UNIVERSITY OF NAIROBI

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THE CONTRIBUTION OF AGRICULTURAL EXTENSION SERVICES TO FOOD SECURITY OF SMALLHOLDER HOUSEHOLDS IN NANDI COUNTY, KENYA

By

JOHN SIGEI
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Supervised By: PROF. PRESTON CHITERE

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DECLARATION

This project is my original work. It has not been submitted for a degree in this or any other university.

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JOHN SIGEI   DATE

C50/60028/2010

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

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PROF. PRESTON CHITERE   DATE

DEDICATION

I dedicate this project to my mum Mrs. Ruth Birir and uncle Kipngeno Ngeny.

ACKNOWLEDGEMENTS

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ACRONYMS AND ABBREVIATIONS

FAO   Food and Agriculture Organization

NGO   Non Governmental Organization

WFP   World Food Programme

FEWSNET   Famine Early Warning Systems Network

ALRMP   Arid Lands Resource Management Project

WFS   World Food Summit

MoFED   Ministry of Finance and Economic Development

ICT   Information and Communication Technology

PCP   participatory Community Planning

T&V   Training and Visit

FFS   Farmer Field Schools

FPF   Farmer Participatory Framework

ABSTRACT

The purpose of this study was to determine the contribution of agricultural extension service on household food security in Nandi County. The specific objectives of the study were to assess the household head demographic characteristics, establish the level of access to extension information by households and its effect on food security, determine the level of farmers' accessibility to credit and its effect on household food security, find out the farmers' level of adoption of inputs and practices recommended by the extension services and how it affects food security of smallholder households and to determine the food security situation of households in Nandi County.

The study adopted a survey research design where the target population was 14,489 households in Tinderet District. The study used purposive sampling to select 2 locations from the 15 available in Tinderet. Purposive sampling was again used to select 4 sub-locations from each of the sampled locations. Eight villages were then sampled from the sampled sub-locations and 15 households sampled randomly to bring the sample size to 120 households. The researcher sampled 12 key informants to provide indepth information on the effect of extension services on the food security in Nandi County. Data was collected using questionnaires and interview schedules. Data was analysed using descriptive statistics.

The study established that the food security situation in the district was dire even though farmers harvested maize and beans. The study further established that farmers adopted inputs and practices recommended by the extension services such as improved seeds, timely preparation of land and planting and timely harvesting among others. However, respondents found difficulty in accessing credit. Finally, the study established that households accessed information through the radio broadcast and field demonstrations. The study recommended that the farmers should be encouraged to diversify and stop looking at maize as the only food crop but explore other foods crops such as bananas, potatoes among others; the government should lower the farm inputs through subsidies to encourage the farmers to use fertilizer in planting; the government should make it easy for the farmers to access credit through state enterprises like Agricultural Finance Corporation where the requirements such as demand for collateral will be relaxed for the farmers so that more and more farmers can access credit and; more extension officers need to be employed to reach more farmers and to do more follow-ups on farmers.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The importance of food at the household level is obvious since it is a basic means of sustenance. Adequate intake of quality food is a key requirement for healthy and productive life. Helen (2002) asserted that food is useful for maintaining political stability, and ensuring peace among people while food insecurity can result in poor health and reduced performance of children. Shala and Stacey (2001) found that many countries mainly in the sub Saharan region experience food insecurity with food supplies being inadequate to maintain their citizens' per capita consumption. They also found that sub-Sahara Africa was the most vulnerable region.

Food security is an important theme in the debate of rural development and poverty alleviation policies in many developing countries. Despite the substantial increase in food production in many countries, 790 Million people in developing world do not have adequate food to eat. Another 34 million people in the industrialized countries and those in Transition also suffer from chronic food insecurity (FAO 1999). If the entire World's undernourished people were gathered together, the population of the continent of the hungry would dwarf that of every other continent except Asia (FAO 1999).

Food security means access by all people at all times to adequate food for an active healthy life (World Bank, 1996). It entails both the availability of food and the ability of all members to have access to adequate amount of food. According to Alamgir and Arora (1991) food security means the assured availability of food for individual households to draw on to meet their minimum consumption requirements during a given period. At the national level, food security exists when all people at all times have the physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and healthy life, while at the household level, food security implies physical and economic access to food that is adequate in terms of quantity, safety and cultural accessibility, to meet each person's need (Ingawa, 2002). A country can be

said to be enjoying food security when people's fear of not having enough to eat is removed and the most vulnerable group, namely women and children, in the marginal areas have access to adequate quality of food they want. Household food security can therefore be defined as a household having assured sets of entitlement from food production, cash, income, reserves of food of assets and/or government assistance programmes such as in times of need they will be able to maintain sufficient nutritional intake for physical well-being (Idrisa, Gwary and Shehu, 2008).

There is growing literature on food security in developing countries. Most previous studies concentrated on objective food security measures at the household level. These measures look at the consumption (converted into calories) or expenditure data. Mallick and Rafi (2010), among others, argue that consumption has large seasonal volatility and most of these studies use single round of survey, thus consumption data may systematically under or over report the true food security.

Different pillars of food security have been assessed in the literature. For instance, in rural Pakistan, Khan and Gill (2009) analyzed the determinants of three components of food security i.e. food availability, accessibility and absorption. Food availability is achieved when sufficient quantities of food are available to all individuals. Khan and Gill explain that access to food is attained when household members have enough resources to acquire food. Food absorption/utilization has health dimension and requires a sufficient energy from diet and access to clean water and sanitation. They find that food availability requires the increased production of crops and livestock products. In food accessibility component they found that electrification and adult literacy positively contribute to food accessibility while marginalization of land contributes negatively to food accessibility. For food absorption, they found that child immunization, female literacy, safe drinking water and number of hospitals increase food security.

At the household level, Feleke et al. (2005) and Kidane et al. (2005) probed the household food security in rural households of Ethiopia. The studies link food security and technology adoption (adoption of high yield varieties of maize and fertilizer application). They concluded that technology adoption do increase household food security. Other factors analyzed include farm size, livestock ownership, education of head of household, household size and per-capita production of the household. With the exception of household size all the other factors increase food security.

A hypothesis that is often raised in the literature is that wealth, assets ownership (e.g. land, livestock) and income is a good predictor of food security (Iram and Butt 2004; Feleke et al., 2005; Kidane et al., 2005; Babatunde et al., 2008). A household with resources is expected to withstand shocks in production or prices that create food shortages. Unexpected, in Pakistan, Iram and Butt (2004) who measured food security as per capita calories, found that mother education reduce likelihood of food security. Babatunde et al. (2008) conducted a gender-based analysis of vulnerability to food insecurity in Nigeria. They found that female headed households were more vulnerable to food insecurity than male headed households. They also found that increase in farm size and crop output reduces vulnerability to food insecurity in male headed households. Mallick and Rafi (2010) found no significance differences in the food security between male headed households and female headed households among the indigenous ethnic groups in Bangladesh. Their finding is in contrast to the conventional view that female headed households are vulnerable.

In the literature, studies have also focused on the levels and causes of the food insecurity problems. In general, food insecurity is linked to high food prices, poverty and low agricultural productivity (Nyangweso et al., 2007; Misselhorn , 2005; GoK 2008; Dávila 2010; Lewin 2011). Dávila found that higher prices for maize affected Mexican household living standard and food security both in urban and rural areas, with the poorest net buyers of maize were most affected. In Malawi, Lewin shows that a 25

percent increase in the price of maize flour would increase the likelihood of food insecurity in Northern Malawi by 12 percent, while a similar increase in fertilizer prices would increase food insecurity by 30 percent in the central region. Using dietary diversity among household in a poor Vihiga district in Kenya, Nyangweso et al. found that household income, number of adults, ethnicity, savings behavior and nutritional awareness are critical when addressing the question of food security from the demand side. In Kenya a widespread hunger prevailing particularly in semi arid areas is not due to inavailability of food in the market but due to inadequate purchasing power among the rural poor. Household food insecurity results from insufficient access to agricultural land, lack of diversity of food crop production and poor post-harvest practices. Agricultural extension, credit and marketing infrastructure are poor. Household food security is impeded by income, labour and time constraints. They may differ widely from country to country and from one location or population group to another, even within the same country (Iram and Butt, 2004).

Different interventions have been shown to improve food security situation. For instance, participation in drylands interventions (Makueni district Agricultural Project, Kenya) such as irrigation have been shown by Lemba (2009) to have significant impacts on household food security, which was attributable to improved access to resources (mainly for production). Similar results were found for irrigation schemes in Malawi (Lewin 2011). In Nepal, Tiwari *et al.* (2010) assessed the effects of Maize varietal intervention to improve productivity and food security. They found that food availability increased as a result of the improved varietal intervention with greater relative benefits to poor farmers compared to rich farmers. Extension services have also been used to address the food insecurity in many parts of the world (Agbamu, 2005).

A general consensus exists that extension services, if properly designed and implemented, improve agricultural productivity hence a improved food security (Romani 2003, Evenson and Mwabu 2001). The term 'extension' is here understood to mean 'advisory and other services' that help rural families to make the best possible use of the

productive resources at their disposal (Katz 2002). Agricultural extension brings about changes in household food security, through education and communication in farmers attitude, knowledge and skills (Koyenikan, 2008). The role of agricultural extension involves dissemination of information, building capacity of farmers through the use of a variety of communication methods and help farmers make informed decisions. Sinkaye, (2005) equates help in extension to empowering all members of the farm households to ensure holistic development. Agricultural extension service is one of the agencies transforming subsistence farming into modern and commercial agriculture which promotes household food security.

Agricultural extension services provide farmers with important information, such as patterns in crop prices, new seed varieties, crop management, and marketing. Exposure to such activities is intended to increase farmers' ability to optimize the use of their resources. At times even when technologies are available, smallholder farmers have no access to them (Fliegel, 1993). Awareness of existing technologies generates effective demand by providing a critical signal to input distribution systems (Davidson et al 2001). Thus, extension systems and input distribution systems are mutually reinforcing the contribution of extension to agricultural productivity growth depends on functioning input distribution systems, and vice versa. In addition, ideal extension system provides feedback from farmers to research centres.

The extension service in most African countries is bedeviled by several problems as identified by Agbamu (2005). These include inadequacy and instability of funding, poor logistic support for field staff, use of poorly trained personnel at local level, ineffective agricultural research extension linkages, insufficient and inappropriate agricultural technologies for farmers, disproportionate Extension Agent: Farm Family ratio and lack of clientele participation in program development (Rivera, Quamar and Crowder, 2001). Others are poor input supply, irregular evaluation of extension programmes and policy, institutional and programme instabilities of National agricultural extension systems. Some of the recommendations to improve the service are to make its content more relevant to farmers, alternative sustainable financing option, well trained, and adequate

staffing, and the use of participatory extension approach under stable policy and sustainable institutional arrangement (Romani, 2003).

In Kenya, public agricultural extension service was started during the colonial period and continued after independence in 1963 (Muyanga, 2004). The government was responsible for the provision of the agricultural extension services through the ministry of agriculture. The government support in extension service system led to a rapid growth in agriculture sector. As a result of economic challenges, government streamlined its expenditure which directly affected agricultural extension services in the country. It was then that the government introduced the national Agricultural Extension Service Policy which calls for the demand-driven extension service and involvement of other players in the agricultural extension services (Republic of Kenya. 2004). Due to the weakening of the public extension service, a number of extension agents like the community based organizations, private sector, NGOs and consultancy groups have tried to fill the gap (Atieno, and Kanyinga, 2008). Despite the emergence of these groups to provide the services of extension, the household food security situation has continued to deteriorate.

Some parts of Nandi County mainly the North are self reliant in maize production while the south is maize deficient. This is despite the fact that 68% of the south is arable and having a good climate (FAO, Kenya, 2007). For instance, maize production for 2005 was 43,767 metric tones accounting for over 98% of total cereals produced in the district (Langat, Sulo, Nyangweso, Ngéno, Korir, and Kipsat, 2010). It is by far the most important food crop in the region. The annual demand for the same period was estimated at 96,823 MT (Republic of Kenya, 2002). This is an indication that the area's own production can only last for five months. The south therefore relies on imports from the districts in the North and Uasin Gishu.

Most of the households depend on own production for a higher proportion of food consumed apart from cooking fat, fish, meat and pulses (other than beans). This excludes those under the mixed farming: horticulture/tea/livestock livelihood zone where there is greater reliance on market for foodstaff consumed. Nearly 80% of foods consumed by

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households in the area are obtained from the market (Republic of Kenya, 2002). A major factor affecting food security is that a lot of maize (30%) is sold when green. This not only leaves little for home use but it also fetches lower prices in the market.

Tinderet division experiences low food production due to rugged topology while Nandi Hills host most of the multi-national tea estates leaving little land for agricultural production. The tea estates occupy about 97.2 km of the total land in the district. Food prices are usually very high during maize scarce months. Apart from the traditional foods, maize and milk, there is little diversification for home consumption and national deficiencies are rampant in the district due to lack of awareness of nutritional knowledge. Foods such as eggs and poultry are still considered taboo in some of the communities. An assessment of nutritional status of under-five year children in the county indicate that about 32%, 6.8% and 22.8% suffered stunting, wasting and underweight respectively (FAO, Kenya, 2007).

1.2 Statement of the Problem

Agriculture in Africa is predominantly peasant. Smallholder farming plays a crucial role in food production for both rural and urban populations and remains a major source of income, employment, and export earnings (Krishna, 1977). Over time more and more people in these economies have shifted from wholly subsistence farming to commercialized agricultural production. Adequate home production of food and/or adequate economic and physical access to food are touted as major means through which household food security could be guaranteed. However, smallholder farming in less developed countries which is based on low-input and inefficient traditional farming practices coupled with population pressure on land have impacted negatively on sufficient food production. There is a general consensus from research findings and among policy makers that the future of food security and poverty lies with the smallholder farming.

Much progress has been made in understanding the processes leading to food insecure situations for households. In the 1970s food security was mostly considered in terms of national and global food supplies. In the mid-1980s it became clear that adequate food availability at the national level did not automatically translate into food security at the individual and household levels. Food insecurity occurred in situations where food was available but not accessible because of erosion in people's ability to obtain food from their own production, income, gathering of wild foods, community support, assets, migration, etc (Republic of Kenya, 2007). The household food security approach that evolved in the late 1980s emphasized both availability of and stable access to food. Interest centred on understanding food systems, production systems and households' access to the food supply over time.

In the Agricultural sector, extension service plays a vital role in sharing knowledge, technologies, agricultural information and also linking the farmer to other actors in the economy (Republic of Kenya, 2007). The extension service is, therefore, one of the critical change agents required for transformation of subsistence farming to modern and commercial agriculture. This is critically important in promoting household food security, wealth and employment creation and poverty reduction (Republic of Kenya, 2007). For a long time, the extension service was dominated by the public sector and had good impact. This was as a result of new technologies being introduced; a well-funded extension service; an elaborate set of farmer incentives such as ready market, subsidised inputs and credit; as well as relatively good infrastructure. However, in the last two decades, several constraints have hindered proper functioning of agricultural extension systems and services which has resulted into declining food production in Kenya.

Many studies have demonstrated the existence of a strong relationship between extension services to food security among households. In their study, Evenson and Mwabu (1998) found a positive and significant relationship between the farm productivity and agricultural extension services. Another study by Cerdan-Infanter, Maffiola & Ubfal (2008) found in their study that there was increased yield for sugar and grapes with the adoption of extension services. While these studies were of importance to the researcher,

they never addressed the food security situation in Tinderet with regard to agricultural extension services, hence a knowledge gap. It is this gap that the study sought to fill.

1.3 Research Questions

a) What is the demographic characteristics of household heads and its effect on food security in Nandi County?

b) What is the level of access to extension information by smallholder farmers and its effect on household food security?

c) Have smallholder farmers' accessed to credit on household food security?

d) What is the farmers' level of adoption of inputs and practices recommended by the extension services and its effect on household food security?

e) What is the food security situation of the households in Nandi County?

1.4 Research Objectives

Main objective of the study was to determine the contribution of agricultural extension service on household food security in Nandi County.

Specific Objectives

a) To determine the household demographic characteristics and its effect on food security in Nandi County.

b) To establish the level of access to extension information by smallholder household and its effect on food security in Nandi County.

c) To determine the level of smallholder farmers' accessibility to credit on household food security in Nandi County.

d) To find out the farmers' level of adoption of inputs and practices recommended by the extension services it affects food security of smallholder households in Nandi County.

e) To assess the food security situation of households in Nandi County.

1.5 Scope of the study

The study focused on the contribution of agricultural extension service on household food security. The study was conducted in Tinderet District in Nandi County, Kenya. Although there were many variables which may influenced the household food security, the study focused on use of farm inputs, access to extension service information and the households demographic characteristics.

1.6 Rationale of the Study

The importance of agricultural extension in rural development is widely acknowledged, particularly in developing countries where the majority of the population lives. Agriculture is the main source of livelihood, and access to information is generally costly (Wanga, 1999). Since Kenya's independence in 1963, agricultural extension services were largely provided by the government until the late 1980s. Through the 1990s, the established modes of delivery of extension services began to shift in favour of those that involved farmers in the design or prioritization of these services. This re-orientation of extension towards participatory processes was catalyzed by the increasing realization that effective and sustainable extension programs could only be achieved with the more active participation of the various end-users, especially farmers. This were with the view to improve the food security in the country which is the major goal of the government of Kenya as put in the Kenya Vision 2030 that is to improve food security in the country (Republic of Kenya, 2007).

1.7 Definition of Terms

Household Food Security: This is state when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary need and food preferences for an active and healthy life". This definition takes into account two key determinants of food security: enough food availability (through domestic production, storage, and/or imports), and

the ability to acquire enough food (through subsistence production, market purchases and food transfer). It also stresses the need to look at the food security problem at the individual, household or vulnerable group level.

Farmers' level of access to Credit: Refers to the ability to obtain goods or services before payment, based on the trust that payment will be made in the future: "unlimited credit".

Households characteristics: Refers to the households facts which describe them such as the number of children, economic status, level of education, religion among others.

Household Perception: Refers to the process by which households translate sensory impressions into a coherent and unified view of the world around them.

Households Access to Information: Refers to the ability, right and permission by the households to approach and use the available farming resources that convey recommended farming practices.

Adoption of recommended farm inputs and practices: Refers to the ability of the farmers to use the farm inputs and practices recommended by the Agricultural Extension Officers for better yields.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The literature review in this study is discussed under the following subtopics: concept of food security, food security indicators, food security measurements, agricultural extension services, access to credit, household characteristics, theoretical framework and conceptual framework.

2.2 The Concept of Food Security

World food security was the main focus of the 1996 World Food Summit (WFS) organized by the Food and Agriculture Organization (FAO) of the United Nations. The WFS reports indicate that after 30 years of rapid growth in agricultural production, the world can produce enough food to provide every person with more than 2700 calories per day. This calorie intake is normally sufficient to ensure that all have access to adequate food, provided food distribution is not too unequal. Yet more than 800 million people in the developing world, about 20 percent of their total population, suffer from chronic under-nutrition. Millions more are vulnerable to food insecurity, they cannot guarantee access to sufficient food at all times (Von Braun et al, 1996).

Despite gains in food production and food security on a world scale, many countries and whole regions failed to make progress in recent decades. Sub-Saharan Africa produces less food per person today than it did 30 years ago. The WFS reports further indicate that world agricultural growth to the year 2010 is expected to slow, but should still outpace population growth. But not all regions and countries will share equally in these gains in production and nutrition. The situation in Africa south of the Sahara will deteriorate further, while progress in South Asia will be painfully slow (Von Braun et al, 1996).

The United Nations, technically, defines a household as food secure when it has access to the food needed for a healthy life for all its members (adequate in terms of quality, quantity, safety, and culturally acceptable), and when it is not at undue risk of losing such access (Von Braun et al, 1996). This definition is generally acceptable, because it has the three critical aspects (availability, access and risk). Access refers to the ability to obtain the necessary food, either through own production or purchasing from the market. Risk arises from fluctuations in production or income. In Uganda's context, especially in rural areas where the majority of households depend on own production, the risk to food security arises more from fluctuations in production than from income because very little of what they consume is purchased.

Food insecurity in Uganda has several dimensions. The first is low productivity of the agricultural sector, which means low production and hence reduced food availability. The second dimension is poverty, with 44 percent (8.8 million) of the population living in absolute poverty, according to 1997 household survey data (GoU, 1999). The majority of the poor households are rural based, with low incomes and, therefore, when own food production fails, they are fully exposed to food insecurity. Since agriculture is the main activity of the rural poor, increasing their productivity will achieve two objectives: reducing rural poverty through increased household income, and achieving sustainable household and national food security. The third dimension is the vulnerability to natural hazards, such as poor rainfall that leads to low production and, therefore, increased risk.

Uganda's rural agriculture is predominantly subsistence and semi-subsistence farming. It is predominantly rain-fed and, therefore, food supplies are susceptible to rainfall fluctuations. There is little, if any, stockholding at the household level, a situation that makes rural households find it difficult to go through off-season periods and times of poor harvest. Poor or lack of appropriate and affordable post-harvest technology at household level leads to food losses that have been estimated at about 30 percent. At the national level, there is no specific buffer stock program that would release food onto the markets during times of shortage to stabilize retail food prices during periods of low supplies. In the past, attempts by the government to purchase agricultural produce failed

because of inefficiency inherent in the public sector. Such food reserves, while advantageous to consumers in maintaining low food prices, are very expensive to maintain and tend to rely on government subsidies (GoU, 1999). In Uganda, where public sector management is inefficient, buffer stock programs, if they are to evolve, should be managed by the private sector on a purely commercial basis. However, the private sector has not yet developed enough to maintain large food commodity stocks.

2.2.1 Food Security Indicators

Food security indicators are summary measures of one or more of the dimensions of food security used to demonstrate change or the result of a program or activity for a target population. Food security requires multi-dimensional considerations since it is influenced by different interrelated socio-economic, environmental and political factors. In most analysis of food security conditions, multiple indicators are used to reflect the various dimensions of food security status. Along with the development of the concept of food security, a number of indicators have been identified to evaluate food security situation (Von Braun et al, 1996).

Indicators are often classified into two different types of categories, 'process' and 'outcome' indicators. The former provides an estimate of food availability/supply and food access situation and the latter serves as proxies for food utilization/consumption. Process indicators mainly include food supply and food access indicators. Food supply indicators are known to provide information on the likelihood of shocks or disaster events that affects household food security (Ministry of Finance and Economic Development [MoFED], 2002). Food access indicators, unlike supply indicators are relatively quite effective to monitor food security situation at a household level. 'Outcome' indicators include all direct and indirect indicators of household food consumption, which shows the level, and changes in food consumption and the amount of food in stores serve as proxy estimates for measuring household food situation. They can be disaggregated at lower level as opposed to food supply indicators (Von Braun et al, 1996).

2.2.2 Food Security Measurements

There are many commonly used measures that can reflect the various dimensions of food security. In addition, there are usually a number of ways of measuring any single indicators. At the household level, food security is best measured by direct surveys of income, and consumption and compares that with the adequacy norm appropriate to the household to be food secure and making comparison of these results. Annual income is one of the conventional approaches that have been widely used in measuring food security. This "income or expenditure technique" which is commonly used by economists is obtained by estimating gross annual household's production or income over time. Food security at household level is best measured by direct survey of annual income and consumption, and compares that with the adequacy norm (minimum subsistence requirement) appropriate to the household to be food secure. Thus, the procedure usually used in setting poverty line can also be applied to classify food secure and insecure households (MoFED, 2002).

In this study, the researcher has adopted the minimum threshold cost of basic needs calculated by MoFED (2002) which included the cost of both food and non food requirements. Food security and poverty measurements assume that there is a predetermined and well-defined level of standard of living called 'poverty line' below which a person is deemed to be under poverty or food insecure. That is there exists level of consumption of various goods (food and non food) below which the very survival of an individual is threatened.

In this regards, the cost of basic needs method is often used to set poverty line for classifying food secure and insecure households. This method is superior to the direct calorie intake and food energy intake methods due the fact that the cost of basic needs approach takes into account the cost of getting the basic caloric requirement and non food requirement. In addition, this method yields a consistent threshold (poverty line) across groups, regions and periods. In the cost of basic needs approach of setting poverty line, first, the food poverty line is defined by selecting a 'basket' of food items typically consumed by the poor. The quantity of the basket is determined in such away that the

given bundle meets the predetermined level of minimum caloric requirement (2200 kcal/AE/day). Then, a specific allowance for the non food component consistent with the spending patterns of the poor is added to the food poverty line (MoFED, 2002). Dejene (2004) writes that a daily per capita calorie intake of 2100 kcal is sufficient for productive and healthy life. Thus, a household of six persons may be said to be food secure if and when it can;

a) produce food amounting to 11 quintal of grain equivalent per year and have reserve food stocks about 20 % over and above this amount, and/or

b) earn cash income, primarily from agriculture but with a strategy of gradual diversification away from agriculture, sufficient to purchase the above amount of food, and/or

c) demonstrate the capacity to withstand shocks by accumulating resources/assets, convertible to cash, worth 20% of the food requirement of the household.

2.3 Agricultural Extension Services

Agricultural extension has been reoriented to meet with the changing situation of liberalisation head on. Farmers in remote areas are being encouraged to grow food crops first to ensure food security. However, such farmers are also encouraged to grow high value crops and crops which do not need high fertilizer applications as cash crop. Extension priorities are being developed in three major agro-ecological zones to support technologies which have great potential for farm incomes and household food security while maintaining the sustainability of the resource base.

An improved information and knowledge flow to, from and within the agricultural sector are a key component in improving small-scale agricultural production and linking increased production to remunerative markets, thus leading to improved rural livelihoods, improving quality and yield, food security and national economies (Asaba et al., 2006). The agricultural sector is the backbone of many economies in Africa. In Kenya, the economy depends heavily on agriculture, which accounts for more than 26 per cent of gross domestic product, provides 60 per cent of exports and employs 90 per cent of the work force (Republic of Kenya, 2007). Various studies have revealed that there is a

positive relationship between the increased flow of knowledge and information and agricultural development (Fawole, 2008).

However, most African countries have not devoted their efforts to the dissemination of knowledge and information, especially in rural areas, where 70-80 per cent of the African population lives (Adomi et al., 2003). Only a small amount of agricultural information is accessible to rural farmers, despite the large body of knowledge that exists in research institutions, universities, public offices and libraries. This situation is largely attributed to the weak linkages between research, extension, not for profit organizations, libraries and farmers and thus these technologies have neither reached nor been adopted by their intended beneficiaries to improve their farming activities in developing countries including Kenya (Tire, 2006).

The advancements in the information and communication technologies (ICTs) provide an opportunity for developing countries to harness and utilize information and knowledge to improve productivity in various sectors including agriculture (Lwoga, 2010). Unfortunately, resource poor farmers are mainly affected by the digital divide which is a gap between groups or individuals in their ability to use ICTs effectively due to differing literacy, technical skills and useful digital content (Ghatak, 2007). Nevertheless, the emergence of low-cost ICTs (such as radio, cell phones and the media) may bridge the digital divide (Lwoga and Ngulube, 2008). Given the fact that there are disparities to the accessibility and utility of the ICTs especially in the developing countries, it is also important to investigate the application of these tools for the improved farming activities especially in the rural areas.

It is widely recognized that increasing agricultural production is, in many parts of the developing world, an important component of a strategy to increase incomes, reduce hunger, and contribute to the improvement of other measures of well-being. Doing so requires improvements in the productivity of factors of production. As D. Birkhaeuser, Evenson and Feder (in Owens et al, 2003), showed that agricultural extension represents a mechanism by which information on new technologies, better farming practices, and

better management can be transmitted to farmers. It is not surprising, therefore, that considerable amounts of funds, running into the hundreds of millions of dollars, are disbursed annually in support of agricultural extension. It is also not surprising that the impact of agricultural extension has received considerable attention.

Owens et al (2003) in their study on the impact of agricultural extension service on farm production in Zimbabwe found that after controlling for innate productivity characteristics and farmer ability either using household fixed-effects estimation or by including a measure of farmer ability and village fixed effects, access to agricultural extension services, defined as receiving one to two visits per agricultural year, raises the value of crop production by about 15%.

Birkhaeuser, Evenson, and Feder review 15 studies published between 1970 and 1989 on the impact of extension on farm productivity (output per unit area) or output (Owens et al (2003). By restricting their review to only those studies that use linear regression techniques, they report 26 estimates. Eleven estimates are statistically significant at the 90% confidence level or higher, with the highest estimate indicating that contact with extension services raises output by 27%.

Extension needs to go beyond technology transfer to developing skills and knowledge of farm families for sustainable agriculture and rural development. There should be paradigm shift from the Training and Visit (T&V) which involves technology transfer and emphasizes individual contact to more participatory approach. There will be the need to adopt group approach to ensure effective use of limited resources; personnel, time and fund. The approach will ensure participation, ownership, inclusion and empowerment. More farmers will be reached and all gender categories could be catered for through participatory community planning (PCP).

Variety of extension methods will need to be used. Selection and use of appropriate methods in order to meet specific extension objectives with various categories of farmers will be necessary. They include (a) individual farm and home visits for follow up, (b)

group methods: demonstrations to farmers groups, field days, (c) Mass Media to create awareness and reach large population at a time, (d) Farmers Trainings, and (g) Participatory methods in which extension staff work with farmers to analyze current situations and problems and determine appropriate action for self reliance (Pretty & Volouche, 1997). Examples include RRA, PRA, Farmer field schools (FFS), IMP etc. These extension methods are the tools extension staff draw from, to address specific needs. Their use cannot be restricted but levels of emphasis may vary.

2.4 Access to Credit

Promoting an efficient, sustainable and widely accessible rural financial system remains a major development challenge in most Sub Sahara African countries. With about 73% of Africa's population living in the rural areas and experiencing a high incidence of rural poverty, improved rural finance is crucial in achieving pro – poor growth and poverty reduction goals. However, the development of rural financial systems is hampered by the high cost of delivering the service to small, widely dispersed customers; as well as difficult financial terrain characterized by high covariant risks, missing markets for risk management instruments and lack of suitable collateral (Onumah, 2002)

One of the important factors which account for the relative poverty of the rural population is the system of finance found in most developing countries. Farmers are trapped in the "vicious cycle of poverty", because they do not have the capacity to save because their real incomes are low. This is due to the low productivities, which are due to lack of capital investments which, in turn, are due to their inability to forego consumption and to save.

The demand for agricultural credit stems from economic and social factors prevalent in the rural areas of the developing countries. Access to credit to allow low income farmers to afford to use fertilizer on food crops is a major problem in virtually all of Africa, primarily because, unlike some cash crops, input suppliers cannot be assured of recovering their loans by acquiring farmers' surplus production. However, the case of Kenya shows that solid progress can be made in improving small farmers' access to

credit – much better than in most countries in Sub- Saharan Africa. In Kenya's case, small farmers' access to credit for fertilizer on maize has been facilitated by their participation in cash cropping schemes for tea, sugar and, especially in earlier times, coffee (Jayne, Yamano, and Nyoro, 2004).

Oweis, Hachum and Kijne (1999) has indicated that the lending factors, which govern the distribution of available funds, are the terms of lending. In a perfectly competitive market, credit is allocated according to the prices (Interest rates); borrowing farmers are willing to pay. Interest rates influence the movement of credit among the various sectors of the economy. The factors that affect the structure of interest rates include the availability of collateral to obtain credit, the supply and demand conditions which produce change in interest rates, the opportunity costs and availability of credit to farmers, the scope of competition among, and the services, if any, provided by lenders such as marketing of agricultural commodities.

Low interest rates are defended on the grounds of being a special incentive to farmers to use purchased productive inputs, especially when this means a change from traditional practice. Recent research has demonstrated how efficient farmers are in allocating resources including borrowed capital and their willingness to seize potentially profitable rural opportunities. Khadler et al (1998) observed that both formal and informal loans matter to the poor farmers. However, they note that even though formal lenders tend to provide much more production loans than informal lenders, loan defaults costs tend to be higher than what they can recover. On the other hand, the benefits of informal credit seem often problematic because such funds are very fungible.

Therefore, in order to have a significant improvement in food production, there is a great need for a good agricultural credit system. The government is encouraging the development of a viable and sustainable financial system to service the agricultural sector. This includes an improvement in the accessibility of credit and other financial services (including banking) to the smallholder producers. The liberalisation policy has made bank interest rates to be high thereby making borrowing more costly. However, it

has also encouraged producers to borrow prudently and they are utilising credit judiciously.

2.5 Household Characteristics

In the past, most societies in Sub-Saharan Africa assumed males to be heads of households irrespective of the status of their spouses, and female-headed households were not recognised (van Driel, 1994; Mutoro, 1997). However, in recent times, compositions of households have undergone profound changes, and female-headed households have emerged. Female headship of households has been estimated to be 13 per cent in Middle East and North Africa, 22 per cent in Sub-Saharan Africa, 16 per cent in Asia, 35 per cent in the Caribbean and 24 per cent in Latin America (United Nations, 2000; Bongaarts, 2001; Katz, 2003).

This phenomenon is as a result of migration of males to seek greener pastures in urban as well as other rural mining and cash crop growing areas, thus relinquishing the responsibilities of managing households to women. Other reasons include, females becoming widowed, divorced, abandoned by husband or a single woman who can cater for herself as a result of the acquisition of land. In contemporary times, war, sickness and death from HIV/AIDS have reduced rural male populations especially in Sub-Saharan Africa resulting in more female-headed households (Mtshali, 2002; Deere, 2005).

Some studies have shown that women in typical rural settings, having the responsibility of looking after their children without financial assistance from husband or other relatives tend to be less endowed compared to those with financial assistance (Barrow, 1996; van Vuuren, 2000). Although females put in a lot of energy and time for agricultural production, their agricultural output remains low due to certain factors including land, labour, farm equipment, technical assistance and information (Preibisch et al., 2002; Njuki et al., 2004; Doka and Monimart, 2004). With a shortage of labour and capital, women heads of household are often forced to make adjustments to cropping patterns and farming systems. These adjustments have resulted in decreases in production and, in

some cases, shifts towards less nutritious crops. Not surprisingly, these households often suffer from increased malnutrition and food insecurity.

Theories accounting for food crop production after Malthus (1960) have centred on two key conditions, namely: demographic pressure (Boserup, 1981) and market price incentives (Schultz, 1964). Boserup who wrote mainly after the agricultural and industrial revolutions, suggests that increasing population pressure mostly leads to an increase in land use intensity. Even though, this scenario will bring about a diminishing return on the labour and capital that has been invested, on the other side of the coin, it will bring about an increase in the total agricultural output (Chayanov, 1966; Turner et al., 1993). Schultz (1964) on the other hand argues that higher market price of food crops, causes farmers to intensify the cultivation of those crops and increase the farm holdings used to cultivate those crops (Mellor, 1990; Wharton, 1969).

The majority of farm households in Kenya are small–scale semi-subsistence producers with limited participation in non-agricultural activities. Because land and finance to purchase agricultural inputs are very limited, increasing family size, according to the literature, tends to exert more pressure on consumption than the labour it contributes to production. Thus a negative correlation between household size and food security is expected (Paddy, 2003) as food requirements increase in relation to the number of persons in a household. Household size is a continuous variable. It is measured in this study by the number of adult equivalent units in a household.

Education is an additional factor which is thought to influence the food security status of households. Educational attainment by the household head could lead to awareness of the possible advantages of modernizing agriculture by means of technological inputs, enable them to read instructions on fertilizer packs and diversification of household incomes which, in turn, would enhance households' food supply (Najafi, 2003). Educational attainment of a household head is considered by this study to be a qualitative variable.

Farmland size is a continuous variable. This study expected farmland size to affect food security status of households positively. According to Najafi (2003), food production can be increased extensively through expansion of areas under cultivation. Therefore, under subsistence agriculture, holding size is expected to play a significant role in influencing farm households' food security. The sample households plough fragmented plots with different sizes and fertility levels. Plot sizes are available in local units of measurement. The size of farmland owned by a household was determined by summing the fragmented plots, and converting it to hectares using a conversion factor.

Hofferth (2003), in his study, argues that the higher the age of the household head, the more stable the economy of the farm household, because older people have also relatively richer experiences of the social and physical environments as well as greater experience of farming activities. Moreover, older household heads are expected to have better access to land than younger heads, because younger men either have to wait for a land distribution, or have to share land with their families. A similar study by Obamiro *et al* (2003) arrived at a similar conclusion regarding the relationship between age of a household head and household food security. Age of household head was measured in years. Hofferth (2003) further states that subsistence farming is generally characterized by greater reliance on labour than commercial agriculture. In subsistence farming, households with larger labour supplies are better positioned to increase the productivity of their land. Availability of a relatively larger labour force, regardless of farm size, can be an advantage to those households who strive to achieve food security, provided that the excess labour force is engaged in other income generating activities. Similar study by Jiggins (1986); Thomas and Leatherman (1990); and Chen (1991) report that labour availability is an important determinant of household productivity and food security, especially in subsistence-oriented households given the necessary landholding and rainfall. It is thus expected by this study that labour availability will affect food security positively. A conversion factor was used to measure labour availability in terms of man equivalent units.

A household's wealth status forms the other important source of livelihood for farming households. Livestock contribute to households' economy in different ways, e.g. as a source of pulling power, source of cash income, source of supplementary food, and means of transport. Besides, livestock are considered a means of security and means of coping during crop failure and other calamities (Kang'ara *et al* 2001). Livestock provides not only food for the producers, but also a range of other products which could be sold or consumed by the livestock owner to provide nutrition, income, traction and fuel. The major products of livestock include draught power, meat, milk, eggs, manure which is used as fertilizer or fuel, feathers, fibre, hides, and horns. In addition to these products livestock serve as an asset and may provide a reserve that can be converted to cash in times of need. A study by Kassa *et al* (2002) found that households who own livestock have good food security status as well as sustainable farming. Particularly in Kenya, where crop failure is frequent due to poor rainfall, the level of a household's resources a critical factor in combating such disasters.

2.6 Theoretical Framework

The theoretical framework that guided the study were two theories namely adoption and diffusion theories and farmer participation framework.

2.6.1 Adoption and Diffusion Theory

Diffusion theory examines the process by which innovations are adopted over time (Gregor and Jones, 1999), or by which innovations are communicated through specific channels over time among the members of a social system (Apperson and Wikstrom, 1997). It originated in Europe in the early part of the twentieth century with the rise of the social sciences, and its early focus was on individuals as decision makers; by the early 1960s studies were conducted on organizations as units of adoption, including areas such as political science (Apperson and Wikstrom, 1997). Diffusion theory's beginnings can also be traced to rural sociology, geography, medical psychology, cultural anthropology, and industrial economics; however, it was introduced to the consumer behavior field in the mid-1960s (Gatignon and Robertson, 1985).

As originally applied by Rogers to the field of consumer behavior, diffusion theory has four key elements: innovation, communication channels, time, and the social system (Mahajan, Muller and Bass, 1990). In terms of innovation, diffusion models examine the development of a life cycle curve in order to forecast first purchase sales of innovations (Mahajan, Muller and Bass, 1990). Communication channels are made up of both the mass media and interpersonal communications; external communications influence early innovators or adopters, while interpersonal communications influence the speed and shape of the diffusion process over time (Mahajan, Muller and Bass, 1990). As such, diffusion's focus is on interpersonal communications within social systems over time as it relates to the spread of innovations (Gatignon & Robertson, 1985) and it emphasizes that the norms and beliefs of the social system must be considered in any diffusion process of innovation (Gregor and Jones, 1999).

Since all potential adopters in a social system do not adopt a new product at the same time, adopters can be classified into categories, depending on when they adopt the product. These categories are important because they can aid the targeting of new prospects for a new product, assist in developing marketing strategies to penetrate the various adopter categories, and assist in predicting the continued acceptance or rejection of a new product (Mahajan, Muller, and Srivastava, 1990). Rogers' method of categorizing adopters was to distribute the classifications on a bell-shaped curve, using basic statistical parameters of normal distribution. As such, he identified five adopter categories: innovators, who make up 2.5% of the schema; early adopters, who constitute 13.5% of the category; early majority, who make up 34%; late majority, who comprise another 34%; and finally, laggards, who form 16% of the categorization (Mahajan, Muller and Srivastava, 1990).

In the agricultural sector, the government through extension services, field exhibitions, agricultural shows and credit facilities provide farmers with better farming practices, experience, improved skills and provision of farm inputs on credit with the aim of improving food security in the country. This study seeks to determine how the extension

services have adopted the techniques and recommended inputs they have learned from the extension officers and the field exhibitions with the aim of improving their food security.

2.6.2 Farmer Participatory Framework

The term Farmer Participatory Framework (FPF) was coined by Farrington and Martin (1987) after the traditional top-down, prescriptive approaches to agricultural research and extension has heavily been blamed for the low up-take of agricultural technologies and very often for the development of technologies that are not appropriate to farmer needs and socio-economic and agro ecological environments. This has resulted in increasing dissatisfaction with this "transfer of technology" approach leading to researchers opting for farmer participatory research methodologies. Farmer Participatory Framework is based on the pretext that farmers are researchers in their own right and have indigenous knowledge of the local conditions (Chambers et al., 1989).

In the development context, participatory framework may be defined as a process whereby a group or a community identifies a problem or question of interest, reviews what is known about it, conducts research on it, analyses the information generated, draws conclusions and implements solutions (Selener 1997). In this definition, the locus of decision-making rests implicitly within the group or community involved. Participatory research approaches have been developed and applied in four broad areas: (1) community development, (2) action research in ` most notable being: the iteration or repeated cycling of reflection and action; the breakdown of subject-object polarity; the rejection of passive knowledge banking in favour of active knowledge acquisition and generation through participation in research and analysis, and application of the results; facilitation of the development of critical consciousness by external actors.

This study seeks to determine how the farmers in Nandi have been receiving training and advice from the extension officers and other agricultural extension to boost their food security. According to the theory, the diffusion of technology would depend on the level of participation of the farmers at every stage of the implementation. Lack of participation

by the farmers would mean that the problem of food insecurity would continue to be persistent in Nandi County.

2.7 Conceptual Framework

Independent Variables   **Intervening Variable**   **Dependent Variable**

```
┌──────────────────────┐
│ Household heads       │
│ demographic           │
│ characteristics       │
└──────────┬───────────┘
           ↕
┌──────────────────────┐        ┌──────────────────┐        ┌──────────────────┐
│ Farmers level access │ ─────→ │ Adoption of      │ ─────→ │ Level of Food    │
│ to credit            │        │ recommended      │        │ security         │
└──────────┬───────────┘        │ husbandry        │        └────────┬─────────┘
           ↕                     └──────────────────┘                 │
┌──────────────────────┐                                             │
│ Level of access to   │                                             │
│ farm information     │ ←───────────────────────────────────────────┘
└──────────────────────┘
```
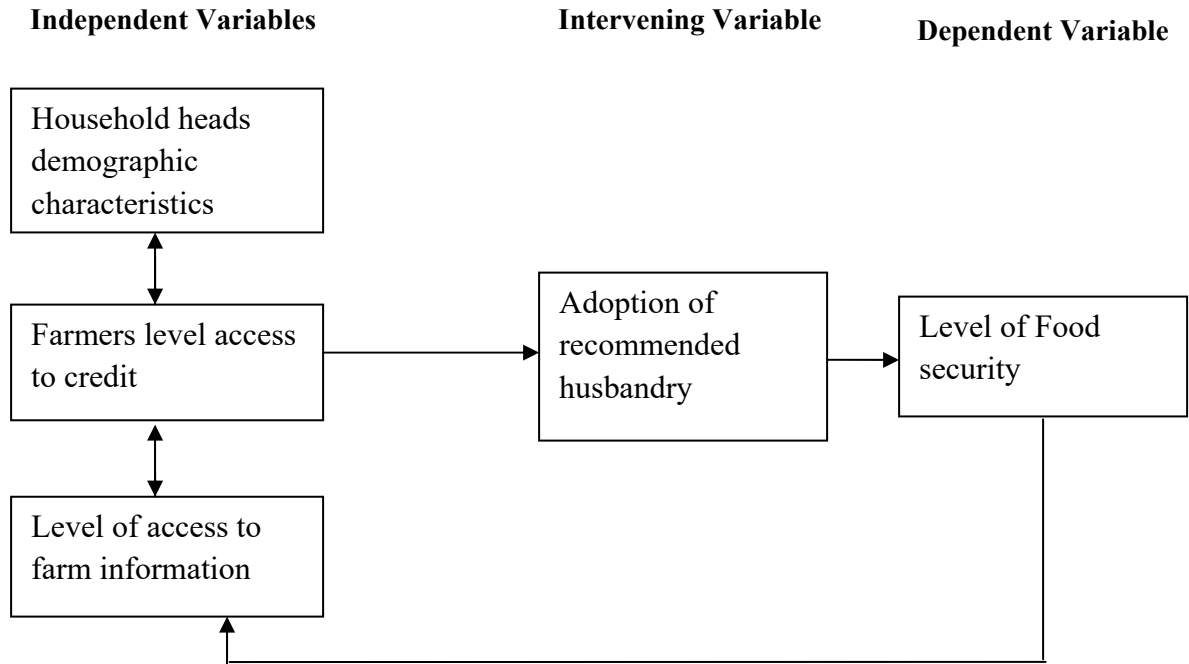
2.8 Operational Definition of Variables

Objective	Variable	Indicators	Measurement	Scale	Type of Research	Data Collection	Type of Analysis
To assess the food security situation of households.	*Dependent Variable:* Food security	Availability of food for the household all year round	Number of bags harvested and consumed	Numbers of times	Survey	Questionnaires and key informant interview	Percentages & content analysis
To find out the farmers' level of adoption of inputs and practices recommended by the extension services it affects food security of smallholder households.	*Independent variables:* Adoption of inputs/practices i. Fertilizers ii. Seeds iii. Artificial insemination iv. Early planting v. Proper drying of grains	i. Rate of use ii. Availability iii. Acreage covered	Rate of use	Numbers of times	Survey	Questionnaires & key informant interviews	Percentages and content analysis
To determine the level of smallholder farmers' accessibility to credit on household	*Independent variables:* Access to credit	i. Evidence of receipt	Amount in Ksh.	Numbers of times	Survey	Questionnaire & key informant Interviews	Percentages & content analysis

food security.							
To establish the level of access to extension information by smallholder household and its effect on food security.	1. Access to extension information	1. Sources of information	1. How was information received	Type	Survey	Questionnaire & key informant Interviews	Percentages & content analysis

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1   Introduction

This chapter presents the procedures that was used in conducting the study. It is organized into the following sub-headings: research design, site selection and description, target populations, sample selection procedures, sample size, research instrument, data collection procedures and sources, data analysis techniques, limitation of the study and conclusion.

3.2 Study Site

The study was carried out in Tindiret District in Nandi County focusing on Household heads and agricultural extension workers in the county. Tindiret District has an area of 379.7 km². The topography of the county is dominated by the Nandi Hills. The local people are mostly of the Nandi tribe. Agriculture, small and large-scale businesses are the main economic activities. The large scale farming is mainly tea farming which is mainly done by foreign investors and the locals are only labourers in the farms. The district boasts of the beautiful green tea table. Apart from tea, other leading cash crops include sugarcane, maize and coffee. These are however done on a small scale basis which is never sufficient for the family. The topography of the county is dominated by the Nandi Hills. According to the 2009 national census, Tindiret District has a total population of 77,055 (Kenya National Bureau of Statistics, 2009).

3.3   Research Design

The study used survey research design. According to Orodho (2004), the purpose of survey is to produce quantitative descriptions of some aspects of the study population. Survey analysis is primarily concerned with relationships between variables. This study sought the contributions of the agricultural extension services on the food security of households in Nandi County. Survey research is a quantitative method, requiring

standardized information from and/or about the subjects being studied. Purpose of survey research design is for researchers to describe the attitudes, opinions, behaviors, or characteristics of the population based on data collected from a sample or a population. The subjects studied might be individuals, groups, organizations or communities. For this case the subjects of study was the households in Nandi County. The main way of collecting information was by asking people structured and predefined questions. According to Kothari (2003), in surveys, the information is generally collected about only a fraction of the study population sample but it is collected in such a way as to be able to generalize the findings to the population. Since it was not possible to study all the households in Nandi, the researcher only studied a section of the Households in the county.

3.4   Unit of Observation and Analysis

A unit of observation is an object about which information is collected (Mugenda and Mugenda, 2003). The unit of observation in this study was the food security of households. The study also targeted the Agriculture Officer in charge of the District. A unit of analysis was household and the agricultural extension officers in Tindiret District in Nandi County.

3.5   Target Population

Target population is defined as all the members of a real or hypothetical set of people, events or objects to which a researcher wishes to generate a research study (Borg and Gall, 1989). The target population in the study comprised of all the households in Tinderet District. According to the 2009 population census, there are 14,489 households in Tinderet District (Kenya National Bureau of Statistics, 2010).

3.6 Sampling Procedures

Wiersma (1985) defines sample as a small proportion of a target population selected using some systematic procedures for the study. He points out that an ideal sample should be large enough so that the researcher can be confident within specified limit, be certain

that a different sample procedures can give approximately similar results. According to Mugenda and Mugenda (2003) descriptive research requires ten percent of accessible population which is adequate for a sample.

There are 15 locations in the district and in consultation with the Ministry of Agriculture extension staff, two locations were sampled purposively. The sub-locations in each were identified and in consultation with extension staff, two were purposively sampled in each location giving a total of four sub-locations. The researcher then in consultation with extension agents and Assistant chiefs purposively sampled 8 villages from the sampled sub locations. The researcher then sampled 15 household heads from each sampled village using proportionate random sampling giving a total of 120 heads each representing a farmer.

The study selected all the 12 extension officers in the district using purposive sampling method. The head of Agriculture in the district were the key informant.

3.7   Data Collection

The interview schedule was divided into 2 sections A and B. Section A sought and collect demographic data of the respondents. Section B contained questions seeking to establish the contribution by the agricultural extension service on the food security of households in Nandi County. Closed and open ended questions were used as a data collecting tool.

Key informants were interviewed using an interview guide. The key informants were the Agricultural Extension Service officers in the county. The study sought to get in-depth information from the extension officers.

The researcher used the services of a research assistant in data collection from the field especially in administering the questionnaires to the household heads.

3.7.1 Data Sources

The study used multiple sources of information, both primary and secondary (referred as triangulation) to ensure construct validity and reliability of the data collected. Secondary data was from journals, books, periodicals and other publications on food security.

Primary data is information gathered directly from field (Kombo and Tromp, 2000). It was collected from selected households, agricultural extension officers and informed farmers who were willing to give information voluntarily on the general view of the contribution of extension services on the household food security. They were selected from samples drawn from the districts in the county. The questionnaires were administered to collect quantitative data.

3.8 Data Analysis

The data that in generated was both qualitative and quantitative in nature. After data collection, primary data was analysed by use of descriptive statistics. The quantitative data was presented in form of bar graphs, tables and charts. The qualitative data was analysed thematically using content analysis. The data was then interpreted and a report written from the findings. The qualitative data was analysed using the content analysis in which the responses were grouped according to their thematic meanings and then presented.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This chapter presents information on background of the respondents, food security situation in the district, the adoption of recommended inputs and practices, access to credit and access to extension information.

The researcher gave out 120 questionnaires to the household and 12 key respondents out of which 112 comprising of 106 household heads and 6 key informants responded by completing the questionnaires and returning and taking part in the interview. This gave a response rate of 84.8% which is high enough to allow for generalization of the findings (Kothari, 2003).

4.2 Characteristics of Households

Our first objective was to examine the characteristics of households is presented including place of residence, gender, age, level of education, number of children, employment status, marital status and land ownership. The findings are presented below.

Place of residence: The results in Table 4.1 show that respondents were distributed evenly between the Kapkitony and Meteitei locations.

Table 4.1: Place of Residence

	Frequency	Percent
Meteitei	51	48
Kapkityony	55	52
Total	**106**	**100**

Gender: The study results show that 78% of the respondents were male and only 22% were female. This means that men were the heads of their families.

Figure 4.2: Distribution of Respondents by Gender
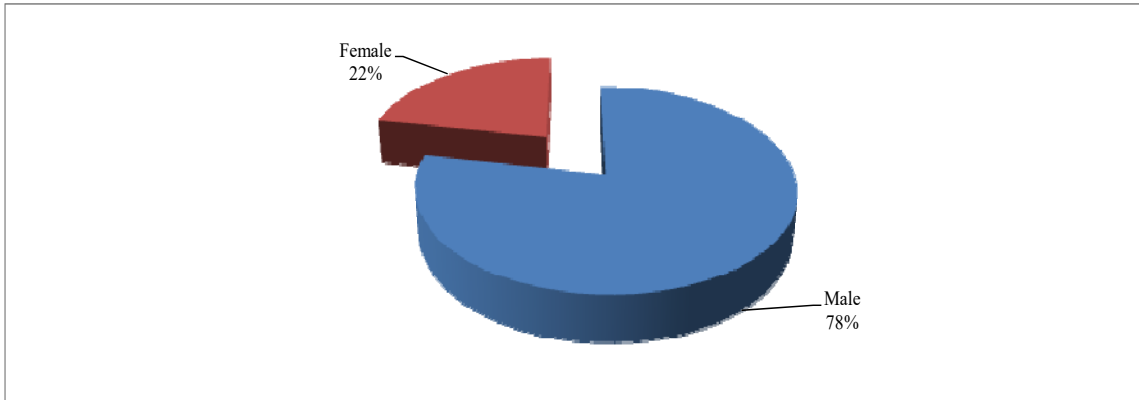
Age: As to what age the respondents belonged, the findings in Figure 4.3 revealed that majority of the respondents were aged 40 years and above as those aged below 40 years were only 26%. This could be attributed to the fact that most youths have gone to work in urban centers leaving the elderly to do the farming which according to Obamiro *et al* (2003) is one of the causes of food insecurity.

Figure 4.3: Distribution by Age
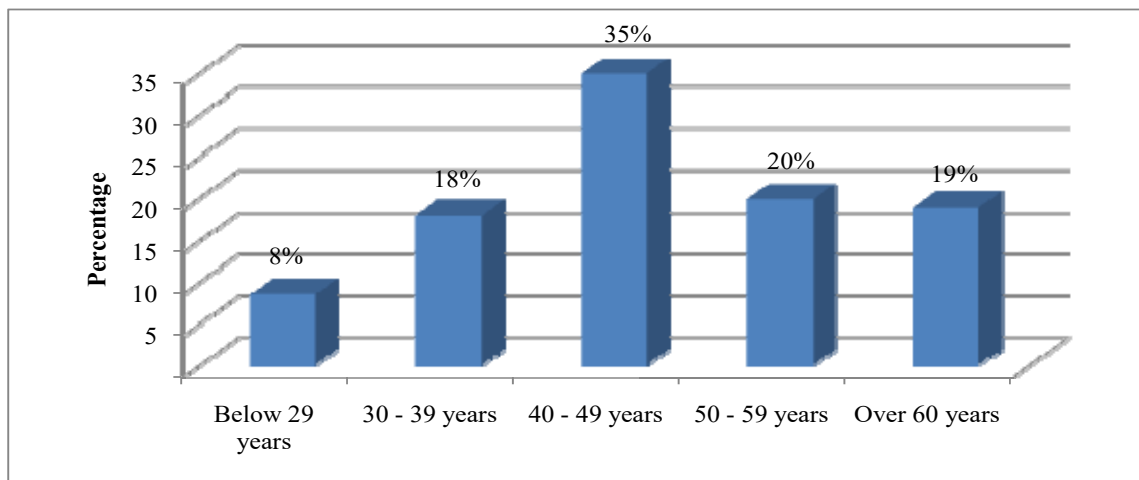
Formal education: The study findings in Table 4.1 show that majority of the respondents have primary education as 45.3% had upper primary education while 20.8% had lower primary education. The results show that those with secondary education were

only 10.4% and 17.9 had college or university education. The results mean that most household heads had little education which may be attributed to the low food security in the region as advocated by Najafi (2003).

Table 4.1: Level of Education of the Respondents

		Gender			
		Male	**Female**	**Total**	**%**
Level of Education	None	2	4	6	5.7
	Lower primary	14	8	22	20.8
	Upper primary	42	6	48	45.3
	Secondary	8	3	11	10.4
	College/University	17	2	19	17.9
	Total	83	23	106	100

Employment: The study findings show that 33% of the respondents were employed while 34.9% were self employed. The results also show that 32.1% of the respondents were not employed. The findings meant that the respondents are employed and self employed in the same measure.

Table 4.2: Employment Status

		Gender			
		Male	**Female**	**Total**	**%**
Employment status	Employed	31	4	35	33
	Self employed	32	5	37	34.9
	Not employed	20	14	34	32.1
	Total	**83**	**23**	**106**	**100**

Occupation: The study sought to determine the occupation of the respondents and according to the findings presented in Figure 4.4 most of those employed (42.9%) were

49

teachers while 25.7% were tea pickers. The study show that majority of those self employed (67.6%) were farmers. The study findings therefore meant that the main occupation in the region is small scale farming.

Figure 4.4: Occupation of the Respondents
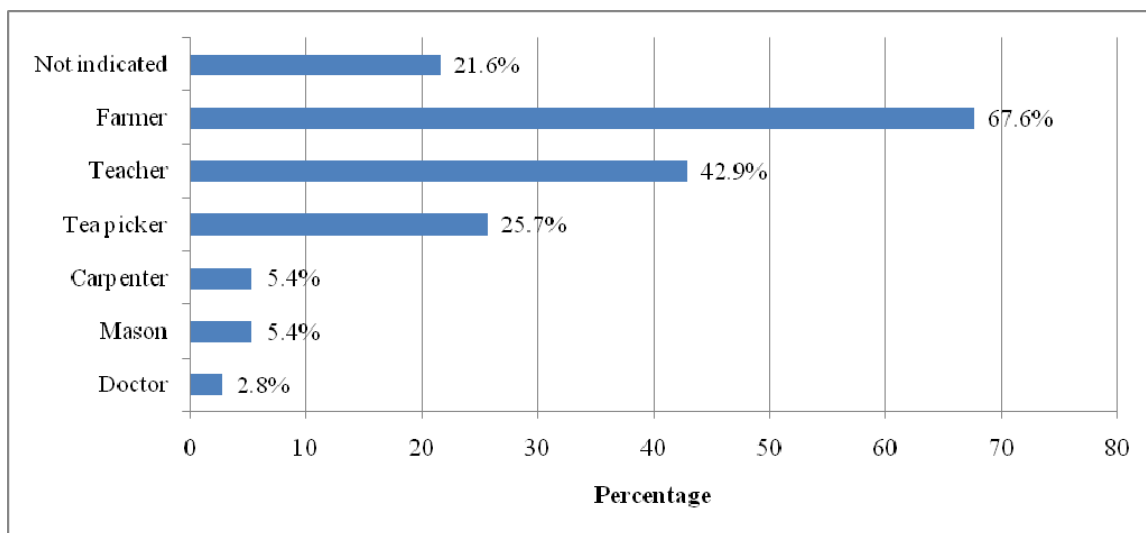
Marital status: The study established that majority of the respondents (80%) were married while 13.2% were widowed. This means that small scale farming is dominated by people who have families.

Table 4.3: Marital Status of the Respondents

|		Gender			
		Male	**Female**	**Numbers**	**%**
Marital status	Single	2	1	3	2.8
	Married	70	19	89	84
	Widowed	11	3	14	13.2
	Total	83	23	106	100

Number of wives: The study sought to determine the number of wives the sampled household heads had where it became evident that most household heads (74.5%) had one spouse. Only four heads had two spouses. This means that most families were monogamous.

Table 4.4: Number of Wives

Number of Wives	Numbers	%
One	79	74.5
Two	4	3.8
Not applicable	23	21.7
Total	**106**	**100.0**

Number of children: The study in Figure 4.5 established that 32.1% of the families had between 5 and six children and more than seven children. The results show that only 33% of the respondents had less than four children. This may explain the food security situation in Tinderet as argued by Paddy (2003) that food requirements increase in relation to the number of persons in a household.

Figure 4.5: Number of Children Reported by Respondents
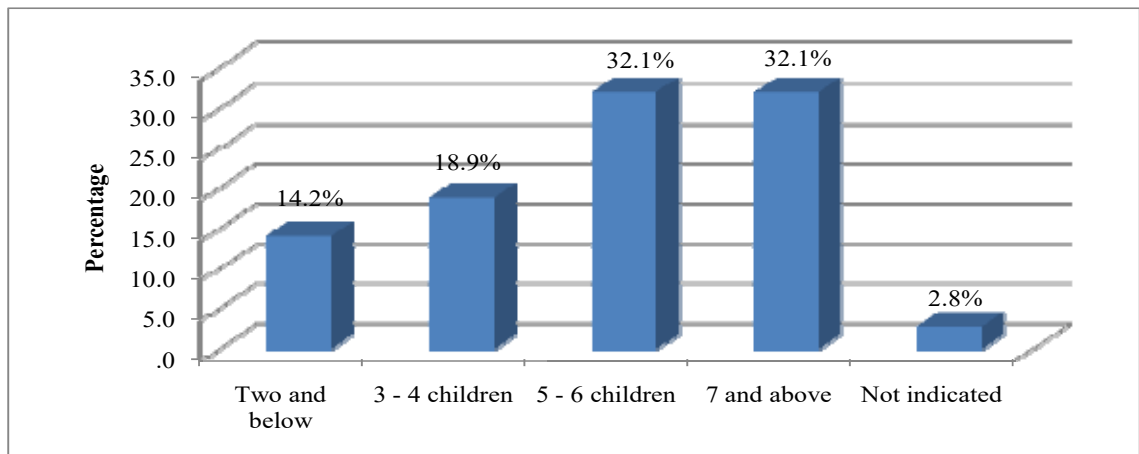
Number of dependants: The study also established that the families had other dependants as 42% of the respondents had less than three dependants while 13% have between three and five dependants. These means that the households in Tinderet were large and therefore needed increased food requirements (Paddy, 2003).

Figure 4.6: Number of Other Dependants Reported by the Respondents
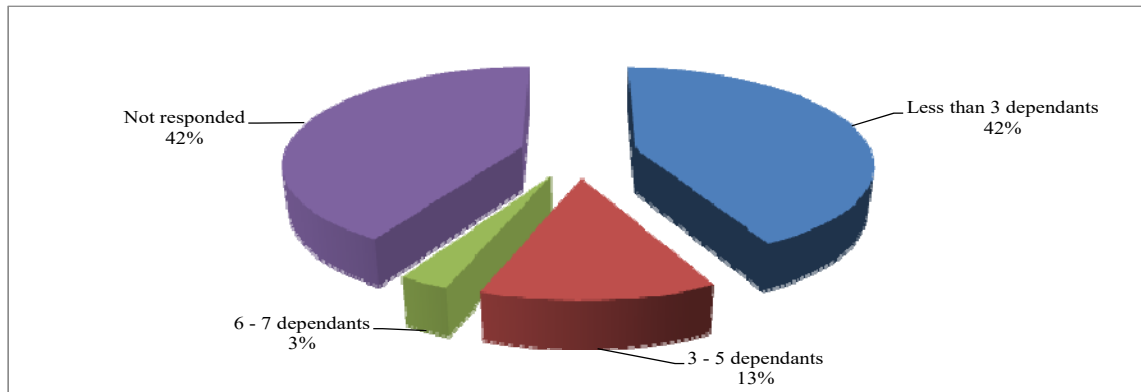
Land Ownership: The study established that most of the respondents (76%) owned land. The results however show that 21% of the respondents did not own land. Asked to state whose land they farmed, the respondents indicated that they tilled the land belonging to their relatives.

Figure 4.7: Land Ownership
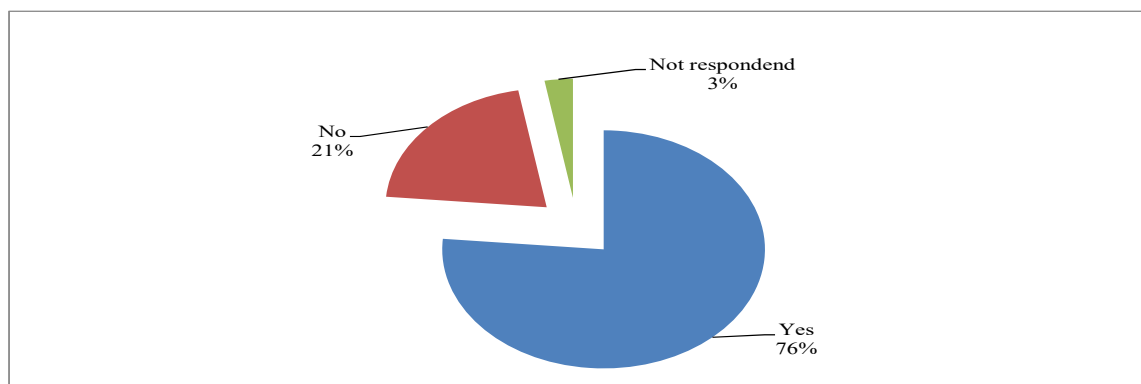
Asked to state the acreage, 19.8% of the respondents indicated that they had less than three acres while 17% had between three and five acres. Only 25.5% of the respondents had more than 10 acres. These findings may be used to explain the food security situation in Tinderet as the findings agree with the views of Preibisch et al (2002), Njuki et al (2004) and Doka and Monimart (2004) who noted that land was one of the determinant of food security in small scale farming.
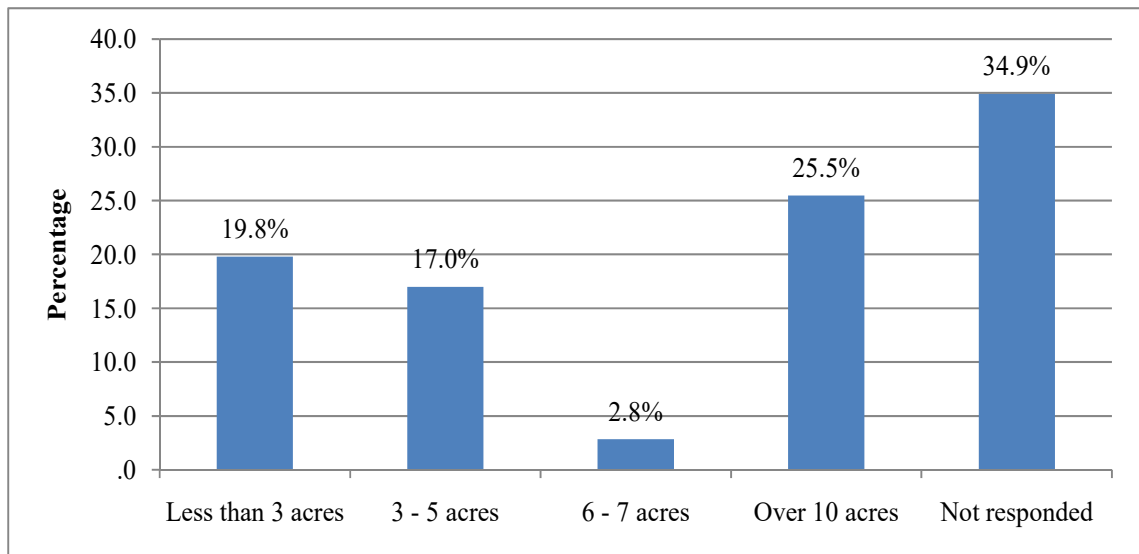
Figure 4.8: Acreage of Land

4.3 Access to Extension Information

The second objective of the study was to determine the extent to which the households in Tinderet had access to extension information. The indicators were whether received information, lessons learned and whether adopted. The findings are presented in subsequent sections below.

4.3.1 Received Information about Better Farming

Asked to state whether they had ever received information about better farming, 71% of the respondents indicated that indeed they had received information about better farming. The findings show that only 26% of the respondents had never received information on

better farming. According to the key informants, most farmers sought extension information on farming practices on regular basis.

Figure 4.9: Received Information about Better Farming
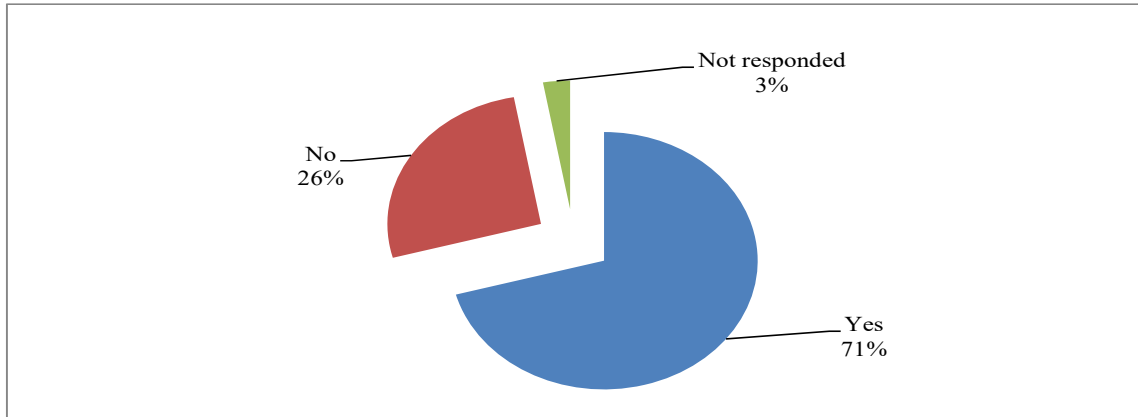
4.3.2 Sources of Information on Better Farming

Respondents were asked to state the sources of information over the past three years. The findings in Table 4.5 show that 59.4% received the information through the radio broadcast and contact farmers. The results also show that 50% of the respondents received the information of good farming from the field demonstrations. The study further show that 55.7% of the respondents received the information through field days. Barazas also featured strongly as sources of information as was indicated by 41.5% of the respondents. The study however, established the extension office featured as the least source of information to the farmers with regard to better farming practices. The respondents explained that the extension officers have not accessed the area to hold any demonstration to the farmers. These findings may explain the food security problem in Nandi county as the farmers do not get the services of extension officers. These findings confirm the views of Owens et al (2003) that access to agricultural extension services, defined as receiving one to two visits per agricultural year, raises the value of crop production by about 15%.

Table 4.5: Sources of Information on Better Farming

	Yes		No		No Responded		Total	
	F	%	F	%	F	%	F	%
Radio broadcast	63	59.4	12	11.3	31	29.2	106	100
Visited by extension worker	24	22.6	48	45.3	34	32.1	106	100
Visited extension office	12	11.3	60	56.6	34	32.1	106	100
Farm newspaper	37	34.9	35	33.0	34	32.1	106	100
Field demonstrations	53	50.0	19	17.9	34	32.1	106	100
Field days	59	55.7	13	12.3	34	32.1	106	100
Agricultural shows	19	17.9	53	50.0	34	32.1	106	100
Barazas	44	41.5	28	26.4	34	32.1	106	100
Contact farmers	63	59.4	9	8.5	34	32.1	106	100
Workshops/farm courses	15	14.2	57	53.8	34	32.1	106	100

As to what they learnt, 3% of the respondents indicated that they learnt on how to conserve the soil. The study established that 2% of the respondents learnt best practices of dairy farming for better milk harvest. The study further established that 7% of the respondents learnt on the use of fertilizer both for planting and top dressing. The findings revealed that 5% of the respondents learnt on the use of modern technology in farming. The study established that 5% of the respondents indicated that they learnt how to control pests in their farms. According to the findings of the study 3% of the respondents indicated that they received information on how to get credit to buy firm inputs.

Asked to state how they used the information, 5% of the respondents indicated that they have put into practice the information they have received while 3% indicated that they had seen differences in the yields they receive if used information and if not. The findings showed that 7% of the respondents indicated that there has since been improvement in the production of milk.

According to the responses from the key informants on the influence of extension information of farming practices on food security, one key informant stated that the dissemination of information had a positive impact on the food security as the farmers now conserve the soil, use fertilizers for planting and use certified seeds.

4.4 Access to Credit

The third objective was to determine the level of smallholder farmers' accessibility to credit and its effect on food security. The emphasis is on access to credit and its sources, kinds of inputs bought and other sources of money for buying inputs. The findings are presented below.

4.4.1 Used Credit to Buy Farm Inputs

The respondents were asked to state whether they have been buying farm inputs for maize and bean crops over the past three years. The study findings in Figure 4.10 show that majority of the households that took part in the study (86%) indicated that they had never used credit to purchase firm inputs. The results show that only 8% of the respondents have used credit to purchase the farm inputs.

The study established that the source of credit for those who received credit were two organizations namely, Ukulima Biashara and Juhudi Kilimo which are micro finance companies such as K-rep microfinance which use groups as collateral to give credit to farmers. The results revealed that while one respondents borrowed Ksh. 40,000, another borrowed Ksh. 16,000 which was repaid in a monthly installment of Ksh. 3.500 and Ksh. 1,000, respectively. The findings of the study may be taken to mean that only a few farmers in Tinderet used credit to purchase firm inputs which may be attributed to the food security situation in the county. The findings here were confirmed by one key informant who noted that "it was only less than 5% of the farmers in Tinderet district who accessed credit to buy firm inputs." Some of the key informants stated that access to loans was only for the few who are able to produce title deeds as security as this is a requirement by the banks, otherwise the farmers have to be organized into groups in

order to access the loans. The findings of the study are in agreement with Jayne, Yamano and Nyoro (2004) who noted that lack of access to credit has deprived the low income farmers to use fertilizer and other inputs such as recommended others on food crops and compounded the food security problem in virtually all of Africa.

Figure 4.10: Use of Credit to Buy Farm Inputs by the Respondents
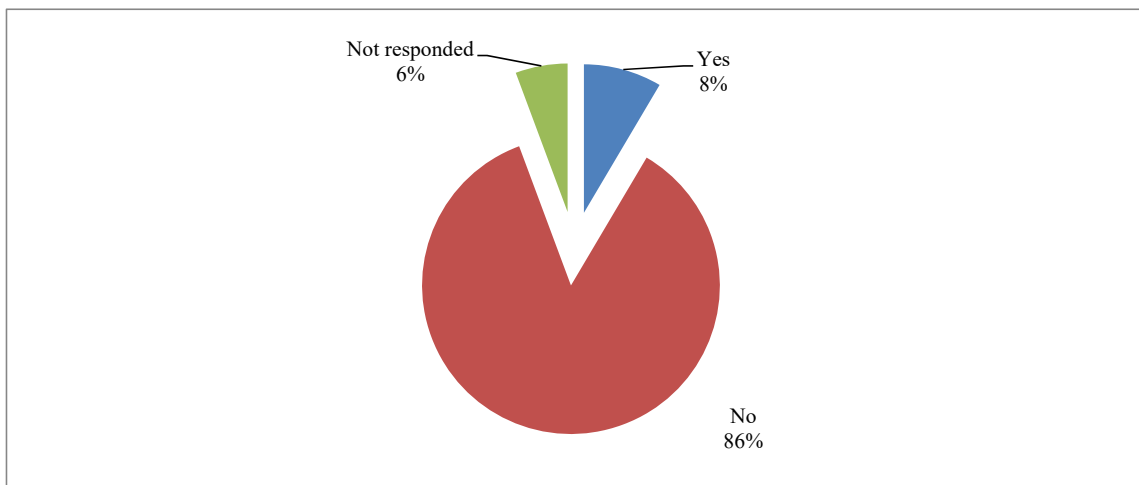
4.4.2 Types of Credit

The study sought to determine the form in which the credit was given and according to the study findings this was mainly in the form of money and labour (Table 4.6).

Table 4.6: Form of Credit

	Number	**%**
Money	3	2.8
Labour	3	2.8
Not responded	100	94.3
Total	**106**	**100.0**

4.4.3 Farm Inputs Bought Using Credit

Respondents were asked to state the farm inputs they bought. The findings in Table 4.7, 5.7% of the respondents indicated that they bought seeds using the credit while 2.8% bought fertilizer.

Table 4.7: Farm Inputs Bought

	Number	**%**
Seeds	6	5.7
Fertilizer	3	2.8
Not responded	97	91.5
Total	**106**	**100.0**

The key informants when asked to state the influence of credit on the food security, three key informants stated that since access to credit was very low, the influence was minimal. However, one key informant indicated that for those who have access to credit, it has improved their productivity and hence food security. This finding that access to credit improved are in agreement with Khadler and others (1998) that credit whether formal or informal matter to the poor farmers.

When asked to state the difficulties they faced in the repayment of the credit, the respondents indicated that sometimes when the crops failed, it became very difficult as they have to source for money elsewhere to repay the loan which in mot cases is not easy. Respondents also indicated that due to the fact that the group members act as guarantors to each other, a default by a member became a burden to the group members.

4.5 Adoption of Inputs and Practices

The forth objective of the study was to determine the farmers' level of adoption of inputs and practices as recommended by the extension services and its effect on household food

security. The indicators were inputs such as fertilizer, seeds, manure, and practices land preparation, weeding, pest control, harvesting and drying of grains. Other indicators were the yield harvested. The findings are presented below.

4.5.1 Farm Inputs and Practices Used

Respondents were asked to indicate the farm inputs and practices they used for the main food crops (maize and beans) and according to the results majority of the respondents used improved seeds for maize and beans (79% and 73%, respectively). The study established that the types of seeds that were used by the households were hybrid 614, 629, 513 and 628. The study also established that majority of the households (63% for maize and 66% for beans) prepared land on time. Most of the respondents stated that they practiced timely and clean weeding for maize and beans (59% and 63%, respectively). The results show that the respondents harvested the maize and beans on time (69% and 71%, respectively). The study established that majority of the respondents (59%) used between 1 and 2 acres of land on maize while the equal percentage utilized less than one acre on beans. The study however revealed that the households did not fully embrace the use of fertilizer both for planting and top dressing especially for the beans and to some extent maize.

Table 4.8: Farm Inputs and Practices Adopted by the Respondents for their Maiz and Beans Crops

Inputs and practices	Maize			Beans		
	Yes	No	Total	Yes	No	Total
Improved seeds	79	21	100	73	27	100
Timely land preparation	63	37	100	66	34	100
Fertilizer for planting	56	44	100	41	59	100
Fertilizer for topdressing	46	54	100	33	67	100
Farm yard manure	33	67	100	21	79	100
Timely and clean weeding	59	41	100	63	37	100
Insect pest control (field)	31	69	100	41	59	100
Timely harvesting	69	31	100	71	29	100
Proper drying of the grain	71	29	100	67	33	100
Insect pest control (storage)	55	45	100	53	47	100

Results from the key informants as to whether the households employed the recommended extension services in farming practices, two of the key informants stated that the farmers sought services from the relevant offices on farming practices. Another respondent indicated that most farmers adopted the various technologies and farming methods. He however noted that the level of adoption was varied as there were early and late adopters. According to another key informant, the farmers did not embrace the recommended extension services fully as they ignored the use of fertilizer during planting and topdressing.

4.5.2 Yield Obtained

The study established that most of the households got between five and 10 bags of maize while 22% got between 11 and 20 bags of maize. The result, however, showed that majority of the households (96%) got less than five bags of beans.

As to how much the households were able to consume, majority of the households were able to consume only less than five bags. The results show that 39% of the households consumed between 4 and 6 bags of maize while 26% of the respondents consumed between 7 and 10 bags of maize. This meant that maize was more consumed than the beans.

The respondents were asked to state how many bags they sold. The results show that most of the households did not sell which may be attributed to the fact that the households produced hardly enough for them to consume and therefore found nothing left to sell. The results however show that 34% of the respondents sold less than five bags. The results also show that 28% of the households sold less than five bags of maize while 22% sold between 5 and 10 bags of maize. Asked to state reasons for selling, respondents indicated that they sold the produce so as to buy farm inputs. Others indicated that they sold the produce to get money to buy basic needs and pay school fees.

Table 4.9: Yield Obtained

	Number of bags	Maize (%)	Beans (%)
	Less than 5 bags	17	96
	5 - 10 bags	44	4
	11 - 15 bags	22	0
	16 - 20 bags	13	0
	Over 20 bags	4	0
Yield harvested (90Kg bag)	**Total**	**100**	**100**
	Less than 1 bag	0	67
	1 - 3 bags	23	27
	4 - 6 bags	39	6
	7 - 10 bags	26	0
	Over 10 bags	12	0
Amount consumed at home	**Total**	**100**	**100**
	None	32	66
	Less than 5 bags	28	34
	5 - 10 bags	22	0
	11 – 15 bags	18	0
	16 - 20 bags	12	0
	Over 20 bags	6	0
Amount sold	**Total**	**100**	**100**

4.5.4 Types of Livestock

On the type of livestock that was kept by the households, the study established that 83% of the respondents reared cattle. The results also show that 29.2% of the households reared goats while 19.8% kept poultry. The findings mean that even though the

households kept livestock this was on a small scale except for cattle which almost every home had.

**Figure 4.11: Types of Livestock Kept by the Respondents**
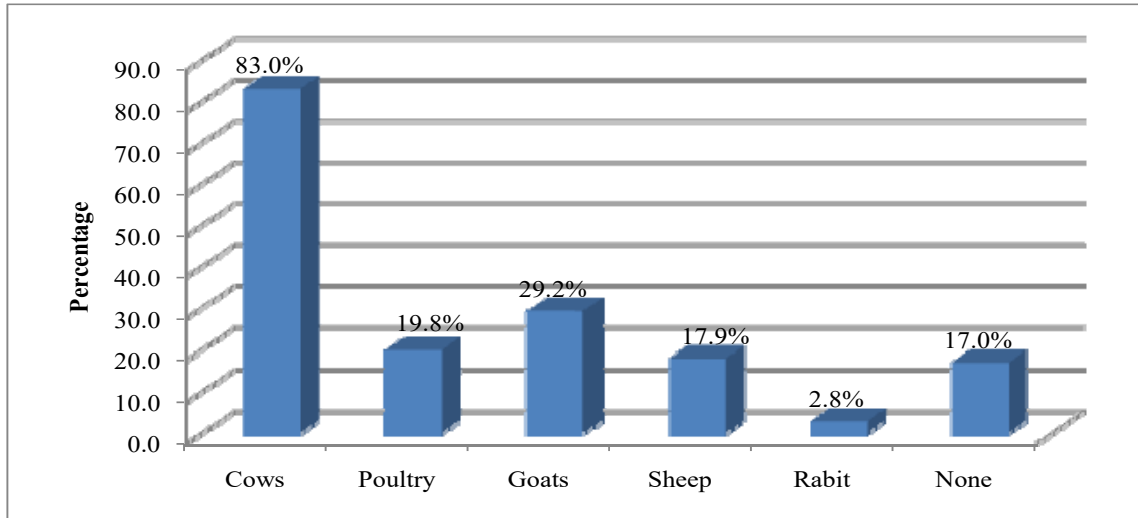
4.5.5 Practiced Artificial Insemination (AI)

Asked to state whether they have practiced AI, majority of the respondents (78%) indicated that they have never used AI. Only 11% of the respondent households had used AI. This meant that the households had not embraced the technology of AI.

Figure 4.12: Practiced Artificial Insemination (AI)
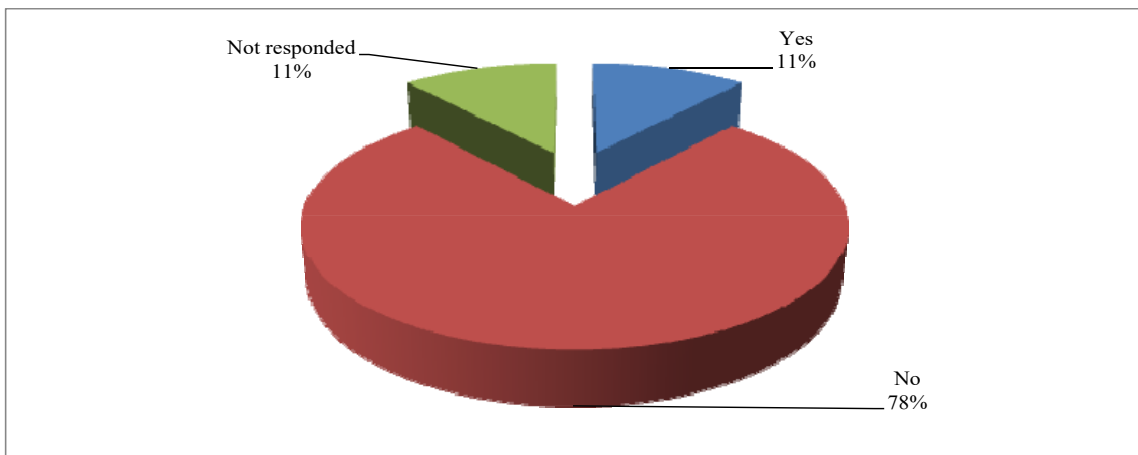
4.5.6 Amount of Liters of Milk Harvested per Day

The results show that 34% respondent harvested between five and ten liters of milk per day while 26.4% harvested less than five liters. Only few households harvested more than 10 liters of milk a day.

Table 4.10: Amount of Liters of Milk Harvested per Day

Amount of milk harvested	Number	%
Less than 5 liters	28	26.4
5 - 10 liters	36	34.0
11 - 15 liters	4	3.8
Over 20 liters	5	4.7
Not responded	33	31.1
Total	106	100.0

Asked to state what quantity of milk they consumed in a day, most of the households (54.7%) indicated that they consumed less than five liters a day while 14.2% indicated that they consumed between 5 and 10 liters of milk. These findings meant that only small quantities of the produced milk were left.

Table 4.11: Quantity of Milk Consumed by the Household of the Respondents

Amount of milk consumed	Numbers	%
Less than 5 liters	58	54.7
5 - 10 liters	15	14.2
Not responded	33	31.1
Total	**106**	**100.0**

4.5.7 Sale of Surplus Milk

As to whether the households sold surplus milk produced, 49% of the respondents indicated that indeed they sold the surplus. The results show that 17% of the households never sold their milk surplus.

Figure 4.13: Sale of Surplus Milk by the Respondents
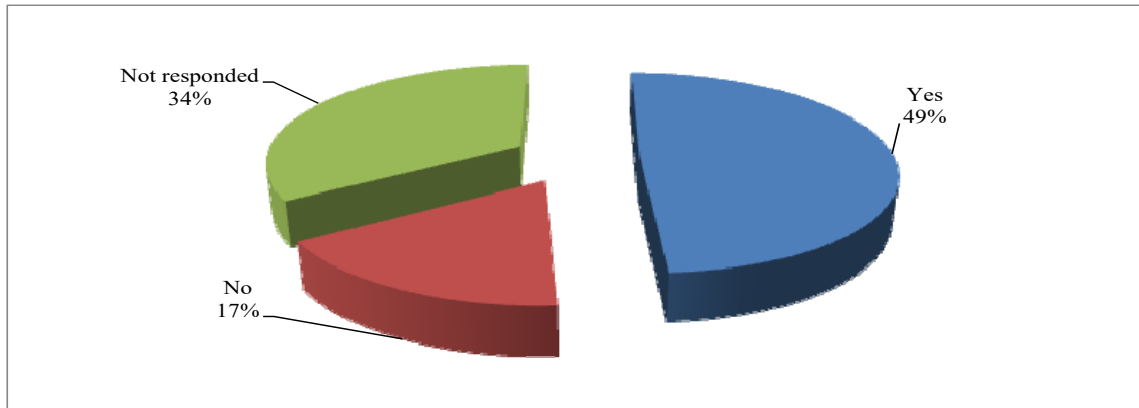
4.5.8 Amount Earned from Milk the Sale of Milk

The study findings in Table 4.12 showed that 18.9% of the respondents indicated that they fetched over Ksh. 10,000 per month. The findings showed that 15.1% of the respondents fetched between Ksh 5,000 and 10,000 and and an equal percent got less than Ksh. 5,000.

Table 4.12: Amount Fetched From Milk

Amount fetched	Number	%
Less than 5000	16	15.1
5000 - 10000	16	15.1
Over 10000	20	18.9
Not responded	54	50.9
Total	**106**	**100.0**

4.6 Food Security Situation

The fifth objective of the study was to determine the food security situation in Nandi County. The highlights were on quantity of grains consumed by households per month, how long the harvest lasted, the amount spent on purchase of grains in case of scarcity and the food security situation. The findings are presented in subsequent sections.

4.6.1 Quantity of 90kg bag of Maize/beans Consumed by Household Each Month

The study findings show that halve of the respondents (50%) consumed one bag of 90kg maize each month while 37.7% consumed less than one bag a month. On the other hand, nearly all the respondents (94.3%) households consume less than one bag of 90kg of beans. The study findings mean that maize was the most consumes grain by the households in Tinderet district.

Figure 4.14: Quantity of 90kg bag of Maize/beans Consumed by Household Each Month by the Respondents' Households
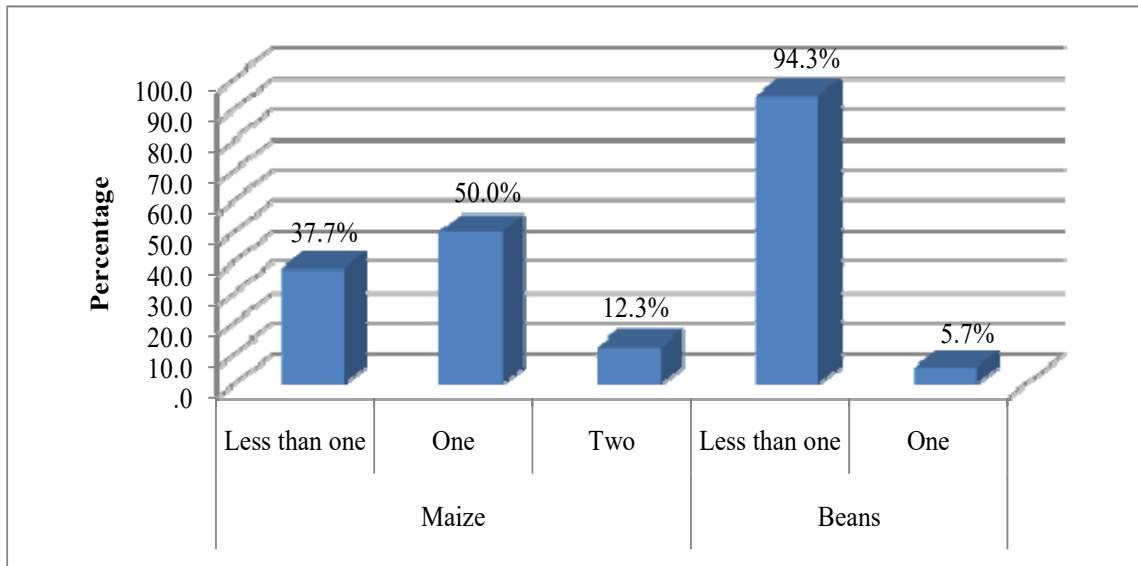
4.6.2 Number of Months Yield Obtained Lasted

The study established that according to 27.4% of the respondents, the maize obtained lasted for 10 months and more while 26.4% indicated that the maize yield lasted between 7 and 9 months and between three and six months. The findings show that 19.8% of the respondents indicated that the maize lasted just one to three months while 50% of the respondents indicated that the beans lasted them only one to three months. The findings show that 24.5% of the respondents indicated that the beans lasted them 10 and above months. The findings of the study meant that the grains are consumed in less than 10 months which mean that the households have to find alternative source of grains within the year.

Figure 4.15: Number of Months Yield Obtained Lasted
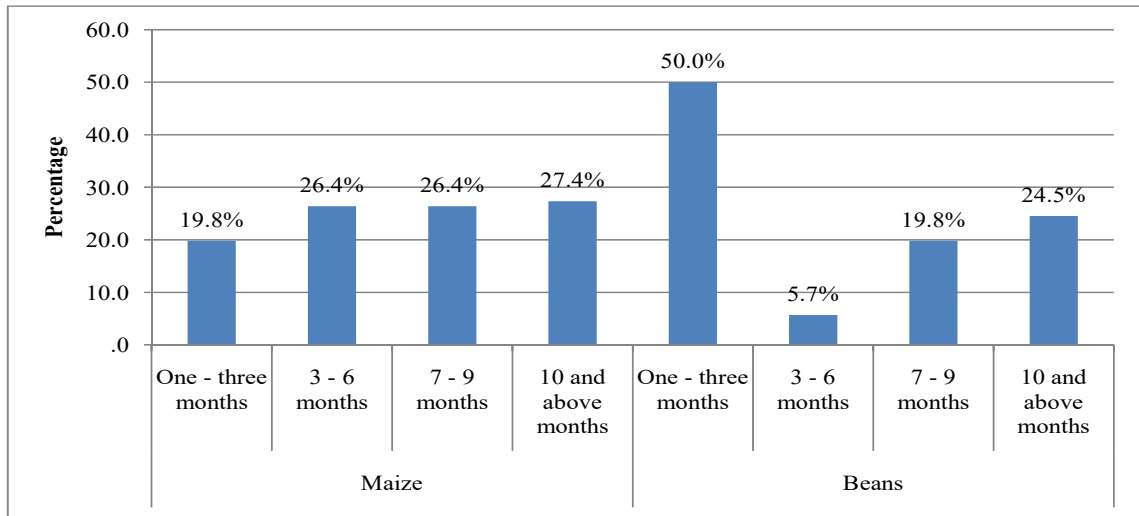
4.6.3 How Grain was obtained

Asked to state how they obtained grains for house consumption incase of shortage, the study shows that 55.7% of the households purchased the grains while 17% depended on food aid from either the government or well wishers.

Table 4.13: How Grain was obtained

	Frequency	Percent
Aid	18	17.0
Purchase	59	55.7
Not responded	29	27.4
Total	**106**	**100.0**

4.6.3 Amount Spent per Month on Grain Purchases

Respondents were asked to state the amount per month they spent on purchase of grains and the study findings revealed that 29.2% of the respondents indicated that they spent between Ksh. 3,000 and Ksh. 5,000 while 14.2% spent between Ksh. 1,000 and Ksh. 3,000 on the purchase of the grains.

Figure 4.16: Amount Spent per Month on Grain Purchases
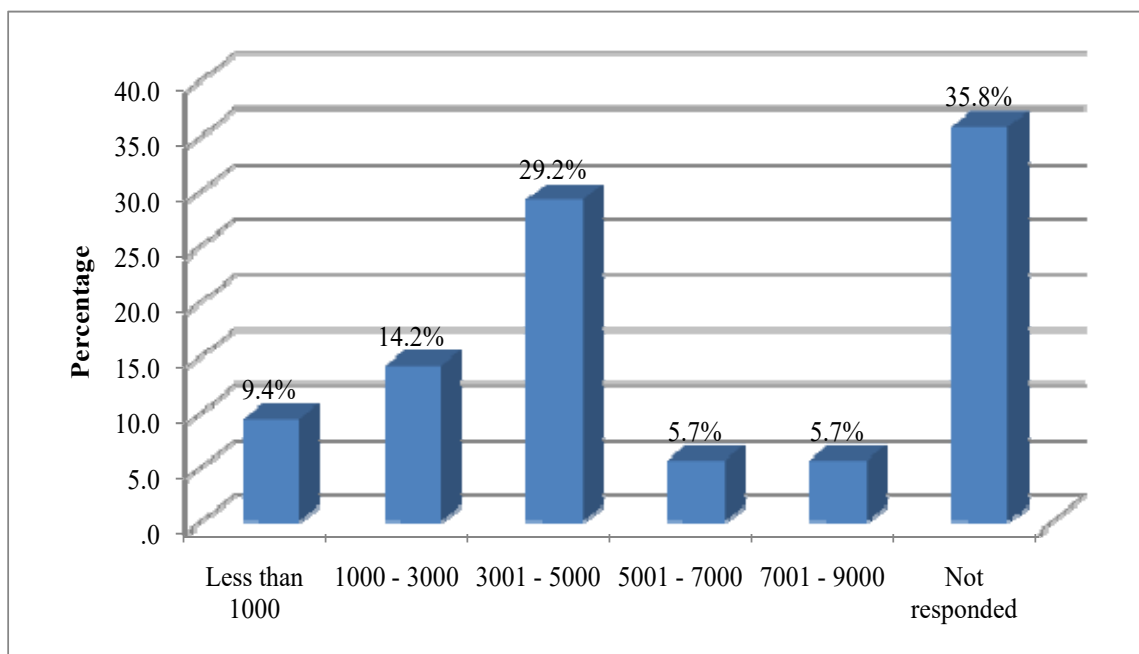
4.6.4 Food Security of Households

Respondents were asked to describe the food security of households and most respondents 39% described it as insecure as 14% described it as very insecure. The findings show that only 33% of the respondents described the food security of the household as secure.

Figure 4.17: Food Security of Household

According to the key informants, the food security situation in the district keeps fluctuating from time to time. The key informants also added that not all the areas of the district are food secure. They noted that the food security situation worsens due to the fact that the households sell all their reserves. However one key informant stated that the region is food secure.
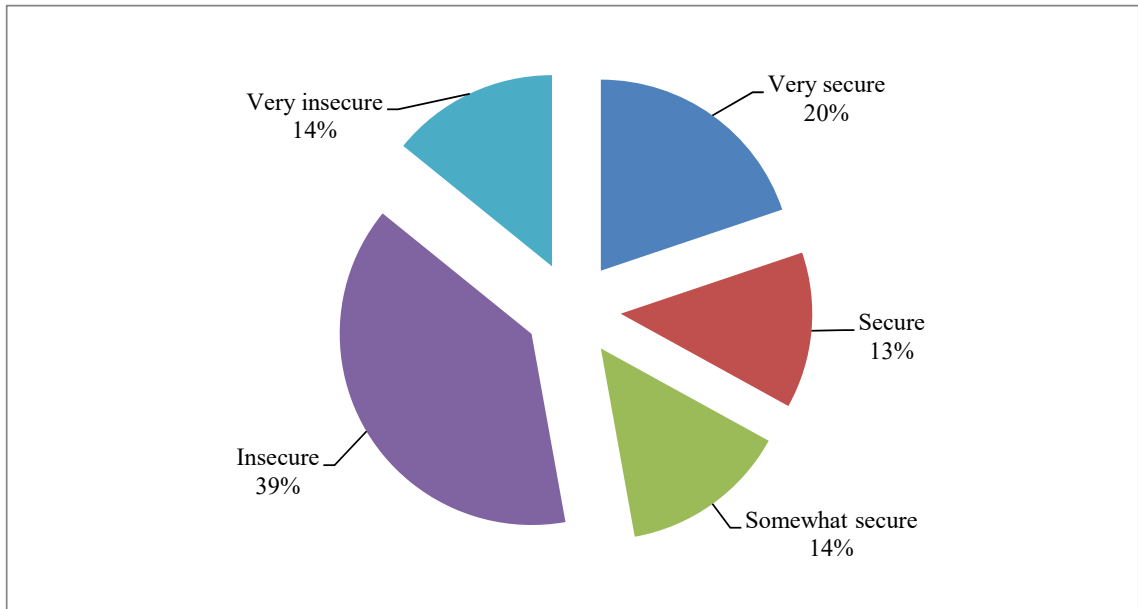
Asked to state the reasons for the food insecurity in the region, two key informants stated that the food insecurity in the region was as a result of the overdependence on maize both for consumption and for cash. The key informants also blamed the food insecurity on the poor fertility of the soil and the refusal by the farmers to apply fertilizer citing high costs of the input. Respondents also stated that the food insecurity situation in the district was as a result of the population pressure which means that the demand for food is increasing while the ability of the land to produce at full potential was diminishing. One of the key informants also indicated that for a long time the farmers have relied on a few cash crop mainly sugar cane and tea. According to one key informant the poor fertility of the soil is blamed on the topography of the area as a lot of fertile soil is lost to erosion and the farmers were not keen on planting on terraces.

4.6.5 What to do to Improve Food Security

The key informants when asked to state the measure to be taken to enhance food security in the region stated that there was need to intensify extension services in the region. They suggested that the government should employ more extension staff in the region so as to ensure that every farmer is reached. The Key informants also suggested that the government needed to hold more agricultural demonstration with the aim of improving the farmers knowledge of better farming practices. The respondents also stated that farmers should be exposed to more successful farmers through tours and shows. The respondents indicated that the government should develop channels through which farmers can access credit easily. The respondents suggested that the farmers should be encouraged to diversify and stop depending on maize as the sole food crop to grow crops like bananas, Irish and sweet potatoes among others. There was need according to the respondents to practice soil and water conservation so as to retain soil fertility.

According to one respondent, the farmers can be encouraged to practice commercialization through commercial village model. This is a model whereby farmers come together in groups known as commercial producer groups (cpgs). Several producer groups form a commercial unit/village for the production of one or two commodities for instance bananas, passion fruits among others. The farmers in the group are able to acquire inputs in bulk which reduces the cost of production due to economies of scale.

The respondents also indicated that the farmers in the region should be encouraged to increase their livestock and poultry farming to subsidies their produce from the farms.

4.7 Conclusion

The study established that even though the farmers had pieces of land, they were too small to produce food which could sustain the family for the rest of the year. This was explained by the fact that despite most farmers ablility to harvest maize and beans, the harvest could barely last them more than six months and therefore they had to resort to alternative ways of getting grains such as buying and government aid. From the findings further revealed that farmers in Tinderet district adopted inputs and practices as

recommended by the extension services. The households used improved seeds, timely preparation of land and planting, and timely harvesting among others. Accessibility to credit was described by the respondents as poor. This was because only a few farmers were able to access credit to buy the farm inputs. Majority of the farmers had to sell their produce to purchase farm inputs which is another reason for the food insecurity in the region. Access to information according to the study findings was available to most households whether through the radio broadcast of field demonstrations.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

5.1.1 Characteristics of Household Heads

The study established that the distribution of the respondents according to place of residence was near even. However, there were more male (78%) male headed households than female (20%). Close to one third of the respondents were aged 40 and 49 years. The findings revealed that most of the respondents (45.3%) dropped out of school in upper primary while 20.8% dropped out of school in lower primary. One third of the respondents were self employed while another one third of the respondents were employed. Farming was the major occupation for most respondents (67.6%) which was followed by teaching (42.9%). Majority of the respondents (84.0%) were married to one wife and had between 5 and 6 children and seven and above children. Apart from their families, the respondents dependants. Even though majority of the respondents (76%), most of the respondents had only small peaces of land of less than 5 acres.

5.1.2 Access to Extension Information

The study findings revealed that 71% of the respondents had received information about better farming practices. The sources of information included radio broadcast and contact farmers (59.4%), field demonstrations (50%), field days (55.7%) and Barazas (41.5%). The study however, established the extension office featured as the least source of information to the farmers with regard to better farming practices. The lessons learnt included soil conservation, best practices of dairy farming for better milk harvest, use of fertilizer both for planting and top dressing, use of modern technology in farming, control pests in farms and how to get credit to buy firm inputs. The respondents who used the information and had seen differences in the yields they received. Some respondents indicated that there had since been improvement in the production of milk.

5.1.3 Access to Credit

The study findings revealed that majority of the households (86%) have never used credit to purchase firm inputs. However, those who received credit received it from Ukulima Biashara and Juhudi Kilimo which are micro finance companies such as K-rep microfinance which use groups as collateral to give credit to farmers. The results further revealed that respondents borrowed as low as Ksh. 16,000 and as high as Ksh. 40,000. This was repaid in a monthly installment of Ksh. 3.500 and Ksh. 1,000. The major forms of credit was in form of money and labour (2.8% respectively). The inputs bought with the credit included seeds (5.7%0 and fertilizer (2.8%). Access to credit had minimal influence of food security since it was very low. The study established that despite not having access to credit, majority of the respondents (86%) bought farm inputs. The sources of money ranged from own savings (32.1%) and sale of produce (48.1%).

5.1.4 Adoption of Inputs and Practices

The study established that most of the respondents (76%) owned land. However, most of the land were not enough for any meaningful farming as 19.8% had less than three acres while 17% had between three and five acres. Only 25.5% of the respondents had more than 10 acres. The study revealed that majority of the respondents used improved seeds for maize and beans (79% and 73%, respectively). These were hybrid 614, 629, 513 and 628. The study findings revealed that majority of the households (63% for maize and 66% for beans) prepared land on time while 59% practiced timely and clean weeding for maize and 63% for beans. The results showed that 69% the respondents harvested the maize on time and while 71% harvested beans on time. Most households (44%) got between five and 10 bags of maize while 22% got between 11 and 20 bags of maize. Majority of the households (96%) got less than five bags of beans. The results showed that 39% of the households consumed between 4 and 6 bags of maize while 26% consumed between 7 and 10 bags of maize. According to the results of the study, most households did not sell their produce. The results however showed that 34% sold less than five bags of beans. The results further showed that 28% sold less than five bags of maize while 22% sold between 5 and 10 bags of maize.

The study established that 83% of the respondents kept cattle. The results also show that 29.2% of the households kept goats while 19.8% kept poultry. However, majority of the respondents (78%) have never used artificial insemination (AI). SImilarly 34% of the farmers harvested between five and ten liters of milk per day while 26.4% harvested less than five liters. Most households (54.7%) consumed less than five liters a day while 14.2% consumed between 5 and 10 liters of milk. The surplus milk according to 49% of the respondents was sold. The sale of milk according to 18.9% of the respondents fetched over Ksh. 10,000 per month and according to 15.1% it fetched between Ksh 5,000 and 10,000 and less than Ksh. 5,000.

5.1.5 Food Security Situation

The study findings revealed that 50% of the households consumed one bag of 90kg maize each month while 37.7% consumed less than one bag a month. On the other hand, nearly all (94.3%) the households consumed less than one bag of 90kg of beans. According to 27.4% of the respondents, the maize obtained lasted for 10 months and more while 26.4% indicated that the maize yield lasted between 7 and 9 months and between three and six months. The findings showed that 19.8% of the respondents had their maize last just one to three months. However according to 50% of the households, the beans lasted for just between one and three months. The study established that incase of shortage, 55.7% of the households purchased grains while 17% depended on food aid by either the government or well wishers. The findings revealed that 29.2% of the respondents spent between Ksh. 3,000 and Ksh. 5,000 while 14.2% spent between Ksh. 1,000 and Ksh. 3,000 on the purchase of the grains. The food security situation in the district was described by 39% of the respondents as insecure while according to 14% it as very insecure. The respondents explained that the food security situation in the district keeps fluctuating from time to time. Reasons for food insecurity were given as overdependence on maize both for consumption and for cash, poor fertility of the soil and the refusal by the farmers to apply fertilizer and population pressure which has put pressure on land.

5.2 Conclusions

The study concludes that the household characteristics such as level of education, number of children and farm acreage influenced the food security in Tinderet district as most of them are semi illiterate and therefore are limited to information absorption. The large family size also directly influence the food security.

The study findings revealed that even though most farmers were able to harvest maize and beans, the harvest could barely last them more than six months and therefore they had to resort to alternative ways of getting grains such as buying and government aid. The food security was therefore described as insecure.

From the findings of the study, it is clear that the farmers in Tinderet district adopted of inputs and practices recommended by the extension services was described as high as the households used improved seeds, timely preparation of land and planting, and timely harvesting among others. The study therefore concludes that the farmers in Tinderet employed the recommended farming practices and used recommended inputs.

Accessibility to credit was described by the respondents as poor. This was because only a few farmers were able to access credit to buy the farm inputs. Majority of the farmers had to sell their produce to purchase farm inputs which is another reason for the food insecurity in the region.

Access to information according to the study findings was available to most households whether through the radio broadcast of field demonstrations. The study therefore concludes that the farmers in Tinderet has access to extension information.

5.3 Recommendations

The study revealed that the food security in the region was described as insecure. The study therefore recommends that the farmers should be encouraged to diversify and stop looking at maize as the only food crop but explore other foods crops such as bananas, potatoes among others.

The study established that despite the fact that the farmers used recommended inputs and practices, the use of inputs such as fertilizer was low. The study recommends that the farmers should be encouraged to use fertilizer in planting through incentives by the government such as subsidies on farm inputs which will lower the prizes for the farm inputs.

The study established that the accessibility to credit by the farmers for the purchase of farm inputs was very low. The study recommends that the government should make it easy for the farmers to access credit through state enterprises like Agricultural Finance Corporation where the requirements such as demand for collateral will be relaxed for the farmers so that more and more farmers can access credit.

The study established that even though the farmers have access to extension information, the influence of the information is yet to be realized in terms of food security. The study recommends that more extension officers need to be employed to reach more farmers and to do more follow-ups on farmers.

5.4 Suggestions for Further Research

This study was done on the contribution of extension services on food security with particular focus on Nandi County. It is suggested that similar study should be replicated in other regions with the aim of determining the contributions of agricultural extension services on food security. Further research is recommended to determine the effect of other factors on food security not considered in this study.

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ANNEX 1

INTERVIEW SHEDULE FOR HOUSEHOLDS

Introduction

I am a Master of Arts student at the University of Nairobi and currently undertaking a research study on the effects of Agricultural Extension Services on food security of smallholder households in Nandi County, Kenya as part of my course work. To achieve this you have been selected to provide me with the information on the same. The information given will be purely for academic purposes and your name shall not be mentioned anywhere in the report. Thank you for your corporation.

Name_____   Location_____

Date of Interview_____

1 Farmers' Characteristics

a. Sex: Male ( )   Female( )

b. Age: Below 29 years   ( )   30 – 39 years ( )   40 – 49 years ( )

        50 – 59 years ( )   Over 60 years ( )

c. Level of education: None ( )   Lower primary {1-4} ( )

        Upper primary {5-8} ( )   Secondary {9-12)   ( )

        College/university   ( )

d. Occupational status: Employed   ( )   Self employed ( )

        Not employed ( )

    i. If self-employed, what

       occupation_____

    ii. If employed what

       occupation_____

e. Marital Status: Single   ( )   Married   ( )   Divorced

        ( )   Separated   ( )   Widowed   ( )

f. Number of spouses _____

g. Number of children: Less than 2   ( )   3-4   ( )   5 – 6   ( )

Above 7   ( )

h. Number of other dependants _____

2 Adoption of Inputs and Practices

a. Do you own land?   Yes   ( )   No   ( )

    i.   If yes, how many acres? _____

    ii.   If no, whose land do you farm? _____

    iii.   How large is the land (acreage)? _____

b. Which of the following farm inputs and practices did you use for your main food crops this year and what yield have you obtained or expect to obtain?

	Type of Food Crop					
	Maize			Beans		
	Yes	No	Acres	Yes	No	Acres
Improved seeds (specify type_____						
Timely land preparation						
Fertilizer for planting						
Fertilizer for topdressing						
Farm yard manure						
Timely and clean weeding						
Insect pest control (field)						
Timely harvesting						
Proper drying of the grain						
Insect pest control (storage)						

	Maize	Bean
Yield 90 Kilogram basis harvested		
Amount of yield used for home consumption		
Amount of yield sold		
How much did you earn (Kshs.)		

    a. If you sold some of your yield why? _____

3. LIVESTOCK

    a. What types of livestock do you rear? _____

    b. If you have cattle, do you practice AI?   Yes ( )   No   ( )

    c. What amount of litres do you harvest a day? _____

    d. What quantity do you consume? _____

    e. Do you sell the surplus?   Yes ( )   No   ( )

    f. If yes how much do you fetch in a month? _____

4 Farmers' Access to Credit

    a. Have you been using credit to buy farm inputs for your maize and beans crops over the past three years?   Yes ( )   No   ( )

    If yes, indicate:

	Sources of credit	Amount Ksh.	Progress in Repayment
1			
2			
3			

b. If yes, what are some of the farm inputs you bought with the credit?

   Seeds ( )   Fertilizer   ( )   Pesticides   ( )   Animal feeds ( )   Others (specify) _____

   If you used credit, where do you get it from?

   Credit from bank   ( )   Credit from KFA   ( )

   Credit from Co-operative   ( )   Others (specify)_____

c. If you did not use credit, did you buy farm inputs?   Yes   ( )   No   ( )

d. If yes where do you get the money to by farm inputs?

   Own savings ( )   From friends ( )   From sale of produce ( )

e. In what form was the credit given?   Input ( )   Machinery   ( )   Money ( )   labour ( )   Marketing   ( ) Others (specify)_____

f. What   difficulties   (if   any)   have   you   had   with   repayment   of credit?_____

   _____

5 FARMERS' ACCESS TO EXTENSION INFORMATION

g. Have you ever received information about better farming?

   Yes   ( )   No   ( )

h. If yes from which of the following sources have you received information over the past three years?

	Yes	No
Farm radio broadcasts (Specify)_____		
Visited by frontline extension worker		
You visited extension office/research station		
Farm newspapers		

Field demonstrations		
Field days		
Kapsabet Agricultural shows		
Barazas where farming was talked about		
Contact farmers		
Workshops/farm courses(how long and where?)		

i. If you have not accessed these sources, why

_____

_____

_____

_____

j. What did you learn from these sources and adopt on your farm?_____

_____

_____

k. a) If you have accessed these sources, what information did you get?

_____

_____

_____

b) How did you use it _____

_____

_____

_____

5 Food Security

a. How much grains in 90Kg bags does your household consume each month?

      Maize_____

      Beans_____

b. How many months did the yield you obtained last year and reserved for home consumption last?

    i.   Maize: Less than 3 months ( )   4 – 6 months ( )

                           7 – 9 months ( )   Over 10 years ( )

    ii.   Beans: Less than 3 months ( )   4 – 6 months ( )

                           7 – 9 months ( )   Over 10 years ( )

c. If the yield lasted less than 12 months, how did you obtain grain for house hold consumption?   Gifts ( )   Aid ( )   Purchase   ( )   others (specify)_____

d. If you purchased, approximately how much money did you spend each month?_____

e. In your opinion, how would you describe the food security of your household?

      Very secure ( )   Secure ( )   Somewhat secure   ( )

   Insecure   ( )   Very insecure ( )

ANNEX II

INTERVIEW GUIDE FOR KEY INFORMANTS

a. Name_____ Position_____

b. Age: below 29 years ( )   30 – 39 years ( )   40 – 49 years ( )

           50 – 59 years ( )   Over 60 years ( )

c. Gender: Male ( )   Female( )

d. How long have you worked in this region?   Less than 2 years   ( )

           3 – 5 years   ( )   6 – 8 years   ( )   Over 8 years

           ( )

e. How   would   you   describe   the   food   security   in   this region?_____

_____

f. In your opinion, do the farmers in Tinderet District employ the recommended extension services in farming practices? _____

_____

_____

g. State whether in your opinion farmers access credit to buy farm inputs?_____

_____

_____

h. How   has   access   to   credit   influenced   the   food   security   in   the region?_____

_____

_____

i. Do   the   farmers   seek   extension   information   on   farming practices?_____

_____

j. How has the extension information influenced the food security in the region?_____

_____

k. What are some of the reasons for the food insecurity among the households in Tinderet?_____

_____

_____

l. In your opinion, what should be done to improve the food security situation in the region_____

_____

_____