight for their rights, access extension services and help them access credits easily by pulling the risk together. County government should support smallholder farmers to readily access credit facilities hence enable smallholders increase food security and crop production. They should be encouraged to organize for barter arrangements with other organizations such as One Acre Fund to aid in provision of inputs. These can help peasants acquire inputs in a timely manner and plant crops ahead of time. Peasants should be heartened to embrace culture of saving from their surplus sale to help them in farm husbandry and purchase of inputs in time.

5.3.2 Recommendations for further studies

- i. Further study on county extension services support to smallholder farmers in general need to be carried out to determine the underlying reasons of low or lack of dissemination of information to farmers.
- ii. Further study on factors influencing field day trainings and extension services in general should be undertaken to establish the underlying effects on food crop production.

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APPENDICES

APPENDIX I: QUESTIONNAIRE FOR HOUSEHOLD HEAD

Dear Smallholder Farmer,

I am **George Odunga** a student at the University of Nairobi undertaking a Master of Arts degree in Sociology. I am carrying out study on food production and food security of smallholder farmers and their support by the county government of Siaya, Kenya. I have identified you as a respondent to a questionnaire to collect information on the food production and food security of smallholder farmers and their support by the county government of Siaya, Kenya. I kindly ask you to help me in filling in the questionnaire as honestly as possible. All your responses will be handled with confidentiality and will only be used for academic purposes. You may opt to write your name or not. Thank you for your cooperation.

Thank you.

Name of respondent.....Contact

PART A: PERSONAL CHARACTERISTICS

1. How old are you?

Less than 29 years			
30- 39 years			
40- 49 years			
Above 50 years			

2. Gender: Male [] Female []

3. What is your level of education?

Education level	
None	
Primary school	
Secondary school	
Post-secondary	

4. Marital status : Single [] Married [] Divorced/ separated [] Widowed []

Number of children.....

Number of other dependents.....

5. What is your occupation
 - a. Farmer/ Housewife []
 - b. Casual employee []
 - c. Business []
 - d. Wage employment []

6. What is your main source of income?

.....

Approximate how much income per month do you earn?

Part B: Food Production and Husbandry

Approximately how many acres of land do you own?

Which of the following practices do you carry out?

- a. Crop rotation []
- b. Soil erosion control []
- c. Dairy cattle []
- d. Improved poultry []

Farm units	Acreage
First unit visited	
Second unit visited	
Third unit visited	
Other visited	

7. Which of the following food crops did you plant last long rains and which inputs and practices did you use?

Inputs/ Practices	Maize		Sorghum		Beans	
	Yes	No	Yes	No	Yes	No

PART C: FOOD SECURITY

Acreage planted						
Improve seeds						
Local seeds						
FYM						
Chemical fertilizers						
Pesticides						
Clean seed bed						
Mode of land preparation (hand hoe, ox-plough, tractor and any other)						
Clean weeding						
Type of labour used (family or hired)						
Yield obtained in 90kg bag						

8. Will the yield you obtained take you to the next harvest? Yes [] No []

9. For approximately how many months does long and short rains yield you obtain take your household?

No of Months	
Less than 3 months	
4-6 months	
6-8 months	
More than 9 months	

10. If the yield will not last for more than 9 months, how will you obtain food for your household?

- a. Gifts from friends or relatives []
- b. Relief from the government []
- c. Buying from the market []
- d. Others (specify).....

11. In case you will have surplus yield, how will you dispose it?

- a. Selling []

- b. Gifts to friends or relatives []
- c. Others (specify).....

12. If you will sell, how many bags will you sell...

How much income did you receive?

13. Which of the following improvements have you made on your farm?

Activity	Yes	No
Borehole/ spring water		
Own ox-plough		
Own tractor		
Improved grain store		
Maize Sheller		
Farm workers (specify number)		

Part D: Support by County Extension Services

14. As a farmer, has the county extension service assisted you to access information about your crop farming? Yes [] No []

If yes, in which of the following ways has the county service assisted you to access information?

Type of information	Yes	No
Visited by the extension officer		
Taken on extension trip		
Attended field day		
Assembled for farm demonstration		
Listened to county radio program on farming		
Provided brochures on farming by county extension officer		

b. If you have not been assisted by county extension service to access information on farming, why?

.....

c. 15. Apart from information, has the county extension provided you credit to assist you with your farming?

Yes [] No []

If yes, what kind of credit were you provided?

a. Money (how much) ksh.

b. Materials (specify) approximate value ksh.

c. If you have not been assisted by the county with credit to improve your farming, why?

.....
.....

d. What other factors are affecting your farming? Comment on any four.

i.

ii.

iii.

iv.

APPENDIX II : INTERVIEW GUIDE FOR COUNTY STAFF

This interview schedule aims at investigating food production and food security of smallholder farmers and their support by the county government of Siaya. You are requested to assist in answering all questions to the best of your knowledge and with a lot of honesty. The researcher guarantees confidentiality for all the responses to the questions.

1. Comment on food security and crop production in Siaya County
2. Comment on farm husbandry in Siaya County
3. Comment on county government extension work in Siaya county
4. Comment on farmers' characteristics in Siaya County
5. Comment on the availability of credit to smallholder farmers to finance production cost

APPENDIX II: INTERVIEW SCHEDULE FOR FARMER

I will ask you questions and you will give your answers. I will be writing your responses.

1. How do small scale farmers in the area manage challenges that arise during crop production?
2. How do members of a household in your area contribute to crop farming?
3. What would you identify as the benefits of agricultural extension programmes in Siaya County?
4. What are the challenges that smallholders in the area face in accessing and using farm inputs like fertilizers and certified seeds?
5. Please comment on your farm husbandry right from seedbed preparation to crop harvesting.
6. Apart from the weather and water, what challenges do smallholder farmers face in crop production?
7. What are the requirements for a smallholder farmer to access credit from the county government?