An assessment of the impact of animal traction on rural household food security: a case of Damane rural community of Cofimvaba in the Eastern Cape Province of South Africa

By

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DECLARATION

I hereby certify that this dissertation is the result of my own original work and has not previously been submitted to another university for the purpose of a degree. Where use has been made of the work of others, such work has been duly acknowledged in this text.

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DEDICATION

I dedicate this work to my Mother Princess, Nolondon Manzana and my late Father Harold, Songezo Manzana may his soul continue to rest in peace. You are the best parents that God has blessed me with.

"**MUCH LOVE"**

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ABSTRACT

This dissertation assesses the impact of animal traction on rural household food security. Since rural communities do not have sufficient agricultural capital to purchase improved agricultural technologies for better crop production, and often lack knowledge and skills to apply improved technologies low-cost alternatives must be sought. For these reasons, animal traction has been seen by researchers as an affordable, easy-to-use, sustainable and appropriate operation for crops production in rural areas. Animal traction has been long used and it continues to be used in rural areas to improve food insecurities. But the system confronts a number of constraints that impede the development of its full potential and these should be addressed in order to reap the full benefits of agricultural restructuring in the rural areas. A study was carried out in Damane rural village under Ntsika Yethu Municipality in the Eastern Cape where animal traction is very popular. A total of 80 small-scale farmers were interviewed by means of structured questionnaires to collect data from adopters and non-adopters of animal traction.

A wide range of analytical techniques were employed to assess the impact of animal traction on household food production. Descriptive statistics was employed for analyses of demographic, agricultural production process of the surveyed households and challenges encountered by households. Multiple Linear Regression was applied to determine the factors affecting animal traction use and the extent to which they contribute to gross farm production. The results of the multiple linear regressions showed that animal traction played a significant role in the total output of all the crops produced last season. The results of the t-tests showed that animal traction was the most effective technology compared to the simple hand-tools such as fork, fork spade and hoes. The binary logistic regression was employed to test the probability that resource poor households would adopt animal traction technology. It is therefore recommended that government should support animal traction users by providing all the necessary resources for development of animal in rural South Africa.

Key words: Damane rural village, adoption and non- adoption of animal traction, smallholder producers, food security, multiple linear and Binary Logistic regression models and T- test.

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THE LIST OF ABREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ATNESA	Animal Traction Network for Eastern and Southern Africa
BLR	Binary Logistic Regression
CRLR	Commission on the Restitution of Land Rights
DLA	Department Of Land Affairs
ECDOA	Eastern Cape Department of Agriculture
ECSECC	Eastern Cape Socio-Economic Consultative Council
FAO	FOOD and Agricultural Organization
GDP	Gross Domestic Product
GNP	Gross National Product
HSRC	Human Sciences Research Council
HIV	Human Immunodeficiency Virus
HSRC	Human Sciences Research Council
IFSS	Integrated Food Security Strategy
NDA	National Department of Agriculture
NGO	Non-Governmental Organisation
PGDP	Provincial Growth and Development Plan
POEC	Provincial Office of the Eastern Cape Department Of Agriculture
SANAT	South African Network of Animal Traction
StatsSA	Statistics South Africa
SPSS	Statistical Package for Social Sciences
UN	United Nations

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Joubert (1995) defined animal traction as the use of animals to assist farmers in agricultural production. It helps farmers in carrying out various tasks such as ploughing, harrowing, planting, ridging, weeding, mowing and harvesting. It is a labour saving technology that resource poor farmers can access easily and cheaply. It is also used in irrigation of cultivated fields through driving water-pumps and drawing water from wells. The most preferred and popular animals used to assist in agriculture include cattle, donkeys, mules, horses, and camels (Braimah et al., 2013). Draught animals are also used to provide motive power for vehicles or machinery (Braimah et al., 2013). In some provinces of the country agriculture is the source of income and employment. Therefore if the development of agriculture can be made sustainable that could result into better economic and social growth for the country.

Animal draught power has been used all over the world for many years in places such as Asia, Europe, and Africa (especially in North Africa and Ethiopia), and it is still important for many smallholder farmers. It was believed that animal traction for tillage and wheeled transport was introduced centuries ago (Starkey et al., 2000). During this time animal traction was used to reduce the hard work on farm and to strengthen agricultural production, thereby improving livelihood standards throughout rural communities. Animal draught power also provided smallholder farmers with vital power for crop cultivation and transport. However In 1652 when the first European settlers arrived in South Africa, they found the Khoi-khoi training cattle for packing, riding and war purposes (Kaumbutho et al., 2000). The Europeans started to use these oxen for various tasks such as pulling wagons, transport and production of food and cash crops since they were the only forms of draught animals known and available.

In 1656 the first horses and donkeys were imported but, as a result of the unfavourable environment, it was a while before they were established and adopted (Kaumbotho et al., 2000). For the next 200-300 years, animal draught power improved and spread amongst the settlers as well as the indigenous people, as animals were used to assist in pulling of the trek wagons and carts, to transport heavy goods and to pull passenger coaches. As the twentieth century progressed, mechanical power became increasingly important for transport, mining

and large-scale agriculture. During the middle years of the century (1935–60), the large-scale (generally ‘white') farming sector moved from almost total dependence on animal power to its present dependence on tractors.

During 1960s and 1970s, animal traction received almost no consideration in South Africa. In other African countries, animal power was also seriously ignored. During this period, many people in the world thought that the rapid tractorisation used by large-scale farms in South Africa and developed countries like Europe would also take over smallholder farming in Africa. People were unaware that the lack of knowledge and skills in the use of tractors for food production would derail these aspirations Rural dwellers had insufficient knowledge and skills in the use of tractors and there was no training, research or extension support nor development of supportive infrastructure and equipment and spare parts supply (Starkey, 1995). By the late 1970s, African countries experienced a rapid increase in oil prices and had foreign exchange shortages. Consequently, most tractor systems failed. This created a massive problem, as many people in the world realized that tractorisation was, after all , not going to be economically viable (Starkey et al., 2000). As this problem persisted, animal traction started to be perceived by governments through Africa as an economically and environmentally appropriate development option that had been neglected. Even though had been neglected by policy makers, rural communities still used it to produce food. Nongovernmental organization (NGO’s), farmers and African governments started to consider animal draught power as an important rural power source that could complement mechanical and human power. Even oil-rich countries such as Nigeria and Cameroon started to take animal traction seriously, and politicians and agriculturalists promoted animal power as a realistic option for smallholder farmers (Starkey, 1995).

According to Joubert (1997), in 1980, the use of animal traction for crop production and transport by smallholder farmers began to increase in many Africa countries, even though there was need for relevant research, development and extension services. Animal traction has been used for decades in South Africa, going back to before the arrival of the colonist from Europe in 1652. It was used to assist in crop production and for transportion purposes especially by rural communities. Through the years, animal draught power became largely ignored by the authorities in South Africa, especially during the 1960s, while other Africa countries were becoming increasingly dependent on animal traction. To overcome the ignorance in the use and development of animal draught power in South Africa, in 1990, the

Animal Traction Network for Eastern and Southern Africa (ATNESA) was formed to link animal traction specialists from all over the world. Then in 1993 a national one day ATNESA workshop about animal traction was held. The workshop resolved to form a national network for animal traction, which was named the South African Network of Animal Traction (SANAT). The objective of the SANAT was to improve knowledge and information exchange and to promote relevant research, development, training and policies concerning the use of animal draught power, and to learn from the experiences of other African countries, since animal draught power was still important, easy to use and affordable especially to rural people (Joubert, 1997). During the first SANAT workshop in 1993 no one at the workshop knew exactly the extent to which animal draught power was still being used in South Africa. According to Braimah1 et al., 2013, the network came to a decision that there should be a nationwide survey to verify the current use of animal traction at the time, as well as key issues and constraints concerning animal traction.

As a result, in 1994, SANAT undertook a nationwide survey of the use of animal traction in South Africa by the time. The main objective of the survey was to develop smallholder farm productivity and improve rural livelihoods in South Africa through the effective use of animal draught power for transport purposes and cost-effective, sustainable crop production systems. The immediate objective of SANAT was to produce a publication that would reveal the status of animal traction in South Africa at the time.

According to Starkey (2000), the data was collected around South Africa and the results of the survey were that between 40 and 80 percent of the rural communities which were visited practiced animal traction operations, and a large numbers of commercial farmers were using it for large reductions in their mechanisation costs (Kaumbutho et al., 2000). Most of the respondents interviewed were small-scale farmers. As from 1993, SANAT has developed an effective network linking animal traction users throughout the country. By 1992 and 1993 animal traction was still practiced in South Africa by rural communities. During this time the use of animal traction was uncommon in the large-scale agricultural sector. Animal power was still generally used for transport in most rural areas, for economic and social functions, and for the cultivation of food crops (Starkey et al., 2000). It has also succeeded in promoting and publicising animal traction to the point that it is now gaining wide recognition and is

being recognized by National Governments as one of the power options, not only for agricultural development, but also for rural communities in general.

Although animal traction was still being used by many rural households in South Africa to produce food, it was neglected by the policy makers and was it not included in any of the South African policies (Kaumbutho et al., 2000). For example in 1994 the government reprioritised public spending to focus on improving the food security conditions of historically disadvantaged people. That policy resulted into increased spending on social programmes in all areas of government. So government decided to formulate a national food security strategy that would streamline, harmonise and integrate the diverse food security programmes into the Integrated Food Security Strategy. Many food security programmes were formulated by policy makers to help people fight food insecurity, but nothing was said about the development of animal traction for rural communities (Joubert, 1994).

Based on this background animal traction has been used for decades for food production to fight food insecurities in rural areas and now it is neglected by policy makers. The need for this study is to investigate if animal traction is still being used in rural areas for food production, what problems do users encounter and what kind of assistance have they received from government regarding the development of animal traction.

1.2 Problem statement

According to the World Food Summit organised in Rome in 1996 (FAO, 1996), food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. In South Africa, food security received much attention after 1994 when South Africa became a democratic country. The right of access to sufficient food was set in Section 26 and 27 of the South African Constitution of 1996. On these rights, the Constitution states that “every citizen has the right to have access to sufficient food and water, and that the state must, by legislation and other measures, within its available resources, avail the progressive realisation of the right to sufficient food” (Altman et al., 2009).

The strategic framework for action to achieve food security in South Africa was first outlined in the Reconstruction and Development Programme, which identified food security as a basic

human need (ANC, 1994). It recognised that poverty and food insecurity are the legacy of the apartheid socio-economic and political order. According to Labadarios (2009), the experience of hunger in South Africa has decreased, but under-nutrition remains a serious problem. This is the situation in both urban and rural areas. As in many other countries, especially in Africa, South Africa is battling food insecurity, health problems, poverty, unemployment and crime. Balindlela (2003) mentioned that a massive small-scale farming movement, strategy or policy is needed to address the food insecurities in rural areas, since the opportunities for productive employment are scarce

Du Toit (2011) pointed out that at national level, South Africa is food-secure because it produces its main staple foods, exports its surplus food, and imports what it needs to meet its food requirements, but at the household level, South Africa is unable to address food insecurity especially in poor rural communities. The phenomenon of household food insecurity has led to extremely high levels of hunger, unhealthily conditions, and low labour productivity. Within households, food insecurity often affects the more vulnerable members of the family, namely children and women. According to Labadarios (2009), South Africa's current development path has not as yet adequately resolved questions of food insecurity and poverty. In the provincial growth and development plan of the Eastern Cape Province (PGDP, 2004- 2014), addressing the issue of household food insecurity in the Eastern Cape has been identified as one of the top priorities. It has also been stated that household food insecurity will be addressed through a focus on increased agricultural production, incomes and employment for the poorest households, particularly in the ex-homelands. It has been nine years since the PGDP was developed and adopted but most rural areas are yet to be food secure. (Labadarios, 2009).

Colonialism and apartheid barred agrarian activities, and poverty and food insecurity increased because black people no longer had the means to produce enough of their own food. Different programmes to address the crisis of food insecurity have been implemented by the Government of South Africa (Labadarios et al., 2009). Some of the programmes resulted in massive changes in people's lives, whilst other programmes disempowered people and left them poor and bitter. The school feeding scheme, old-age pensions, and child grants are some of the more successful projects. The land reform programme and the massive food production schemes, on the other hand, have not worked well.

According to Statistics South Africa (2011), in July 2011 mid-year population estimates, South Africa's population is at 50.59 million people; Eastern Cape Province has 6,829,958 people (13.5% of the total population). Among the provinces that make up a country Eastern Cape is the most poverty stricken Province, yet it has a lot of potential that needs to be realized. A lot needs to be done in order to transform households so that they can afford to have balanced, healthy and nutritious meals. The gross domestic product (GDP) of the Eastern Cape Province has been unstable in past years, increasing and then decreasing. In the second quarter of 2012, GDP growth declined drastically from 2.7 percent to 1.6 percent (StatsSA, 2011). These instabilities of the GDP result in unstable food prices and that negatively affect rural people who do not always have money available when food prices increase. One of the solutions to this unstable economy is for rural communities to produce food for themselves. This means strengthening rural food security programmes. Also the government should support the use of animal traction in rural areas by providing implements and working animals, since animal draught power is easy for them to use. This may result in successful and sustainable food security in most rural communities.

People in South Africa are not only faced with serious food insecurity but also serious poverty, especially those living in rural areas. Poverty is severe in rural areas because, the majority of the population living in such areas has limited opportunities for productive employment. (Kaumbotho et al., 2000). Ironically global demand for food is rising as a result of growing incomes while developing countries are experiencing slow growth in agricultural production. Therefore there is a need to expand outputs or produce surplus food. Climate change, population growth, inefficient markets, the unsustainable use of natural resources and consumption patterns converge to put pressure on current and future food availability and access. Food insecurity is closely connected to poverty and, throughout the world, rural poverty remains deeper and more widespread than urban poverty.

Production needs to be increased, as the demand for food is also increasing. An increase in food production can be achieved through the use of improved of technology and the expansion of areas under cultivation (Simalenga, et al., 1997). The use of improved technology in rural communities can be difficult since rural people lack knowledge and they have not been exposed to any training to improve their knowledge and skills. This is based on the lack of extension services in rural areas (Kaumbutho et al., 1999). Improved technology

may also require large amounts capital to acquire. For instance, the use of tractors could increase production but tractors are expensive and not easy for rural people to use.

Land is another resource that can be used to increase production and this can be achieved through the expansion of the areas under cultivation (Simalenga et al., 1997). Land on its own cannot increase outputs; there is a need for the use of labour. People in rural areas migrate to urban areas for better jobs. Also the incidence of HIV and AIDS in rural areas largely reduces the capacity of the labour force (Ncube, 1998). Moreover, human power can be controlled by fatigue, so the use of human power together with land may be insufficient to increase production in rural areas. Therefore, animal traction can be used as a middle way to increase outputs (Simalenga, et al., 2004). Animal traction is ideal for rural people because it is an easy operation that does not require technical knowhow. For instance, donkeys are easy animals to work with. They can be used by women and children (Fielding et al., 2004). Animals are cheaper than tractors. They are also readily available to perform operations because their energy is renewable (Simalenga et al., 1997).

Although animal traction has been neglected and some people have negative attitudes towards it, it has been proved in other countries and regions that effective use of animal traction can expand outputs or generate surplus for households. For instance, in Asia and America, animal power is expanding and is widely used especially by those farmers who are resource poor to produce food (Simalenga et al., 2004). However, at some point, the use of animal traction can be slow to produce rewards; for example, it consumes a lot of time to complete the most basic tasks involved in food production compared to tractor use. Also, at the same time, the animals may sometimes be in poor health and, therefore, not able to deliver the right amount of services to the farmer. So, tractors can be faster and complete tasks on time but still, animal traction is a technology that is most accessible to rural households, since it is the most economical method that fits the income, knowledge and skill profiles of most people living in rural areas desperately working to enhance their livelihoods and welfare. The identified problem of this study is that people living in rural areas are still living in hunger; animal traction was found to be one of the middle ways that can be used to alleviate food insecurity and enough evidences seem enough to guide policy and practise.

Based on the problem statement food insecurities have hit rural people the mostly and food security programmes implemented have not fully addressed the problem of food insecurities

especially at household level. Investigations have been done regarding the use of animal traction to produce food and there is enough evidence to support that animal traction can be used as a middle way to food insecurities in rural South Africa.

1.3 Research objectives

The broad objective of this dissertation is to assess the impact of animal traction on rural household food security in South Africa

The specific objectives include to:

I. Examine the nature and degree of the impact of animal traction on household food production
II. Identify the degree of food security among farmers who adopt animal traction and those who do not.
III. Identify the problems faced by farmers in the project area (Damane rural community) in the successful adoption and development of animal traction.
IV. Investigate whether animal traction is an easier technology option for rural people

1.4 Research questions

I. Does animal traction have an impact on household food production?
II. Does the degree of food security differ among farmers who adopt animal traction and those who do not?
III. Do farmers in the project area (Damane rural community) have problems in the successful adoption and development of animal traction?
IV. Is animal traction the most affordable and easy to use technology for rural people?

1.5 Hypotheses

I. The use of animal draught power in rural livelihoods has no positive impact on household food security; it cannot be used as key to fight food insecurity in most rural areas.
II. The degree of food security does not differ among those who adopt animal traction and those who do not
III. The farmers in the project area (Damane rural community) are not facing constraints in the successful adoption of animal traction to produce food.

IV.

V. Animal traction is not the most affordable technology that rural people can use to produce food.

1.6 Justification of the study

In South Africa, agriculture contributes around 10 percent of formal employment, which is relatively lower than in other parts of Africa, as well as provides work for casual labourers and contributes around 2.6 percent of GDP for the nation (StatsSA, 2011). According to Statistics South Africa (2011) South Africa has a dual agricultural economy, with both a well-developed commercial farming sector and more subsistence-based production in the deep rural areas. South Africa's population is growing at almost 2 percent per year. The population of 49 million in 2009 is expected to grow to 82 mill-ion by the year 2035 (StatsSA, 2009).

Food production or imports must more than double to feed the expanding population, and production needs to increase using the same or fewer natural resources. In addition, the demand for certain food types will shift as more people become wealthier. Agriculture is one of the industries that contribute significantly to rural livelihoods. Therefore, this study focused on rural people's livelihoods and agriculture and suggested ideas and strategies for people living in rural areas to use their available resources such as animals, labour, land, and manure to reduce the high levels of food insecurities.

The results of this study outlined the importance of animal traction in rural areas and identified the constraints faced by animal traction users. Therefore the results of this research might help policy makers, because they will be in a position to see what works and what does not work in rural areas, and also see what rural people need and want in terms of the development animal traction and food security. The study also attempted to find solutions to the problems faced by those practicing animal traction operations. The findings of this study could result in people in rural areas being self-employed, food secure and generating income for their households.

1.7 Delimitations of the study

Although the Ncora Administrative Area is comprises 6 rural communities, the study was limited to the rural households in the Damane rural community. This was because, out of these rural communities in Ncora, the Damane rural community was where the majority of the households still used animal traction technology to produce food. Most farmers in the Damane community used animal draught power to produce crops such as maize, cabbage, potatoes, spinach and pumpkins. So, the study focused on the Damane community, since most farmers there relied on animal traction technology for agricultural purposes.

1.8 Outline of the dissertation

This dissertation consists of five sections: the introduction, literature review, research methodology, the presentation of the research findings and the discussion, conclusion and recommendations. The introduction of the dissertation presents background to the study, the problem statement, justification, research objectives, hypothesis, research questions, and delimitations of the study and the outline of the dissertation. The second chapter reviews the literature giving overview of food insecurities in general basically looking at historical origins of food insecurity and poverty, food security trends, food security challenges in the country, as well as the impact of animal traction technology on household food security, constraints that impede the adoption and development of animal traction, the development of animal traction in rural areas of South Africa: overcoming constrains associated with in animal traction, the role of national and provincial governments in developing sustainable agriculture in rural areas and the investment in agriculture.

The third chapter presents the research methodology which entails the selection of the study area, the description of the study area, the sampling procedure, data collection and data analyses. The fourth chapter presents the research findings of the study, which entails the information related to demographic characteristics of the household heads, agricultural production process of the surveyed households, kind of technology used to produce food by households, assistance received from government regarding the use of technology used to produce food, food security statuses of households, marketing of produce and credit for agricultural purposes. This section further analyses of the variables through the multiple

linear regression, binary logistic regression and T-test. Chapter five presents the discussion, conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed the literature on poverty, food insecurity and the impact of animal traction on food security. The chapter is divided into five sections. The first section briefly discussed food insecurities in general, basically looking at the historical origins of food insecurity and poverty, food security trends and food security challenges in South Africa.

The second section gave an overview of the impact of animal traction technology on household food security, constraints that impede the adoption and development of animal traction. The third section discussed the development of animal traction in the rural areas of South Africa: overcoming constrains associated with in animal traction, the importance of improved agricultural technologies. The fourth section discussed the role of national and provincial governments in developing sustainable agriculture in rural areas and the fifth section discussed the investment in agriculture.

2.2 Historical origins of food insecurity and poverty in South Africa

Poverty and food insecurity in South Africa is the result of several centuries worth of colonial and apartheid policies, designed specifically to create general conditions unfavourable to the well-being of black people in all its aspects (Du Toit, 2011). According to the FAO (2011) the current South Africa changed at the turn of the 20th century from an agrarian setting through the rapid growth of commodity markets that sprung up around major industrial mining, urban populations and commercial agriculture centres. Initially, African farmers and entrepreneurs had successfully participated in the growing commodity markets under conditions of relative land abundance, a low population size, low production, processing and distribution technologies, weak government interventions and relatively undistorted markets (Carter and May, 1999).

Food insecurity and poverty among the majority of the African population, which at the time was largely constituted of independent producers and entrepreneurs, was almost non-existent (Du Toit, 2011). With political and economic forces that led blacks to become the expected

providers of wage labour to mining, industry and large scale agriculture, this situation of relative food security in South Africa among the majority population was to change. Encouraged by its social and economic imperatives, successive white governments throughout the greater part of the 20th century transformed the agrarian 19th century society through a two-pronged strategy that set in motion a process that would concurrently cripple and exclude African farming and entrepreneurial development (Altman and Hart, 2009).

According to Altman and Hart (2009), the strategy enabled and entitled white farmers and industrialists as leaders and chief beneficiaries of industrial development. The decline of African farming led to a gradual loss of agricultural and rural capital, wealth, farming and entrepreneurial skills and experience. Farming and rural enterprise activities ceased to be a window of African entrepreneurial opportunity, management and technical development (Altman and Hart, 2009). The process of modern industrial development in South Africa, thus, became the driving force that created the existing poverty and food insecurity among black people in South Africa. The position of African people in the urban areas was not much better than in the reserves and former homelands. They were located far from places of work and from the general white population. The primary purpose of urban areas was to provide labour to the mines, industries and the general white population. They had very limited access to education, health and social services (Carter and May,1999).

2.3 Food trends in South Africa

According to Statistics South Africa (2011), there has been a large decline in the vulnerability to hunger of South African households over the past decade, from 23.8 percent in 2002 to 11.5 percent in 2011. Despite large declines in the vulnerability to hunger of South African households over the past decade, a large percentage of households (21.1 percent) continues to experience difficulty in accessing food (StatsSA, 2011). The households in urban areas that are experiencing inadequate access to food are more likely to participate in agriculture than those with adequate access. Van Zyl et al., (1996), pointed out that less than a quarter of households in South Africa are involved in agriculture, including doing agriculture as a hobby.

Nationally, more than 84 percent of households that are engaged in agriculture do so to produce extra food for the household while only 4.2 percent of households use agriculture to produce the majority of their food (HSRC, 2004). The HSRC, (2006) mentioned that,

although South Africa has largely maintained its ability to meet national food requirements and to provide food in sufficient quantities and of appropriate quality to consumers, large scale inequality and poverty mean that many households do not enjoy food security or adequate access to food. Many households live in a state of chronic poverty and find it difficult to deal with shocks such as unemployment and natural disasters. (Labadarios et al., 2009).

StatsSA (2011), pointed to large declines in the vulnerability to hunger of South African households over the past decade, from 23.8 percent in 2002 to 11.5 percent in 2011. While almost two thirds (62.6 percent) of South African households receive salaries or wages, it is disturbing to note that 44.8 percent of households are poor enough to receive social grants. Households headed by black Africans and those headed by females remain most vulnerable to hunger and inadequate access to food (StatsSA, 2011). As a participant to the UN Millennium Development Goals, South Africa has committed itself to achieving the goals and targets set out in the document, including halving the proportion of people who suffer from hunger, by 2015 (Balindlela, 2003). Balondlela (1994), noted that, the eradication of hunger and poverty is a particularly important development objective as good nutrition is vital for improved health and human capital outcomes.

The steady increases in food prices that culminated in the spikes of 2008–2009 brought food security back on the global policy agenda (Du Toit, 2011). According to Labadarios et al., 2009, climate change, population growth, inefficient markets, the unsustainable use of natural resources and consumption patterns come together to put pressure on current and future food availability and access. While there is a growing interest in food systems that encompass all dimensions from production to final consumption, most policy prescriptions focus on addressing food security at national level and tend to neglect the crucial importance of access and affordability for low-income groups and more specifically for poor rural residents (Carter and May, 1999). Given that rural residents are mostly dependent on food purchases while the opportunities for productive employment are scarce, food insecurity is increasingly becoming a deep issue that will not be easy to deal with. Labadarios et al., 2009, pointed out that the adverse impacts of the food prices crisis on low-income urban residents have been described extensively. There is also growing literature that examines the consequences of climate change on agricultural production and, to a lesser extent, on transport and storage systems.

Access to sufficient food is the right of all South Africans; however today many South Africans are vulnerable to food insecurity, leading to nutritional problems including stunting, low body weight, and micronutrient malnutrition (Drimie and Ziervogel, 2006). Chronically malnourished children suffer from decreased physical activity and lowered immunity. According to according to Balindlea (2003), the South African government has committed itself to halving poverty between 2004 and 2014. One of the critical components in meeting that objective is household food security because the link between poverty, incomes and household food security is, however, not at all clear. Some poor households they might have to make means to start their own food production.

In order to achieve food security in South Africa policy makers, must know that, it is important to understand what the term entails. The term "food security" constitutes the four of the following dimensions. The terms are food availability, food access or effective demand, reliability of food, and food distribution (Hart, 2009). These dimension are discussed further below

- Food availability: means effective or continuous supply of food at both national and household level. This phenomenon is affected by input and output market conditions, as well as production capabilities of the agricultural sector.
- Food access or effective demand: means an adequate supply of food at the national or international level that does not in itself guarantee household level food security. Concerns about insufficient food access have resulted in a greater policy focus on incomes, expenditure, markets and prices in achieving food security objectives.
- Reliability of food: means utilisation and consumption of safe and nutritious food.
- Food distribution: means equitable provision of food to points of demand at the right time and place. This spatial/time aspect of food security relates to the fact that a country might be food secure at the national level, but still have regional pockets of food insecurity, at various periods of the agricultural cycle.

In the 2010/2011 financial year food security was identified as one of the top priorities for South African government .This is in line with South Africa's millennium development goal which aims to halve the proportion of people who go hungry over the period 1990 and 2015

and to halve poverty and unemployment by 2014. The National Department of Agriculture, Forestry and Fisheries (DAFF)'s major role is, among others, to ensure that opportunities are created to encourage South African citizens to participate in agriculture and produce to reduce food insecurity in the country. The department has since initiated a number of programmes that are meant to contribute positively to food security in the country (Department of Agriculture, 2002)

2.4 Food security challenges in South Africa

The HSRC (2011) mentioned that the current food security challenge in South Africa consists of two dimensions. The first dimension seeks to maintain and increase the ability of South Africa to meet its national food requirements. This involves meeting these needs from the domestic agricultural resource, import food items that cannot be produced efficiently, and export commodities with comparative advantage. The second dimension seeks to eradicate the widespread inequalities and grinding poverty among the majority of households, which is manifested by inadequate and unstable food supplies, the lack of purchasing power, weak institutional support networks, poor nutrition, inadequate safety nets, weak food emergency management systems and unemployment (HSRC, 2011).

2.4.1 Inadequate safety nets

Poor households are typically characterised by few income-earners, and many dependants. They are also often primarily dependent on migrant remittances and social security grants, making them vulnerable to food insecurity (PoEC, 2003). Rural households are particularly vulnerable because of their reliance on the remittances from the urban areas. In South Africa, they are also frequently constrained by a lack of economic activities in close proximity to their communities, inappropriate farmer support services, and they face constraints to gaining access to employment elsewhere, such as a lack of information and transport (Agriculture Policy Unit, 1997). Labadarios et al., (2009) indicated that, at the national level, the challenge is to create the economic conditions that favour poor, food-insecure households.

This means instituting changes that actively foster the participation of all in the mainstream economy, and thereby minimising poor households' dependency on government assistance. In other words, social safety nets should be viewed as a policy of last resort, helping those food insecure households that have not benefited from the enabling, pro-poor economic environment that government has supported (PoEC, 2003).

2.4.2 Weak support networks and disaster management systems

In order to develop new policies and implement food security programmes, policy-makers at all levels of government require considerable information on the conditions of food demand and supply and also producer's (farmers) constraints involved in the food production process in different parts of the country (Department of Agriculture, 2002). This information can be used to overcome the constraints faced by farmers in food production, and also it can be used to identify risky and vulnerable areas, with respect to food access and use. Food insecurity information is multi-sourced and, when using existing data collection systems through established agencies, and research institutions, cooperation and coordination is the key to establishing efficient and cost-effective systems. One such example of weak institutional support networks relates to disaster management systems (DoA, 2002). South Africa does not yet have a structured system of dealing with food security disasters, such as droughts or floods. The DLA (1997), mentioned that these disasters, which occur at regular intervals, can substantially threaten the food security position of agriculture-based households. With few reserves to draw on, these households are hit hard by crop failure and asset loss.

2.4.3 Inadequate and unstable household food production

Hunger and malnutrition in South Africa branch from insufficient, unstable food supplies, at the household or intra-household level. The majority of producers in the former homelands are unable to feed their families from their narrow production base (HSRC, 2004). They are deficit producers, and hence, net consumers of purchased food, and rely on non-farm income to meet most of their household needs. The HSRC (2004) mentioned that even non-catastrophic events such as seasonal, climatic variation are enough to push many of these households to the verge of a food crisis. Government assistance is often a major source of income for many of these households, given the high level of rural unemployment and dwindling migrant income transfers. As a result, many rural areas experience periodic bouts of hunger (HSRC, 2009).

2.4.4 Lack of purchasing power

According to Douglas et al., (2009), the majority of households in South Africa lack cash to purchase food. Underlying the lack of purchasing power is the limited scope of income opportunities, especially in the rural areas. It is well known that South Africa and the Eastern

Cape Province are facing a job crisis (Balindlela, 1993). According to Statistic South Africa (2011), there are large numbers of unemployed people, large and increasing numbers of discouraged workers and a growing non- economically active population. Official unemployment has remained around the 30% mark for more than fifteen years (Hart 2009).

The percentage of employed people with formal jobs is declining slowly as fewer people find formal positions. In South Africa as a whole, this has fallen from 87 percent in 1995 to 82 percent in 2010 (HSCR, 2010). Drimie and Ziervogel (2006), mentioned that black households have the lowest standards of living and are much more vulnerable to poverty, and food insecurity. The HIV/AIDS epidemic and other communicable diseases have further undermined food-insecure households (Ruel and Garrett, 2004).

2.4.5 Poor Nutritional Status

According to the HSRC (2010), one child in four under the age of six years (which translates to approximately 1.5 million children) is underdeveloped due to chronic malnutrition. These figures dramatically highlight the vulnerability of children in South Africa. Food insecurity and malnutrition are highest in provinces with large rural populations such as KwaZulu-Natal, Northern Province, Eastern Cape and the Free State (Hart, 2009). Food insecurity results in poor nutritional status. However, food security does not necessarily guarantee good nutritional status. In order to improve the nutritional status of food-secure and food-insecure South Africans alike, a multi-pronged approach should be considered (HSRC, 2009).

2.5 The benefits of animal traction technology to households

Most farming at subsistence level is located in rural communities where the majority of smallholder farmers have low productivity which results in high levels of food insecurity (Van Zyl et al, 1996). The farmers in rural communities are reliant on animal traction technology for food production and there are only a few who have the means to hire tractors for ploughing (Starkey et al., 2000). These areas are characterised by poor farming practices, and monoculture is mostly preferred.

This section of chapter two reviews the impacts and significance of animal traction technology on household food security, its impact on the environment and on social and economic life, as well as the impact of animal traction on different ages and gender.

2.5.1 The role of animal traction technology on household food production capacity

Normally, the concept of food security is defined as including both physical and economic access to food that meets people's dietary needs as well as their food preferences. A household is considered food-secure when its household members do not live in hunger or fear of starvation (FAO, 1996). Achieving household food security is a critical component in rural households (PoEC, 2003). While South Africa may be food secure as a country, large numbers of households within the country are food insecure. To understand household food security status in this country, it is necessary to investigate how the workings of the food distribution system and resources of a household determine its access to food (Altman et al., 2009).

Poverty and food insecurity would be addressed by expanding employment opportunities, thereby enhancing household incomes (Altman et al., 2009). Employment has expanded substantially since the mid-1990s, but not enough to address poverty meaningfully, especially in rural areas. This is because people in rural areas have no formal education, while some went to school but did not complete grade twelve. These days

the government only employs people who have grade twelve qualifications or higher; thus limiting job opportunities for rural people. In such a situation, if poverty cannot be fully addressed by expanding employment opportunities, animal traction can be used as a middle way to try to keep food security and poverty levels at minimum levels in rural areas (Joubert, 1997). Animal traction technology is suitable for any uneducated, unskilled person and it is does not require much technical knowhow.

The efficient use of animal traction plays an essential role in ensuring food security, economic growth and employment creation for rural people. Animals can assist directly with crop production (ploughing, planting, and weeding) (Joubert, 1997). Food production, distribution and rural trade are also assisted through animal-powered transport (on-farm, marketing, riding, pack transport). Approximately 50 percent of the world's population in rural areas use animal draught power to cultivate crops in order to improve their household food security. Animal draught power has been seen by researchers all over the world for example in Asia, Africa and Europe as a tool that could be used to reduce rural food insecurity.

2.5.2 The benefit of animal traction to the environment

Animal traction is valued by many farmers as increasing labour and land productivity, reducing drudgery and increasing efficiency in farming practices. Starkey (2000) mentioned that animal traction is an environmentally-friendly technology that is based on renewable energy and that assists the ecologically-efficient integration of livestock and crop-production. It is widely known that draft animals not only produce manure, they also transport composts to the field. The energy source (mainly pasture and crop residues) is ecologically renewable and neither depletes fossil reserves nor requires foreign exchange.

2.5.3 The social and economic benefit of animal traction

The potential contribution of draft animal power to agricultural development in South Africa cannot be over-emphasised. Most rural communities now are aware of how draft animals can reduce their workload and increase land productivity, whilst raising income, social status and prestige among themselves (Altman, 2009). This is because most rural communities obtain incomes from their agricultural production activities as well as from old-age and child support grants.

Besides the production of crops animal draught has played a significant role in most rural livelihoods. Oxen have played a vital role in customs of many indigenous people for decades (Starkey, 1995). Donkeys, horses and mules have been used for reducing drudgery particularly of women who use them to haul water, carry groceries as well as the cultivation of crops and the transport of harvest (Kaumbutho et al., 2000). According to Joubert (1995), livestock contributes significantly to rural housohlods' economy in many ways. Animals may be as a source of supplementary food, means of transport, security, and means of survival during crop failures. Animals also produce products such as meat, skin, milk, and manure which could be used as fertiliser or fuel, feathers, fibres, hides, and horns

The adoption of animal traction (as with most investments in agricultural development) tends to increase income differences between farmers within villages (Acharya, 2004). Animal draught power has been also been used for transport in many rural communities (Fielding and Starkey 2004). Farmers with animal transport (carts or pack animals) have wider contacts with traders (Simalenga et al., 1997). The resulting enhanced market access allows them to

increase their production and also their profit. With animal transport, greater use is made of manure and crop residues, which increases overall farm production. The development of efficient animal-based transport is often constrained by limited supplies of carts and capital or credit for acquisition. However, animal-based transport is usually very profitable. As long as there are sufficient numbers of carts in an area, local artisans ensure the technology is sustainable. The selling of animal produce also increases the household economic status (Fielding and Starkey, 2004).

2.5.4 Benefits of animal traction on different ages and genders

Animal draught power has the potential to reduce men's and women's drudgery in agricultural production and household tasks (Joubert, 1997). The use of animal traction by people in rural areas could lead to increased agricultural productivity and increased human productivity. Full benefits from animal traction operations can be achieved if both women and men have access to and control of the use of the animal draught power (Kaumbutho et al., 2000). The social costs and benefits of animal traction vary considerably between people of different ages and genders in farm households. Men and children usually train the animals; they work with them and herd them. These people have the minimal problems associated with first use of animals and area expansion, but may later benefit from easier and more fulfilling work. In some rural communities men consider it appropriate to cultivate land for the crops usually grown by women, in others they do not. Women and children often have the task of weeding and harvesting since it is the easiest work to do and their work may be increased if the cultivated areas are expanded and animal traction can be used as a middle way to reduce the work for women and children in the field (Kaumbutho et al., 1999).

2.6 Constraints that impede the adoption and development of animal traction

Constraints associated with animal traction can impede the development of animal traction in rural areas. There are many constraints which are associated with animal traction, and they result in lower rate of adoption of animal traction by rural communities. These problems include lack of implements and spares, lack of human labour, lack of capital and credit and scarcity of draught animals

2.6.1 Lack of implements and spares

Lack of appropriate implements and spares can be an important constraint to the use of animal traction and farmers have sometimes found it difficult or impossible to obtain suitable equipment (Starkey et al., 2000). In some cases the problem is the implement quality rather than quantity. Farmers are only offered equipment of poor standard or inappropriate design and consequently do not purchase them. For example, farmers in Tanzania wanted to purchase conventional mouldboard ploughs, but the local factory at Mbeya only produced unpopular, wooden-beamed ploughs, and the farmers considered lack of implements was a constraint, while the factory pointed to unsold stock

Poor implement adjustment causes unnecessary work for the animals and farmers in many rural areas. The lack of knowledge or inadequate training responsible for poor use of implements reduces the overall efficiency of animal traction use. While this is clearly important, it is unlikely to be a primary constraint to animal traction, although in extreme cases, the difficulties experienced can lead to the abandonment of this technology (Starkey, 1995).

2.6.2 Lack of human labour

The limited availability of human labour can be a critical constraint in the use of animal traction (Joubert, 1995). Two or four people are need when animal traction operations are used to cultivate crops (Simalenga and Joubert, 2004). One (usually an adult or strong youth) handles the plough, one guides the animals, and one or two (often children) encourage or beat the animals. Most rural households do not have sufficient labour to employ animal traction operations, because large numbers of people in rural areas migrate to urban areas for better jobs. The incidence of HIV and AIDS also reduces the capacity of the labour force in rural areas. This results in less adoption of animal traction (Joubert, 1995).

2.6.3 Lack of capital and credit

According to Acharya (2004), agricultural credit is one of the most important productive resources in agriculture. It enables farmers to procure all agricultural production inputs, equipment and machinery necessary for agricultural production. It is well known that the lack of capital or credit can be a critical constraint to agricultural development, and the adoption of animal traction can be highly dependent on the availability of capital and credit (Bellamy

et al., 1981). Large numbers of small scale farmers in South Africa are resource poor (Bellamy et al., 1981). Small scale farmers have traditionally been unable to access credit from formal financial institutions. Smallholder farmers in developing countries generally finance their productive efforts in three ways; firstly with the profits from the previous season's harvest paying for diesel, seeds, labour etc.; secondly from other sources of income such as sales of livestock, waged work etc and thirdly from informal sources such as relatives, friends, moneylenders and own savings (Backer, 1965).

This credit from informal sources is not enough for rural people to procure better and improved agricultural technologies and to expand their production levels. The market cost of oxen, cultivation implements and carts in Africa is high relative to average farm incomes (Kaumbotho, 1999). In areas of low animal traction adoption, few crop farmers have both sufficient savings and also the confidence in animal traction to purchase animals and implements without assistance. The lack of agricultural credit in rural areas results the in low adoption of animal traction by rural households.

2.6.4 Scarcity of draught animals

The scarcity of draught animals is also a major constraint in the development and adoption of animal traction in rural areas (Simalenga and Joubert, 1997). Death due to poor health and stock theft of draught animals are the major problems that most rural communities face. These results in limited availability of draught animals in rural areas and can result in lower rate of employment of draught animal power in some areas. In the humid and sub-humid zone of West and central Africa, there are very few cattle due to the theft of draught animals (Simalenga and Joubert, 1997).

2.7 The role of improved technologies as a solution to production constraints

According Drimie and Ziervogel, (2006) animal traction is important in rural areas, as it is still being used by most rural communities to produce food and for transportation. Even though there are many challenges in the adoption and use of animal draught power, but it is still the most affordable, available and easy to use operation to produce food for rural communities. The successful, sustainable and adoption of animal traction in South needs a major development as the people who are using it encounter it many problems. Animal traction technology should be improved and made advanced for rural community so that it

can be a technology that they can use to fight household food insecurities. The role that improved agricultural technology plays is discussed below.

2.7.1 The role of technology in agricultural production

Phillips (1987) defined technology as the artificial capability created by people to facilitate the manipulation of physical things. Food is subject to the economic principles of scarcity. Unlike the artificial value of scarce items such as gold, an adequate supply of food is paramount to population survival and skills diversification, making agriculture a first level priority (Pesek, 1993). Agricultural technology can contribute to increased food production, which could result in more food being available and better rural incomes (better access to food). Since the growth of agricultural productivity is also vital for stimulating growth in other sectors of the economy, the use of improved agricultural technologies could result in wide-spread economic growth in the country, because the country could produce high yields of food to meet its food requirements and export the surplus (Moreno & Sunding 2003; Kidane et al., 2006). Moreno & Sunding (2003) and the World Bank,(2008) mentioned that in developing countries such as South Africa, agriculture is a strong option for spurring growth, overcoming poverty, and enhancing food security, and this has necessitated an increase in agricultural productivity through the introduction and use of improved agricultural technologies.

2.7.2 Adoption and non-adoption of agricultural technology

Reliable arguments have been advanced to suggest that the production of food via high-yield agriculture techniques can meet the nutrition requirements of the global population (Avery, 1995). The contribution of new technology to economic growth can only be realized when the use of the new technology is widely diffused. Diffusion itself results from a series of individual decisions to begin using the new technology. These decisions are the result of a comparison of the uncertain benefits of the new invention with the uncertain costs of adopting it. According to Nzomoi et al., (2007), an analysis of the adoption of improved agricultural technology indicates that households with access to credit, higher education levels, extension advisory services, as well as members of agricultural associations are more likely to adopt new agricultural technologies. Nzomoi (2007) also mentioned that households and small-scale, resource poor farmers are less likely to adopt new technologies because they lack credit for purchasing it and skills to operate the new technologies. For rural people,

animal traction is the most is available, easy to use and affordable technology that they use for soil tillage and other farm aspects.

2.7.3 Innovation and transfer of technology

Technology acquisition and transfer into the economy are central to productivity change and growth, leading to increased economic productivity and living standards (Avery, 1995). The end results of technology transfer should ideally be that the recipient is able to use, replicate, improve on and possibly resell the technology. For transfer to contribute to sustained and equitable development, it must involve a broad and encompassing process that avoids creation and maintenance of dependency. The process must encompass all elements of origins, flows and uptake of expertise and experience, across and within countries, stakeholder organisations and institutions (Avery, 1995).

Moreno & Sunding (2003), mentioned that transfer of technology should involve researcher-extension agent– farmer or end-user of technology but in some parts of the country that system is likely to be successfully adopted. Other approaches, such as participatory action research and farmer-to-farmer learning are more appropriate. Recipients of transfer of technology should therefore be able to identify and select technologies that are appropriate to their needs. The implementation of transfer in agriculture could be guided by the Norms and standards for extension and advisory services (Moreno & Sunding, 2003). These provide the minimum standards such as skills levels of extension agents and advisors; resources requirements at district, municipal and local offices to be adhered to in the provision of services to farmers. Apart from being a catalyst for economic growth generally, agriculture provides food, clothing, employment, tourism, contributes to the alleviation of poverty and promotes international competitiveness.

According to Moreno & Sunding (2003), agricultural extension services and transfer of technology should also include packaging and further development of existing technologies and commercialisation of products. The government should fund partnerships with other role players. These and related activities will improve production and increase income generation in the sector. Financial support must be made available to service providers on a competitive basis, and to institutions to strengthen their capacities to facilitate the transfer of technology, undertake adaptive research and provide advisory services.

2.7.4 Technology transfer on the subject of animal traction

Transfer of animal traction technology is defined as the dissemination of knowledge and skills to animal traction users, including extension services and training (Celis et al., 1991). Small holder farmer's agricultural growth, in the short term, depends on rising productivity through the application of new agricultural technologies such as fertilizer application, herbicides, pesticides, improved varieties and agronomic practices (Dadi et al., 2001). According to Starkey and Kaumbutho (1995) most of technology transfer relating to animal traction took place through the family, neighbours and migrant. More information concerning the use and development of animal traction needs to be shared amongst countries, farmers, nongovernmental organisations and research institutions.

Technology is changing every day and the majority of farmers in rural communities do not receive sufficient information on alternative technologies (Nzomoi et al., 2007). Effective technology transfer regarding animal traction adoption could result in sustainable and vibrant use of animal traction; thus, raising the living standards of rural households. The prospect of the enhanced agricultural production offered by improved agricultural technologies is recognised as essential to improving the household food security of small-scale farmers, raising rural income and creating national surpluses that can provide the basis for economic growth (Celis et al., 1991). Technology in small-scale farming might help to improve the small-scale farming sector. According to Adesina and Baidu- Forson (1995), the adoption of improved agricultural technologies and farming practices has been for many years a major factor that contributes to agricultural productivity and growth in developed countries.

Nzomoi et al., (2007) mentioned that the adoption of new agricultural technologies by small-scale farmers could positively affect smallholder income, labour opportunities for the poor, food prices, environmental sustainability, and linkages with the rest of the rural economy. Agricultural technology has been a primary factor contributing to increases in farm productivity in developing countries over the past half-century (Agricultural Research Service, 1992). Although there is still widespread food insecurity, the situation, without current technology development, would have been unimaginable.

Agricultural growth is assumed to depend on rising productivity. Small-scale farmers face the problem of low productivity because they do not adopt new agricultural technologies. New

technology can provide additional rural employment, but there are always countervailing pressures to reduce labour input and lower its cost. Food prices are demonstrably lower because of technology, but the distribution of benefits between consumers and producers depends on the nature of the local economy and trade patterns (Farrel et al., 2000). The adoption of technology requires adequate incentives for producers.

2.8 Government policies on the development of animal traction in rural South Africa

There has been a lack of effective policies that support the development and use of animal traction in rural areas (Starkey, 1995). For example there are many strategies outlined in the Provincial Growth and Development Plan (PGDP) of the Eastern Cape Province aimed at improving food security and alleviation of poverty. The objectives of the strategies mentioned in the PGDP focus on increasing agricultural production, incomes and employment by the poorest households, particularly in the former homelands (PGDP, 2004-2014).

The strategies set were aimed at creating a rapid transformation and development of the agricultural sector through programmes: to promote household food security by expanded smallholder production, provide land and agricultural inputs to rural people. Government policies have not sufficiently encouraged and support the development and adoption of animal traction to assist people practising animal traction to overcome the challenges they face (Simalenga and Joubert, 2004)..

2.8.1 Government subsides

Animal draught power has been used for years by rural communities to produce food, so the knowledge of using animal traction is passed from generation to generation (Simalenga and Joubert, 1997). This suggests that people in rural areas have indigenous technical knowledge of how to use of animal traction to produce food. Since rural people have indigenous technical knowledge of how to use animal draught power to be food secure, they should have been subsidised with animal traction equipment's and animals to grow crops, and access to productive land for agricultural purposes will not be a problem since they have easy access to land through the land redistribution and tenure reforms.

2.8.2 Efficient extension services

According to Simalenga and Joubert (1997), there has always been a lack of effective extension services in rural areas is also an obstacle for animal traction users. The poor and insufficient extension services have resulted to lack of training, technology transfer, skills development and slow adoption of new technologies.

2.8.3 Networking, workshops and information exchange

It has been proven that promotion of animal traction workshops, networking, and information exchange in the past lead to sustainable development of animal traction in the rural areas of South Africa (Starkey et al., 1994). Animal traction workshops and networks link animal traction specialists all over the world. Networks and workshops have helped to improve knowledge and information exchange and to promote relevant research, development, training and policies concerning the use of animal draught power, and to learn from the experiences of other African countries through multidisciplinary teams in the past. Governments and Nongovernmental organizations of South Africa have not supported the animal traction networks ATNESA and SANAT in conducting these workshops for better development and adoption of animal draught power.

Starkey (1997) indicated that the animal traction workshops and networks have helped in identifying several important needs that could lead to the sustainable development of animal traction in rural areas; for example, the need to incorporate animal traction into government policies, the need for awareness creation and training for many people involved in decision-making, policy formulation, research, training and education, the need to include animal traction in a range of education and training curricula, the need for action-orientated animal traction research to overcome the backlog of technical and operational constraints resulting from years of neglect, the need for a multidisciplinary approach to animal traction research, training and development, based on holistic, farming systems perspectives, participatory methods and networking collaboration and also the need to make people aware of the many useful ways in which animal traction can empower rural communities in the new South Africa.

2.8.4 Effective Veterinary services

Lack of effective veterinary services is one of the major constraints leading to the lower rate of adoption and development of animal traction in rural areas (Anderson and Feder 2003). Rural people have insufficient knowledge on how to keep animals in good health for example most of the people lack knowledge on how to protect animals against diseases, the use of chemicals, vaccines and drugs and suitable feeds for animals (Kaumbotho et al., 2000).. Animals used for their draught power should always be in excellent health so that they perform farm operations at their full potential. In some rural areas, animal health is one of the major constraints that impedes the adoption and development of animal traction and this result in the death of some animals..

2.8.5 Added animal traction curricular at educational institutions

Working animals play a fundamental role in livelihood improvement as they provide farm power and contribute to food security and poverty reduction, income generation and gender equity (Fielding and Starkey, 2004). The animal traction curriculum has been neglected by schools in South Africa. According Simalenga and Joubert (2004) animal draught power studies have been missing from the educational curriculum and people generally lack relevant understanding and knowledge.

2.8.6 Implementation of the research findings concerning the development of animal traction

Many surveys and studies have been done concerning the development and adoption of animal traction in rural areas and publications are available on the internet, at public and university libraries. The ATNESA and SANAT workshops have identified ways in which animal draught power can be successfully developed and used to increase the food security of its users by maximising food production through assisting in farming operations (Starkey, 1995). ATNESA and SANAT publications also contain information on how to overcome the constraints that impede the development of animal traction.

2.9 The role of national and provincial governments in improving rural livelihoods: Land reform in rural areas of the Eastern Cape Province

The Eastern Cape Province consists more of rural than urban areas. The economy of the Eastern Cape Province is characterised by extreme levels of uneven development, food

insecurity and poverty. In the Provincial Growth Development Plan (PGDP, 2004-2014), a key to poverty eradication, food security and uneven development lies in the rapid transformation and development of the agricultural sector (PoEC, 2003). The challenge of poverty and food insecurity requires a focus on the growth of the agrarian economy in the former homelands through programmes to promote household food security by expanded smallholder production, development of commercial agriculture through optimum use of the highest potential agricultural land in the former homelands and also a focus on land redistribution and, in the longer term, land tenure reform to release land for poor households and for new commercial farming enterprises (PoEC, 2003).

Government has and is working on achieving the sustainability of agriculture in the rural areas of the Eastern Cape. National and Provincial governments have implemented many food security programmes in the Eastern Cape in order to address issues related to poverty and to improve the living standards of rural livelihoods (DoA, 1995). The food security programmes implemented in the Eastern Cape include Siyazondla homestead food production, massive food production and comprehensive nutrition programmes (Balindlela, 2003). According to Van Zyl et al., (1996), the government, in trying to improve rural livelihoods, has also made amendments in the land reform policy of South Africa, by adding policies that resulted in people living in rural areas having easy access to acquire state land for residential and agricultural purposes.

The purpose of land reform in South Africa is to provide sustainable, equitable and vibrant land reform programmes (DLA, 1997). In 1994 the Minister of agriculture and land affairs implemented land reform policies focusing on improving and advancing subsistence farming. The policies outlined the significance of land reform and the development of small-scale agricultural production in the socio-economic development of rural areas. The government wanted to ensure food security and to eradicate extreme inequalities of resource distribution. Presently the department of rural development and land reform has its land reform programmes (redistribution, restitution and tenure reform) which are geared towards achieving its constitutional obligations of securing people's rights and enabling equitable access to land and resources DLA (1999).

2.9.1 Land tenure reform in rural areas of the Eastern Cape Province

Land tenure has been defined as 'the terms and conditions under which land is held, used and transacted (DLA, 1997:48). Tenure reform aims to strengthen the rights of people whose land tenure is insecure as a result of discriminatory laws and practices in the past. These include farm workers, labour tenants and rural households living on privately-owned land, as well as people living in the former homelands under the authority of traditional chiefs. Tenure reform also seeks to address the inequalities between owners and occupiers by formalising informal rights, upgrading weak rights and setting in place restrictions on the removal of rights to land (CRLR, 2002). This land reform programme leads to more black people having adequate access to land for agricultural purposes.

2.9.2 Land restitution reform in rural areas of the Eastern Cape Province

The land restitution programme is responsible for the settlement of land restitution claims under the restitution land rights Act 22 of 1994, as amended and to provide settlement support to restitution beneficiaries DLA (1997). The land restitution programme aims to provide increased access to and the productive use of land by 2014. The main purpose of land restitution is to restore land rights or award alternative forms of equitable redress to claimants finalised. This programme has resulted in many rural areas having sufficient land for residential and agricultural purposes.

2.9.3 Land redistribution reform in the rural areas of the Eastern Cape Province

The purpose of the land redistribution programme is to provide the poor with access to land for residential and productive uses, in order to improve their income and quality of life (Didiza, 2002). The programme aims to assist the poor, labour tenants, farm workers, women, as well as emergent farmers. Redistribution of land is usually perceived as having the potential to significantly improve the livelihoods of the rural poor and to contribute towards economic development. Land redistribution beneficiaries are provided with grants to start agricultural production by the national department of rural development and land reform.

2.10 Agricultural investment in South Africa

According to statistics South Africa by 2011 the Eastern Cape Province had a population of about 6 562 053 people, and these people largely depend on the agricultural industry to

sustain life. From 2001 to 2011 the population of the Eastern Cape Province increased by 4.5 percent, an increase of 283 402 (StatsSA, 2011). The growing population in Eastern Cape, in fact, in the whole country, needs food for survival so as to carry on their day to day activities. This calls for a massive investment in the food producing sector which is the agricultural sector. The Eastern Cape agricultural sector is a dynamic and livelihood sustainable sector (DoA, 2003).

Governments, international organizations, and civil society have all recognised a convergence between the dual goals of eradicating hunger and making agriculture sustainable. Achieving these goals will require a significant increase in agricultural investment (FAO 2010). The Poverty and unemployment in South Africa are often a rural phenomenon, and given that many of the rural inhabitants are linked to agricultural activities, the various Departments of Agriculture in South Africa have an important role to play in addressing the needs in rural areas.

2.10.1 Why invest in agriculture?

Van Zyl et al.,(1996) mentioned most small-scale farmers in Eastern Cape Province invest in agriculture to feed their families, to increase and diversify their incomes. Investment in agriculture means giving up something now (such as money, effort or time) in order to accumulate assets or capital that will allow an increase in agricultural productivity and incomes in the future (FAO, 2010). For example, purchasing farm implements and animals and learning a new skill are all forms of investment aimed at increasing the farmer's productivity or income.

Governments and development partners need to invest more in agriculture in order to enhance economic growth and reduce poverty to ensure food and nutrition security, to enhance agricultural productivity and to ensure environmental sustainability (Van Zyl et al., 1996). For governments, private sectors, NGO'S and donors investment in agriculture should ensure the allocation of scarce public resources to activities that will raise productivity in the sector (Backer 1965). Agricultural research and market infrastructure count among the most important types of public investment in agriculture. According to the Food and Agriculture Organisation, agricultural investment is also the key to eradicating hunger through the multiple dimensions of food and nutrition security. Investment by farmers and the public

sector in agriculture and supportive sectors can increase the availability of food on the market and help keep consumer prices low, making food more accessible to rural and urban consumers (FAO, 2011). Farmers and governments invest to build capital that allows the agriculture sector to become more productive in the future. There is strong evidence that gains in agricultural productivity have contributed significantly to rising farm incomes and reductions in rural and urban poverty (FAO, 2011).

2.10.2 Who needs to invest in agriculture?

The rising food prices in South Africa affect everyone within the country, especially people living in rural areas where opportunities for productive employment are scarce (StatsSA, 2011). Since the agricultural industry plays a major role in economic growth, poverty alleviation and food security, this calls for everyone in the country to invest in agriculture, so as to overcome the unstable food price crises in the country (Feder & Zilberman, 1985). Investing in agriculture for a better future calls for a renewed partnership between governments, donors, civil society and the private sector especially farmers to ensure significantly more investment in the agricultural industry. Nongovernmental organisations, government, the private sector need to invest in small-scale agriculture that is characterised by poor resource and unskilled farmers.

2.10.3 Constraints associated with agricultural investment

The major constraint associated with agricultural investment is climate change. Climate change is the shift in weather conditions over time (FAO, 2009). Climate change causes global warming, which may result in more extreme and unpredictable weather conditions, such as droughts, floods, storms and heat waves. Climate change has a significant impact on food availability, food accessibility and food system's stability in many parts of the world especially in rural areas. Climate change poses the significant risk of increased crop failure, loss of livestock and impact on local food security (Feder & Zilberman, 1985). In some areas drier and warmer conditions are predicted, in others, wetter conditions are expected and will affect agricultural practices. It will affect human health and livelihoods, as well as people's purchasing power, food markets and food security on a household level.

Douglas (2009), mentioned that global warming makes it difficult for private, non-governmental organisations to invest in agriculture because their returns cannot be

guaranteed. In some parts of the country, yields from rain-fed agriculture could be reduced by up to 50 percent by 2020. Farmers are the largest investors in agriculture but the absence of good governance, appropriate support such as extension services result in farmers not investing enough in agriculture. This affects the quantities and qualities of food produced by farmers.

2.11 Chapter summary

Even though rural development, poverty and food security programmes are in place, it seems nothing much has been achieved up to so far. Rural households are still living in hunger. Animal traction users seemed to have been affected by many production constraints which included lack of implements and spares, human labour, capital and credit, scarcity of draught animals, extension and veterinary services. This chapter outlined that researches that have been done, animal traction was found to be middle way that could alleviate household food insecurities. However strategies and ideas that were found to be useful regarding the development and adoption of animal traction have not been implemented. Nothing has been said and done about animal traction development in the policies of South Africa that are in place for improving rural household food insecurities. This chapter also outline that investment is agriculture as a the key to better food security but government is not investing much in agriculture in rural areas as it is found that land reform programmes, Siyazondla and massive food programmes have field because a majority of households are still living in hunger

CHAPTER THREE

SEARCH METHODOLOGY

3.1 Introduction

In this chapter, a description of the study area is presented, with emphasis on its geographic location as well as its physical and social settings. In addition, the chapter presents the research methodology, highlighting the sampling frame, sampling procedure, the data, the method of data collection, and the method of data analysis.

3.2 Geographical location of the study area

The selected area for the study was the Damane rural village at Ncora Administrative Area in Cofimvaba town in the Eastern Cape Province (IDP report, 2010 – 2011). The Damane rural community is situated on the road between Engcobo and Umtata. The area is located in the Ntsika Yethu Local Municipality of the Chris Hani District Municipality (IDP report 2010 – 2011). The Ncora Administrative Area is comprised of six rural communities including the Damane rural community which is the selected area for the study. Intsika Yethu Municipality is one of the eight local municipalities that form the Chris Hani District Municipality.

The municipality is mainly rural, with 95 percent of its population living in the rural areas. It has 23 wards with a population of 194 246 people and 44 768 households (IDP report 2010 – 2011). The Intsika Yethu Municipality is comprised of rural communities which are faced with food insecurity, The Municipality faces the overwhelming challenge of addressing the legacy of poverty, unemployment and under development that has been brought about by decades of apartheid mismanagement and misrule. Despite progress being made at a national level in terms of economic development and job creation, the Intsika Yethu Municipality continues to be characterised as one of the poorest municipalities in the country.

Before the study area was chosen the researcher had a discussion with Mr S Dyabaza who is an extension officer at the Department of Rural Development and Agrarian Reform at the Cofimvaba district office, who also resides in the Damane rural community. Mr Dyabaza stated that he grew up in Damane rural community and has seen people in the community in the past years practising animal traction operations to produce food for their households and

were still using it to fight food insecurity. Mr Dyabaza suggested two communities for data collection for the research, the Damane and Jojweni rural communities. Of the two villages that were suggested by Mr Dyabaza, the researcher selected the Damane rural community as the area of study because of the enthusiasm of the farmers to participate in the research. Also Mr Dyabaza said that he had seen people using animal traction for years so the community is experienced in animal traction operations. Another reason for choosing the area is that animal traction was used by a large proportion of the residents to produce food. Mr Dyabaza subsequently provided names and contact information of local leaders with whom the researchers established contact to access the farming households.

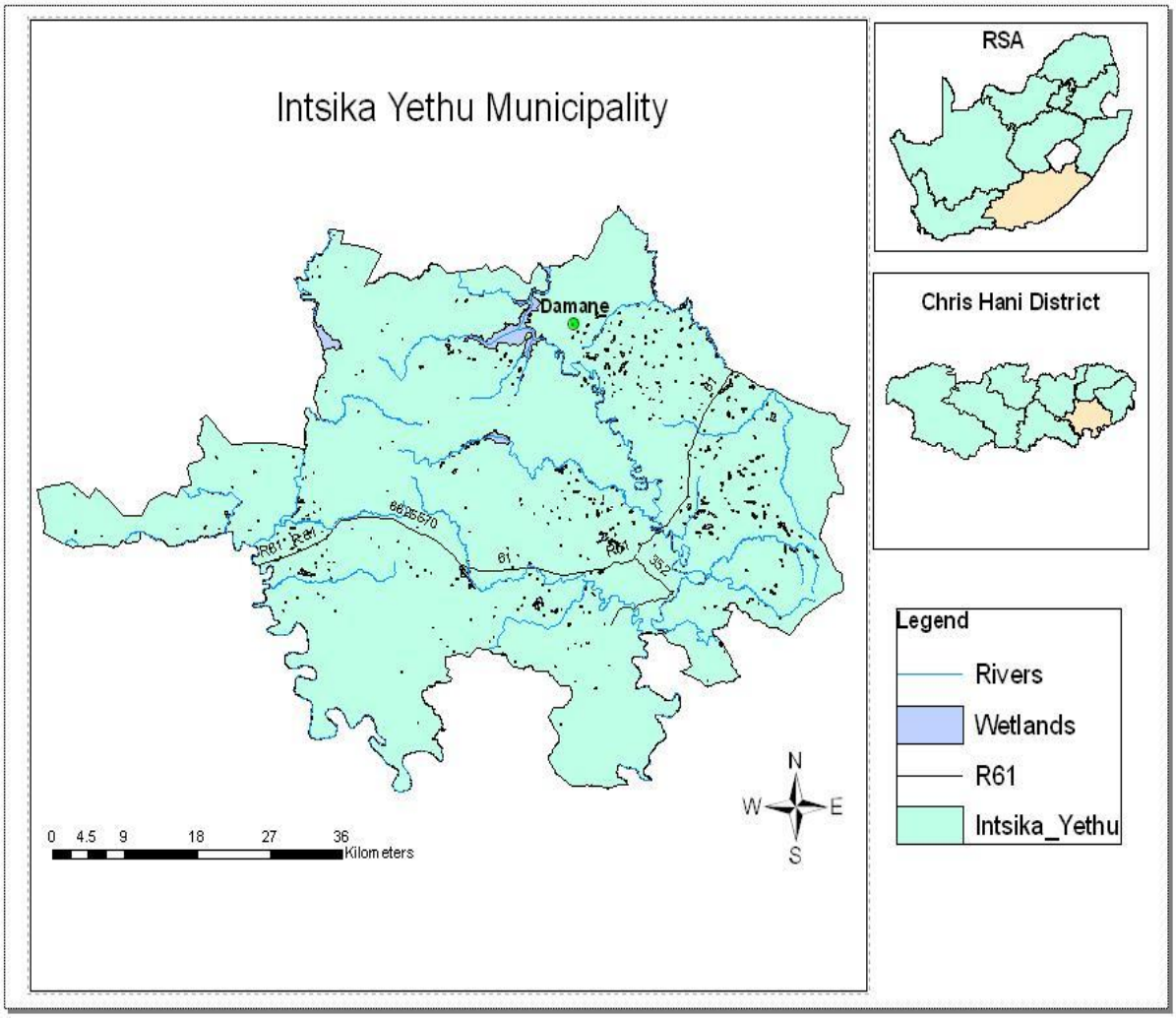

Figure 3. 1 Map of the study area

Source: Map created on ArcGIS software version 9.2 (15/07/2013)

Damane rural community is situated in the former Transkei in a small town called Cofimvaba in the Eastern Cape Province. The area is 49 KM away from Cofimvaba town and its

geographical coordinates area 31^0 46’ 34” South and 27^0 42’ 38” East (IDP report, 2010 – 2011).

3.3 Vegetation of the study area

The vegetation type in the study area was characterised by natural grass vegetation such as (eragrostis curvula, themeda triandra), aloes and shrubs (FAO, 1996). This vegetation is suitable for browsing of livestock. Statistics South Africa (2011) stated that despite the rural electrification programme, firewood is still the most important source of domestic fuel in the rural village.

3.4 Climatic weather conditions of the Damane village

The temperature is characterised by extremes. During the summer months, the maximum temperature often exceeds 37°C. Minimum temperatures in the winter months in the area are often well below zero. Summer rainfall usually ranges between 70 percent - 80 percent of the precipitation with thunderstorms. The average annual precipitation is between 700-800 mm per annum (IDP report, 2010 – 2011).

3.5 Sampling Procedure

A sample is a finite part of a statistical population whose properties are studied to gain information about the whole (Joubert, 1995). When dealing with people, it can be defined as a set of respondents (people) selected from a larger population for the purpose of a survey. A sample should be a representative of the whole population; the manner in which the sample units are selected is significant. 80 households were selected based on the information that was given by the headman of the village. He mentioned some of the households that have been using animal traction for years for food production. In the households visited a household head was interviewed. The total number of households that were interviewed during the survey was 80. The questionnaire was used to gather all the information related to production of food using animal traction to fight food insecurity.

3.6 Data collection

In this study structured interview was used as a tool for collecting data through personal interviews. This study interviewed the households that practised animal traction about their

livelihood strategy (age, gender, population, level of education and employment status etc), socio-economic characteristics (available capital or assets, level of poverty), marketing, land ownership and Measuring household food security for animal traction users (The number of months that the harvest lasted before the next harvest, the quantity produced in kg's or Tons, the number of meals a day each household member consumed in order to satisfy hunger. Data were collected from different individuals and households.

3.7 Data analysis and interpretation

In this study various types of analyses were carried out to analyse data. These included descriptive statistics, multiple linear regression, T- tests and logistic regression. The collected data was coded in Microsoft Excel and then entered into the Statistical Package for Social Scientists (SPSS), Software (version 18) for descriptive and cross tabulation analyses.

Table 3. 1 Relationships among the research objectives, questions, study hypothesis and analytical framework for this study

Research objectives	Research Questions	Research Hypothesis	Analytical frame work
1. To assess the impact of animal traction on rural household food security.	Does animal traction have an impact of animal traction on rural household food security?	The use of animal draught power in rural livelihoods has no positive impact on household food security; it cannot be used as key to fight food insecurity in most rural areas.	Comparisons of technologies through a T-test analyses, multiple regression analyses and binary logistic regression
2. Identify the status of food security between animal traction adopters and non-adopters. .	Does the degree of food security differ between animal traction adopters and non-adopters?	The degree of food security does not differ between animal traction adopters and non-adopters.	Comparisons of groups through a T-test analyses, descriptive analyses and multiple liner regression and binary logistic regression
3, Identify the problems faced by farmers in the project area (Damane rural community) in the successful adoption and development of animal traction	Are the farmers in the project area (Damane rural community) facing problems in the successful adoption and development of animal traction?	The farmers in the project area (Damane rural community) are not facing constraints in the successful adoption of animal traction to produce food.	Descriptive statistics

4. Identify if animal traction is affordable and easy to use and technology for rural people?	Is animal traction the most affordable and easy to use technology for rural people	Animal traction is not the most affordable and easy to use technology that rural people can use to produce food.	Descriptive statistics

3.7.1 The Multiple linear regression model

Economic theory predicts direct relationships between a vast array of socio-economic and community variables and the willingness or otherwise of economic actors to participate in the process of exchange. It is therefore possible to fit a simple linear regression model.

$Y = ʃ(x1 ,x2.....xn)$……(1)

where;

Y= (total output) is the dependent variable representing some measure of animal traction adoption, while the X 's are explanatory variables.

Following conversion, the model can be specified as

$Y = \beta0 + \beta1\ X1 + \beta2\ X2 + \beta3\ X3..... \beta nXn + \mu i.....$ (2)

Where:

$\beta0$ = the intercept or constant term

$\beta1$, $\beta2$,..... βn = slope or regression coefficient

X1 ,X2..... Xn = explanatory or independent variables

μi= error or disturbance term

Given that a number of variables were collected, the data were tested to see how stable the regression results were. The most important tests were for multicollinearity and serial rationearition. In the case of multicollinearity, lets s assume two variables X_1 and X_2 collinenearity exist if

$X_1 = \lambda\ X_2$..... (3)

Where: λ is a constant that ensures X_1 and X_2 are linearly converted. When multicollinearity is detected by the test, the collinear variables are eliminated from the model before it is refitted. For serial correlation, for example interaction between error terms in mumve

However, the equation (2) demands that a more robust function be developed to cater for the several predictor variables in the model. This can be presented as:

$ƛ1X1i + ƛ2\ X2i + ... ƛkXki = 0$..... (4)

where:
ƛi are constants and Xi are the exploratory variables that might be linearly correlated. The speed with which variances of an estimator is inflated by the presence of multicollinearity.

The beta coefficient B1 of X1 is the expected change in Y (the dependent variable) for each one unit change in X, holding X2 and X3 constant. Negative beta coefficient means that a 1 unit positive standard deviation change in X is expected to result in a negative beta coefficient change in Y. Multiple linear regression models were fitted in the study as an attempt to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to observed data. Every value of the independent variable X is associated with a value of the dependent variable Y (total output). The model describes how the mean response Y changes with the explanatory variables.

3.7.2 T-tests

T-tests were computed to compare differences, relative contributions and effectiveness of the animal traction and other farming technologies to poverty alleviation and food security in the project area. Levene's tests were also computed to test the equality of variance amongst variables.

3.7.3 The binary logistic regression

According to Mohammed and Ortmann (2005), several methods can be used to explain the relationship between dependent and independent variables. Such methods include linear regression models, probit analysis, log-linear regression and discriminant analysis. Dougherty (1992) explained that the procedure for formulating a multinomial logistic regression model is the same as for a binary logistic regression. Whereas in binary logistic regression, the dependent variable has two categories, in multinomial logistic regression, it has more than two categories. However, binomial logistic regression model (logit model) has been chosen for this study because of the dichotomous nature of the data collected and it has more advantages especially when dealing with qualitative dependent variables and in case of this study its (adopters and non- adopters of animal traction). Gujarati (1992), emphasised that the model shows how a set of predictor variable X is related to a dichotomous response variable Y. (In (Pi/1-Pi). The dichotomous response variable Y = 0 or 1, with Y = 1 denoting the

occurrence of the event of interest. Dummy variables, also known as indicators or bound variables, characterize dichotomous response.

Logistic regression does not assume linear relationship between the dependent variable and independent variables, but requires that the independent variables be linearly related to the logit of the dependent variable (Gujarati, 1992). Binomial logistic regression model is useful in analysing data where the researcher is interested in finding the likelihood of a certain event occurring. In other words, using data from relevant independent variables, binary logistic regression is used to predict the probability (p) of occurrence, not necessarily getting a numerical value for a dependent variable (Gujarati, 1992). This research analyses the probability of choosing different technologies (animal traction, fork spades, spades and hoes) by rural households farmers, with given technical and institutional influences. Since only two options are available, namely "adoption of animal traction" or "non- adoption of animal traction", a binary model is set up which defines Y=1 for the use of animal traction to produce food, and Y=0 for the non-use of animal traction to produce food. Assuming that x is a vector of explanatory variables and ρ is the probability that Y=1, two probabilistic relationships as stated by Gujarati (1992) can be considered as follows:

$$p(\mathrm{Y}=1)=\frac{e^{\beta' x}}{1+e^{\beta' x}} \quad \text{..... (4)}$$

$$p(\mathrm{Y}=0)=1-\frac{e^{\beta' x}}{1+e^{\beta' x}}=\frac{1}{1+e^{\beta' x}} \quad \text{..... (5)}$$

Since equation (5) is the lower response level, that is, the probability that some or all people would not be able to adopt animal traction for crop production, will be the probability to be modelled by the logistic procedure by convention. Both equations present the outcome of the logit transformation of the odd ratios, which can alternatively be represented as:

logit $$[\theta(x)]=\log\left[\frac{\theta(x)}{1-\theta(x)}\right]=\alpha+\beta_1\chi_1+\beta_2\chi_2+.....+\beta_1\chi_1$$

.....(6)

thus allowing its estimation as a linear modelfor which the following definitions apply:

θ = logit transformation of the odds ratio

α = the intercept term of the model

β = the regression coefficient or slope of the individual predictore (or explanatory) variables modelled

χ_i = the explanatory or predictor variables.

3.7.4 Modelled variables

The demographic factors which were analysed and described under demographic characteristics included: age, gender, marital status and the highest educational level of the household heads. The information which was analysed and described in relation to agricultural production activities of the survey household included: land ownership, land acquisition, total number of Ha of land owned by each household, hectors of land cultivated by each household and reasons for cultivating less of the available land. The information related to credit for agricultural purposes which was analysed and described included: the number of respondents needing credit for agricultural purposes, needs for credit and sources of credit for respondents. The information that was analysed and discussed in relation to food production using animal traction included: reasons the households used animal traction technology to produce food, the number of years that this technology was known and used to produce food, the type of crops produced using animal traction technology, sources of information regarding the use of animal traction, the type of animals used for food production, the cropping practices most animals were used in, the kind of impact that animal traction has had on household food security, the kind of assistance received by households who used animal traction to produce food, the numbers of households needing assistance regarding the use of animal traction to produce food, the kind of assistance needed by farmers in the use of animal traction to produce, the problems that impede the adoption and development of animal traction, the type of production inputs purchased by households practising animal traction and constraints associated with input acquisition. The information that was collected and analysed in relation to cost of production included: the quantity of seeds purchased and quantity of seedlings purchased. The information which was analysed and described in relation to marketing of produce included: the number of households who normally marketed their produce, the portion of the produce normally marketed and the type of markets normally used to market produce. For the presentation of data collected, graphs and tables were used and all this information is presented in chapter four.

3.7.5 Chapter summary

In this chapter, the methods that were used to analyse data were reviewed. Data were collected from 40 households that used animal traction to produce food and 40 that did not use animal traction to produce food at Damane rural community. Stratified random sampling was applied in order to select a sample from animal traction adopters and non- adopters. To collect the data, a questionnaire was administered to the respondents through face-to-face interviews. The advantages that are associated with face-to-face interviews have been highlighted within the chapter. Data was analysed using a combination of Microsoft Excel, Statistical Package for Social Scientists (SPSS 18), multiple regression, T- tests and binary logistic regressions models. The results of the research are presented in the next chapter.

CHAPTER FOUR

PRESENTATION OF RESEARCH FINDINGS

4.1 Introduction

This chapter presents the research findings. The overall objective of the study was to assess the impact of animal traction power on household food security at Damane rural village. Specifically the study aimed to identify the impact on productivity of total outputs of all crops produced during last season and also productivity on maize and beans (as stable foods). It presents the results of the analyses of the surveyed data linked directly to the objectives and research questions. It begins with a presentation of descriptive results related to demographic characteristics, agricultural production process of the households, kind of technology used to produce food, assistance received from government regarding the use of technology, household's food security states, marketing of produce and credit for agricultural purposes. This is followed by presentation of the impact of animal power on agricultural productivity thus contributing to food security of households. Multiple-linear regression is presented which models the relationship between explanatory variables and a response variable, specifically focusing to assess the extent to which animal traction contributes to output of all the crops produced last season. T-tests are presented which compare differences, relative contributions and effectiveness of animal traction and other farming technologies to food security in the project area. Levene's test results are also presented which test the equality of variance amongst variables. Binary logistic model results are also presented which determine the probability that resource poor farming households would adopt animal traction and factors influencing their choices. Table 3.1 shows the relationships that are covered in this chapter.

4.2 Demographic information

Demographics data are the characteristics of a human population. Demographics are used to learn more about a population's characteristics for many purposes, including policy development (Pote, 2008). Demographic trends are important as the size of different demographic groups will change over time as a result of economic, cultural and political circumstances. The results are presented in Table 4.1 below while the details are presented in the next several sub-sections below.

Table 4. 1 Summary of Descriptive Statistics of the key variables for demographic characteristics

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Gender	80	1.0	1.0	2.0	101.0	1.263	.4428
Age	80	28.0	39.0	67.0	4002.0	50.025	7.0746
Marital status	80	3.0	1.0	4.0	178.0	2.225	.8416
Household size	80	6.0	2.0	8.0	413.0	5.163	1.5626
Level of education	80	3.0	1.0	4.0	129.0	1.613	.6842
Source of income	80	4.0	2.0	6.0	315.0	3.938	1.2153

Source field survey, 2013

4.2.1 Gender characteristics of household heads

Household head may be a female or a male depending on cultural, social and economic circumstances. The household head is the one who makes decisions and coordinates the activities of the household (Pote, 2008). In most rural communities it is believed that farming is only meant for males and females should do house work. The information related to gender of household heads is presented in Table 4.1 above and also displayed in Figure 4.1 below.

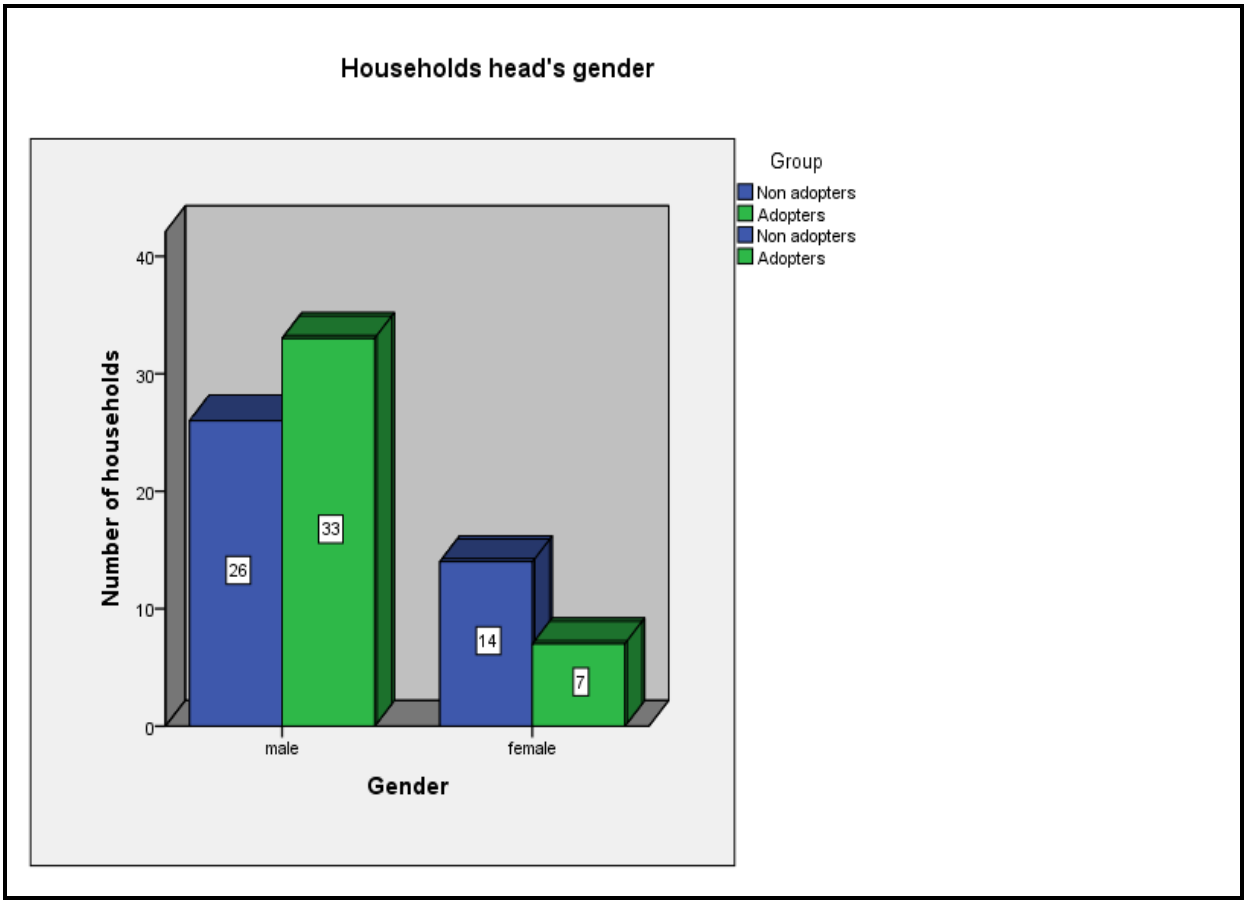

Figure 4. 1 Gender distributions of household heads respondents
Source: Field survey, 2013

Figure 4.1 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Out of the entire 80 sample 59 respondents were males and 21 were females. Thus the distribution of males in the sample collected was 73.75 % while that of males was 26.26 %. These results of Figure 4.1 bring out a conclusion that farming in rural areas was practised by both males and females with larger proportion of males than females. This is because males are more physically stronger than females. Males also are capable of handling heavy implements used in animal traction operations and according to Xhosa culture a household must be headed by a male.

4.2.2 Age of household heads

In most rural areas farming is practiced by old people, this is because youth migrate to urban areas for better job opportunities (Allagnat and Koroma, 1984), Age is also important in farming as it determines experience and knowledge of a farmer in crop production

(Simalenga & Joubert, 1997). Gathered information to animal traction adopters and non-adopters regarding age of household heads is presented in Table 4.1 above and also displayed in Figure 4.2 below.

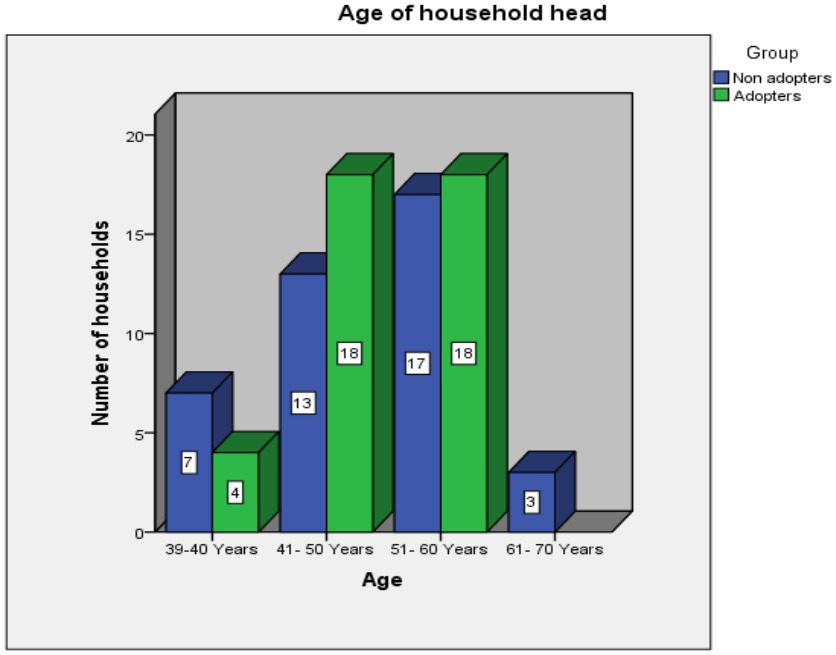

Figure 4. 2 Age distributions of household heads respondents
Source: Field survey, 2013

Figure 4.2 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The age of household heads was divided into four age categories. Figure 4.2 shows that 11 out of all 80 respondents fall under the age ranging between 39 to 40 years, thus the distribution of the respondents was 13.75 %, 31 respondents falling under the age ranging between 41 to 50 years, thus the distribution of the respondents was 38.75 %, 35 respondents falling under the age ranging between 51 to 60 years , thus the distribution of the respondents was 43.75 %, and 3 respondents falling under the age ranging between 61 to 70 thus the distribution of the respondents was 3.75 %. According to the above information it can be concluded that young people do not engage themselves in farming, they live rural areas to urban areas for batter job opportunities and only old people practice farming. The youngest household head was 39 years and the oldest was 67 years old and the mean was 50.025 with a standard derivation of 7.0746

4.2.3 Marital status of the household head

Marital status defines whether the household head is married or not. In marriage wives turn to depend on their husbands to grow and crops for their household especially in rural areas. The information related to marital status of respondents is presented in Table 4.1 above and displayed pictorially in Figure 4.3

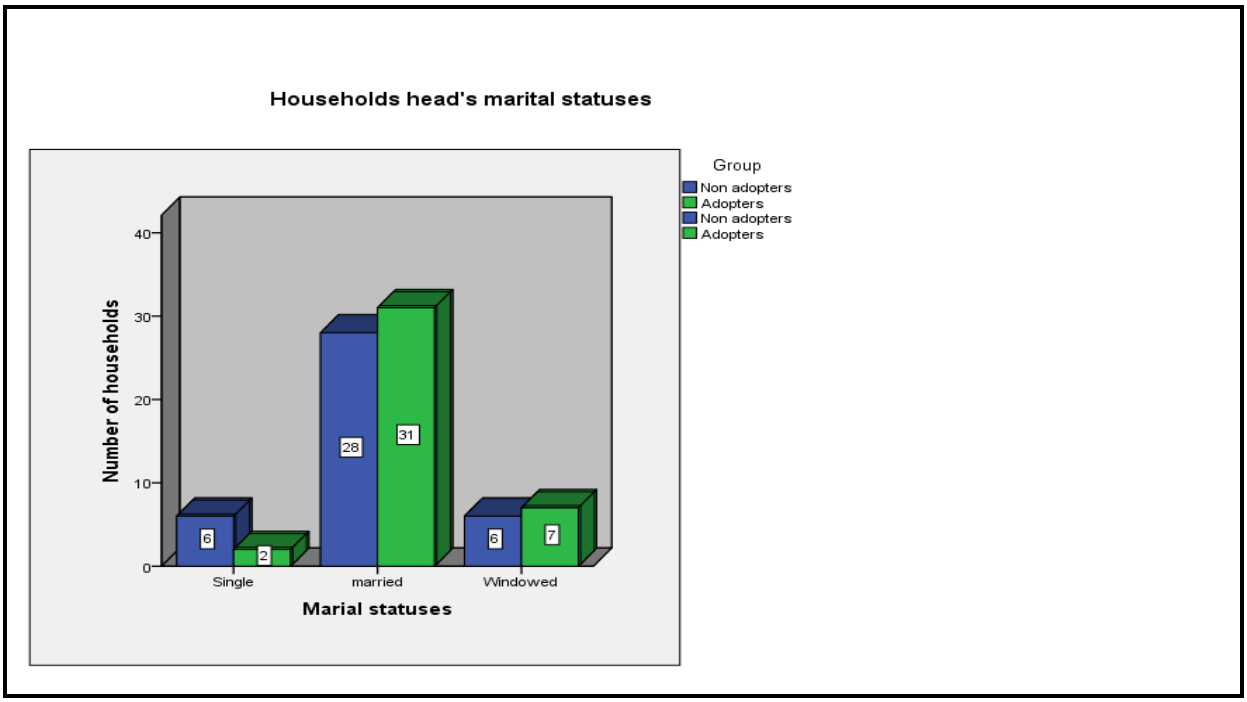

Figure 4. 3 Distributions of marital statuses of the household heads
Source: Field survey, 2013

Marital status of the household heads respondents was divided into three categories namely single, married and windowed and for both non adopters and adopters of animal traction. Figure 4.3 above shows that out of all the 80 respondents of which data was collected from 8 were single, thus a distribution of single respondents was 10 %. 59 were married, thus the distribution of married respondents was 73.5 %, and 13 were windowed and the distribution was 16.25 %. The results in Figure 4.3 bring out a conclusion that farming was practiced mostly by married respondents. This was because married people had families to care off.

4.2.4 Major sources of income for households

Income is the type of money earned through employment by an individual. There are various sources of income from which individuals could get income. The information related to major source of income for household is presented in Table 4.1 above and displayed pictorially in Figure 4.4 below.

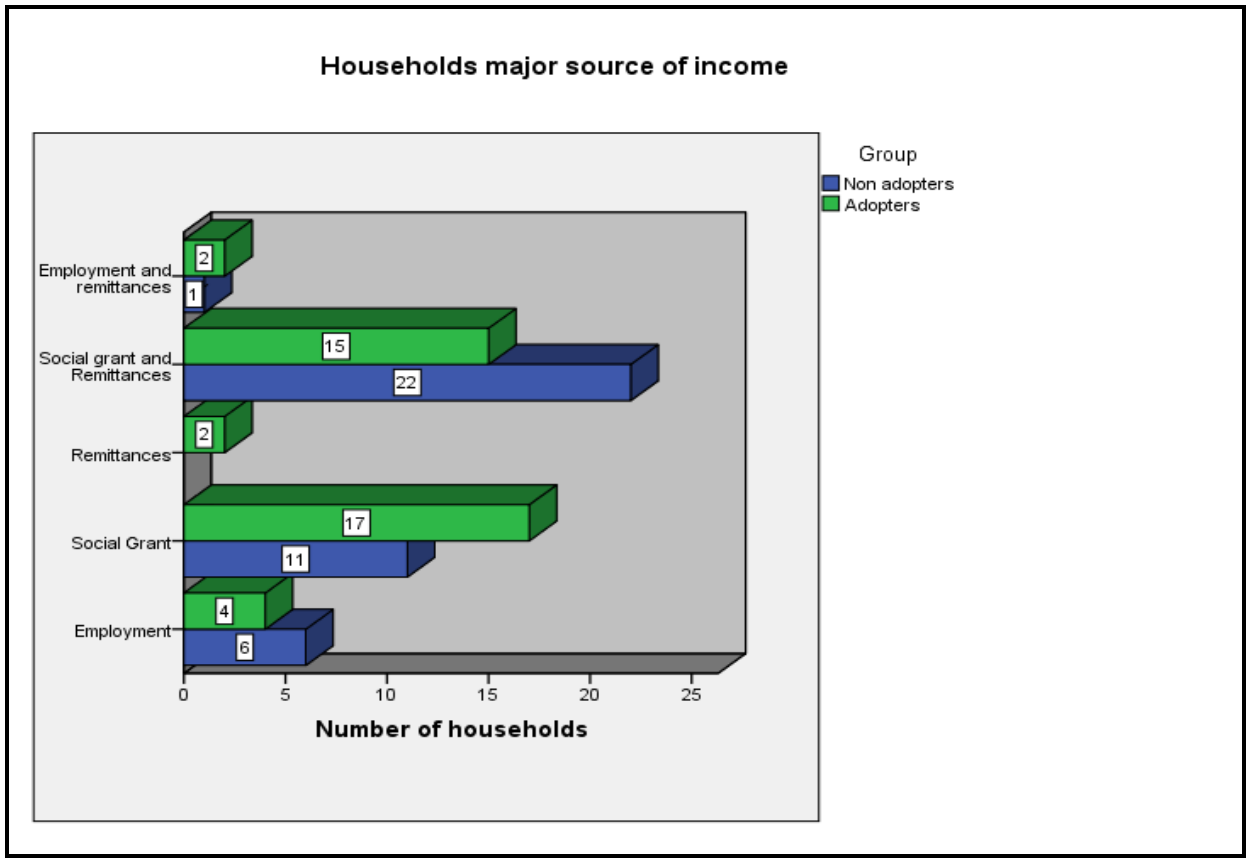

Figure 4. 4 Distributions of sources of income for household
Source: Field survey, 2013

Figure 4.4 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The information collected regarding major sources of income for the household respondents was divided into five categories for both animal traction users and non-users, namely employment and remittances, social grants and remittances, remittances, social grant and lastly employment. Figure 4.4 above shows that out of all the 80 respondents 3 respondents were dependent on employment and remittances as major sources of income, the distribution of the respondents was 3.75%, 37 respondents were dependent on social grant and remittances as major of sources of income and the distribution of the respondents was 46.25 %, 2 respondents were dependent on remittances as major of sources of income and the distribution of the respondents was 2.5 %, 28 respondents were dependent on social grants as a major source of income and the distribution of the respondents was 35 % and 10 respondents were dependent on employment as a major source of income and the distribution of the respondents was 12.5 %.

According to the above results 37 respondents out of the entire 80 interviewed that practice farming were depend on social grants and remittances as a major sources of income. This is so because farming in rural areas was mostly engaged by old age people. Also out of the entire 80 respondents only 10 are employed this brings out a conclusion that there was a high rate of unemployment in the project area.

4.2.5 Highest educational levels of the household heads

Education is the transformation of knowledge, skills and values from generations to generations (Pesek, 1993). Education important aspect in farming because if a farmer is educated it means that the farmer has skills, knowledge and values, therefore education can improve decision-making capability in terms of better planning formulation of farm plans. The information related to educational levels of household heads is presented in Table 4.1 above and displayed pictorially in Figure 4.5 below.

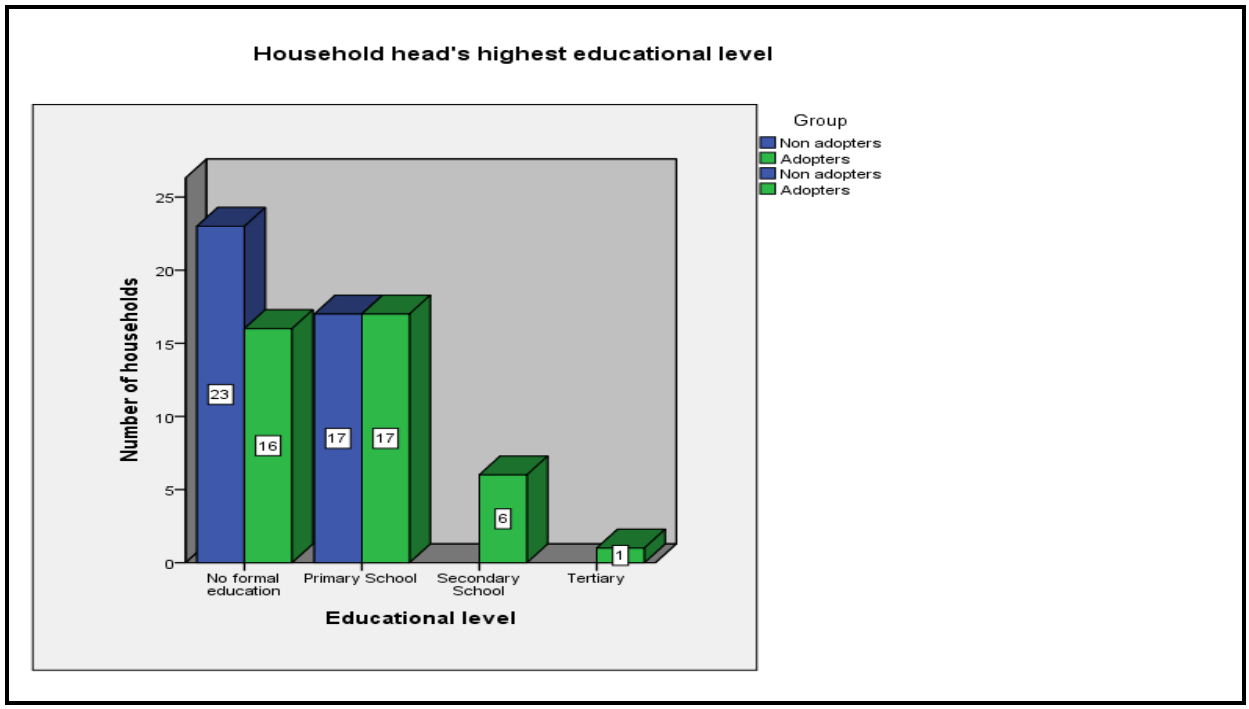

Figure 4. 5 Distribution of the highest educational levels of the household heads
Source: Field survey, 2013

Figure 4.5 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The highest educational level of the household heads respondents was

divided into four categories namely: no formal education, primary school, secondary school and tertiary education. Figure 4.5 above shows that out of all the entire 80 respondents of which data was collected from, 39 respondents had no formal education, and thus the distribution of the respondents was 48.75 %, 34 respondents had obtained primary education and thus the distribution of the respondents was 42.5 %, 6 respondents had obtained secondary education and thus the distribution of the respondents was 7.5 % and 1 respondents had obtained tertiary education and thus the distribution of the respondents was 1.25 %.

The results in Figure 4.5 show that out of the entire 80 respondents 39 respondents had no formal education and 34 respondents had primary education, this bring out a conclusion that farming in the project areas was practiced mostly by respondents who were not educated. Educational levels influence adoption of new innovation by farmers. According to Allagnat and Koroma, (1984) education enables one to acquire and process relevant information.

4.2.6 Household sizes of respondents

A household size refers to the members of individuals who live together as a family. Household size determines the availability of labour for household farming operations. The use of animal traction requires more than one labour in order to operate. When the household size is larger there is likely to be a higher dependency ratio (Pote, 2008), but that also implies that the quantity of labour available to the family might be higher. The study therefore enumerated the households in respect to the size of the households. The results related to household size are presented in Table 4.1 above and displayed pictorially in Figure 4.6 below.

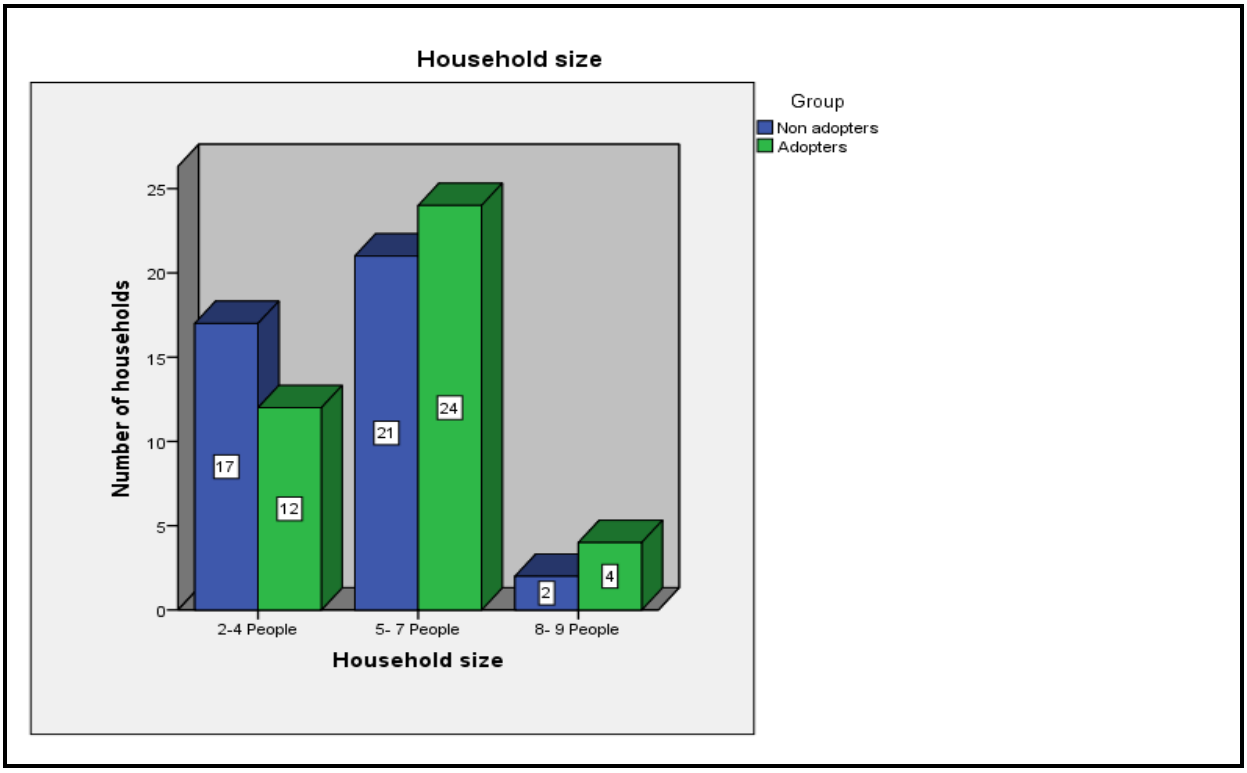

Figure 4. 6 Distributions of household size distributions
Source: Field survey, 2013

Figure 4.6 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The household sizes of respondents were divided into three categories. Out of all the entire 80 interviewed 29 respondents fell under the household size category that ranges between 2 to 4 household members, thus the distribution of the respondents was 36.25 %, 45 respondents fell under the household size category that ranges between 5 to 7 household members, thus the distribution of the respondents was 56.25 % and 6 respondents fell under the household category that ranges between 8 to 9 household members, thus the distribution of the respondents was 7.5 %. According to the above information it can be concluded that the most households consisted of 5 to 7 household members.

4.3 Agricultural production process of the surveyed households

In general, agricultural production is the process of changing or transforming a product from its original state to a more valuable state (Abdulsalam et al., 2008). This process of changing products requires factors of production in order to be achievable, which are land, capital and labour. In this study the information collected, analysed and discussed in respect to agricultural production process of the surveyed households included land ownership, total

number of hectares of land owned by each household, hectares of land cultivated by each household, reasons for cultivating less of the available land, source of capital for farming, labour hiring and sources of water for crop irrigation. The results are presented in Table 4.2 below and the details are presented in the next several sub-sections below.

Table 4. 2 Summary of descriptive statistics of the key variables for agricultural production process of the surveyed households

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Land ownership	80	.0	1.0	1.0	80.0	1.000	.0000
Ha owned	80	5.0	2.0	7.0	518.0	6.475	1.0185
Ha cultivated	80	4.0	1.0	5.0	198.0	2.475	1.475
Reasons for cultivating less land	80	5.0	1.0	6.0	151.0	1.888	.5952
Source of capital	80	1.0	1.0	2.0	124.0	1.550	.5006
Hiring of labour	80	.0	1.0	1.0	80.0	1.000	.0000
Source of water	80	2.0	1.0	3.0	176.0	2.200	.9860

Source field survey, 2013

4.3.1 Land ownership

Land is one of the most important production factors in agriculture. According to Altman (2009), land is the primary input and factor production which is not consumed but without which no production is possible. For this study land is assumed to be a scarce resource for the rural community data collected from. Land ownership has a positive impact on agricultural farming since one has to have access to land in order to grow and produce crops for their households. The information related to land ownership is represented in Table 4.2 above and displayed pictorially in Figure 4.7 below.

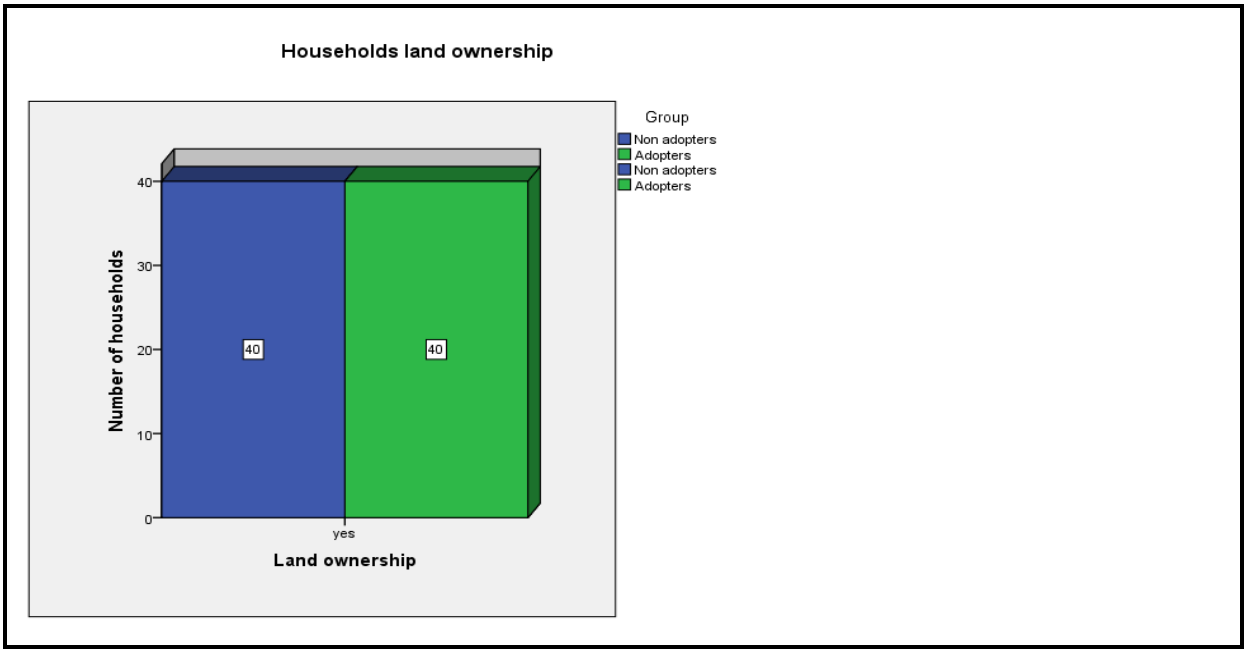

Figure 4. 7 Land ownership distributions of households
Source: Field survey, 2013

Figure 4.7 above shows that data was collected from 40 respondents who were non- animal traction adopters and 40 who were adopters of which all of them had an access to land for agricultural production. The distribution for both of the groups was 100%. According to these results land was available in abundance and it is easy for rural people to access and land was not a scarce resource to them as it was assumed to be.

4.3.2 Total number of hectares owned by each household

Each and every person who wishes to grow and produce crops must have an access to a number of hectares of land. The results related to total number of hectors owned by each household is presented in Table 4.2 above and displayed pictorially in Figure 4.8 below

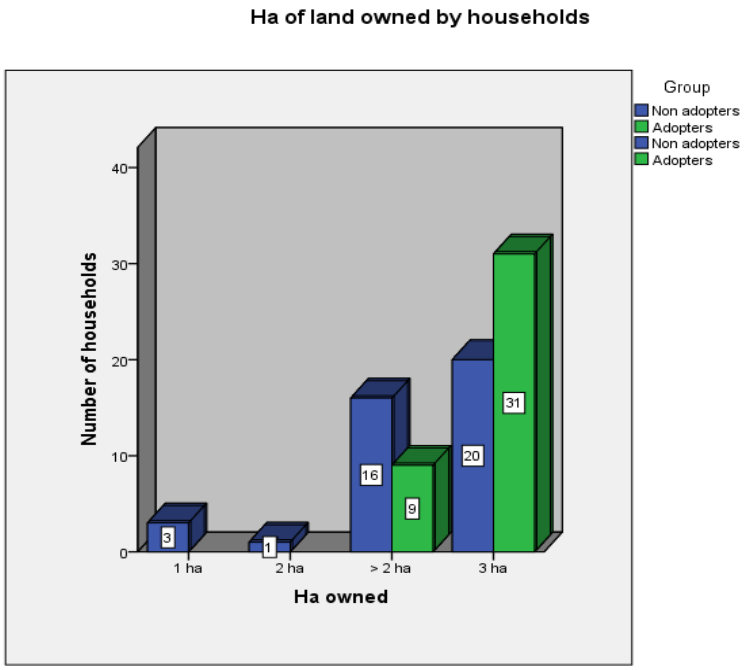

Figure 4. 8 Distribution of household's total number of Hectares owned by households
Source: Field survey, 2013

Figure 4.8 above shows that data was collected from a total number of 40 respondents who were not using animal traction technology to produce food and 40 who were using it. The total number of respondents interviewed was 80. The number of hectares owned was divided into four following categories. Category 1: 1 Ha, Category 2: 2 Ha, Category 3: more than 2 Ha and Category 3: 3 Ha. Non-animal traction adopters out of all the 40 respondents interviewed 3 respondents owned a total number of 1 Ha, thus the distribution of the respondents was 7.5 %, 1 respondent owned a total number of 2 Ha, thus the distribution of the respondent was 2.5 %, 16 respondents owned a total number of more 2 Ha, thus the distribution of the respondents was 40% and 20 respondents owned a total number of 3 Ha, thus distribution of the respondents was 50 %.

While animal traction adopters out of all the 40 interviewed 9 respondents owned a total number of more than 2 Ha thus the distribution of the respondents was 22.5 % and 31 respondents owned a total number of more than 2 Ha and the distribution of the respondents was 77.5 % According to the above information 40 animal traction adopters owned larger proportion of hectares ranging from more than 2 Ha to 3 Ha and the distribution of those respondents was 100%. Also 51 respondents out of 80 respondents interviewed owned 3 Ha of land and the distribution of those respondents was 63.75 % and 25 respondents owned

more than 2 Ha close to 3 Ha and the distribution of those respondents was 31.25 %. According to the above information there was a large proportion of respondents who had ownership to land that could be used to cultivate food crop.

4.3.3. Hectors of land cultivated by each household

The total hectors of land cultivated was the area that crops were grown during the survey of the study. Respondents cultivated different crops. The results related to hectors of land cultivated by each household are presented in Table 4.2 above and displayed pictorially in Figure 4.9 below.

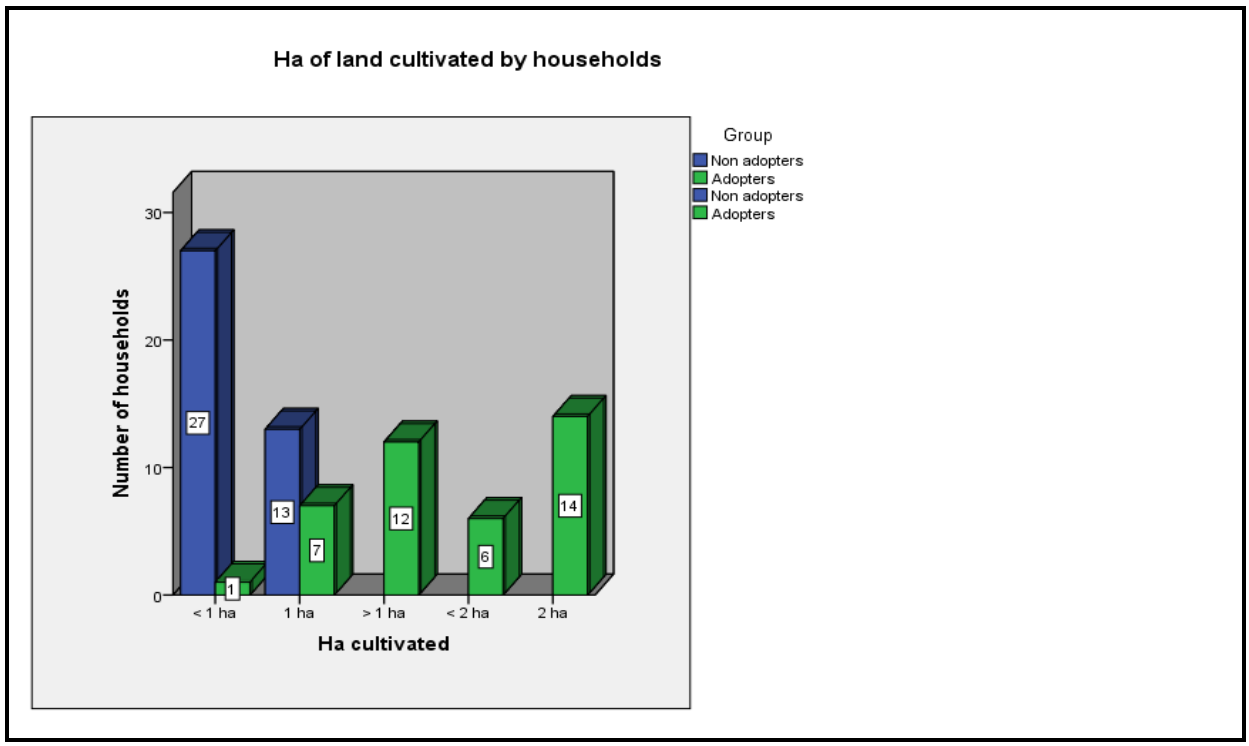

Figure 4. 9 Distribution of hectors of land cultivated by each household
Source: Field survey, 2013

Figure 4.9 above shows that data was collected from a total number of 80 respondents of which 40 were non animal traction adopters and 40 were adopters. The number of hectares cultivated was also was divided into the five following categories: less than 1 Ha, 1 Ha, more than 1 Ha, less than 2 Ha and 2 Ha. Non-animal traction adapters out of all the 40 respondents interviewed 27 respondents cultivated less than 1 hectare of their available land thus the distribution of the respondents was 67.5 % and 13 respondents cultivated 1 hectare of their available land thus the distribution of the respondents was 32.5 % .While animal traction adopters 1 respondent cultivated less than 1 hector of the available land thus the distribution of the respondent was 2.5%, 7 respondents cultivated 1 hector of their available land and the

distribution of the respondents was 17.5 %, 12 respondents cultivated more than 1 hector of their available land, thus the distribution of the respondents was 15 %, 6 respondents cultivated less than 2 hectors of their available land thus the distribution of the respondents was 30 % and 14 respondents cultivated 2 hectors of their available land, thus the distribution of the respondents was 35 % .

These results above illustrate that even though the respondents had an access to land they cultivated less land than they had this could be because of many reasons such as lack of capital to purchase inputs or to hire labour. Also the results above show that all 40 non-animal traction adopters cultivated less land than adopters ranging from less than 1 Ha to 1 Ha while adopters cultivated a more proportion of land ranging from than 1 Ha to 2 Ha. According to these results it is assumed that animal traction was easy to use, effective to cultivate bigger areas, not time consuming and always ready and available for use.

4.3.4 Reasons for cultivating less of the available land

Even though land is an important factor of production, it cannot grow and produce crops on its own there is a need to incorporate agricultural inputs. If farmers lack agricultural inputs such as seeds, seedlings, labour, fertilizer and pesticides that could result to farmers utilizing less of the available land. The information related to reasons for cultivating less of the available land is presented in Table 4.2 above and displayed pictorially in Figure 4.10 below.

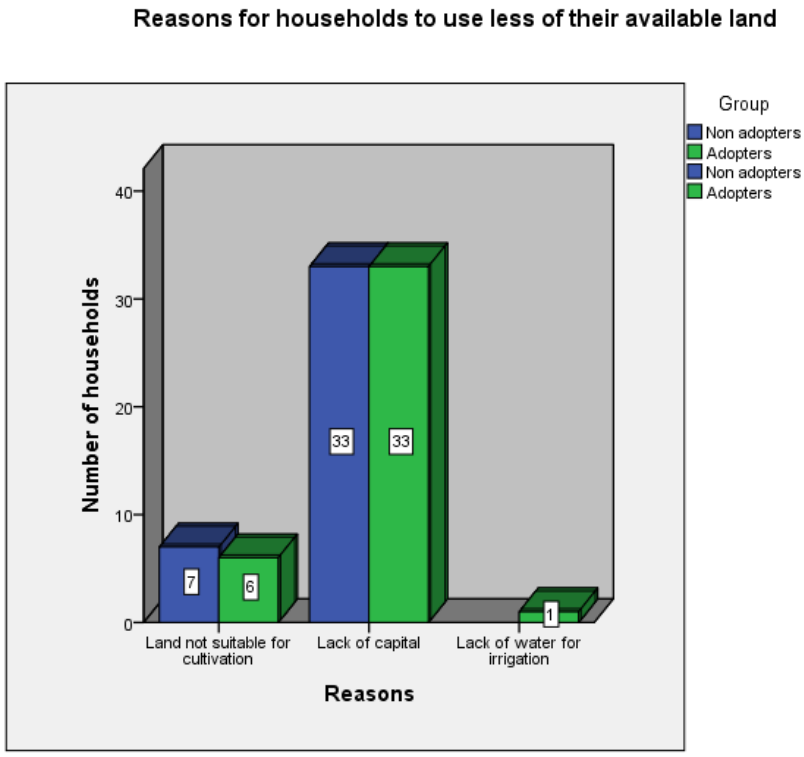

Figure 4. 10 Distribution of reasons for households to cultivate less of their available land.
Source: Field survey, 2013

Figure 4.10 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The reasons for household to be cultivating less of the available land were grouped into 3 different categories namely: Land not suitable for cultivation, lack of capital and lack of water for crop irrigation. Non-animal traction adopters out of all the 40 interviewed 7 respondents cultivated less of their available land because the land was not suitable for cultivation, thus the distribution of the respondents was 17.5 % and 33 respondents cultivated less of their available land because they were lacking capital to procure agricultural inputs, thus distribution of the respondents was 82.5 %. While animal traction adopters out of all the 40 interviewed 6 respondents cultivated less of their available land because the land was not suitable for cultivation thus the distribution of the respondents was 15 % , 33 respondents cultivated less of their available land because they were lacking capital to procure agricultural inputs, thus the distribution of the respondents was 82.5 % and 1 respondent cultivated less of the available land because of the lack of water for crop irrigation, thus the distribution of the respondent was 2.5 %. Figure 4.10 above shows that 66 respondents out of the entire 80 interviewed cultivated less of their available land because

they were lacking capital and the distribution for these respondents was 82.5 %. According to these results it can be concluded that lack of capital was major constraint for both animal traction adopters and non-adopters. Also that water for crop irrigation was a least problem for the households.

4.3.5 Household's sources of capital for farming

Capital refers to monetary resources available for use Allagnat and Koroma (1984). Capital is one of the major factors of production of which production will not be feasible without it. In order to obtain yields of crops at the end of the day, inputs need to be purchased to start the production process. The information related to households source of capital for household is presented in Table 4.2 above and displayed pictorially in Figure 4.11 below

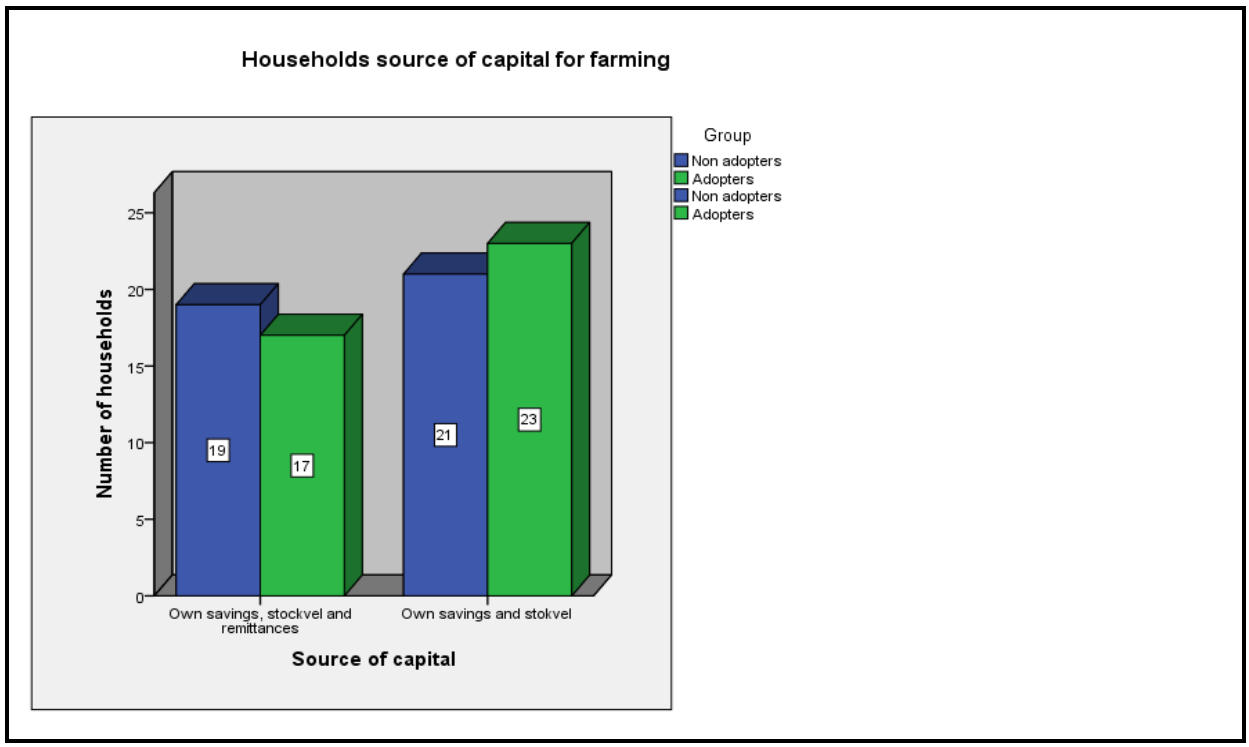

Figure 4. 11 Distribution of household's sources of capital for farming
Source: Field survey, 2013

Figure 4.11 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents that were interviewed was 80. The household's sources of capital were categorised into two following categories. Category 1: own savings, stockvel and remittances and category 2: own savings and stockvel. Non-animal traction adopters out of all the 40 interviewed 19 respondents were dependent on their own saving, stockvel and remittances as sources of

capital, thus the distribution of the respondents was 47.5 % and 21 respondents were dependent on their own saving and stockvel as sources of capital, thus the distribution of the respondents was 52.5 %. While animal traction adopters out of all the 40 interviewed 17 respondents were dependent on their own saving, stockvel and remittances as sources of capital, thus the distribution of the respondents was 42.5 % and 23 respondents were dependent on their own saving and stockvel as sources of capital, thus the distribution of the respondents was 57.5 %. Figure 4.11 shows that 44 respondents out of the entire 80 interviewed were dependent on own saving and stockvel as sources of capital, thus the distribution of the respondents was 55 %. According to these results both non adopters and adopters of animal traction were dependent on their own savings as sources of capital for farming, therefore it can be concluded that respondents acquire capital from informal sources.

4.3.6 Households hiring labour

Labour represents human capital available to transform raw resources into consumer goods. This factor of production is a flexible resource as workers can be allocated to different areas during the production process whenever there is a need. The information related to labour hiring is represented in Table 4.2 above and displayed pictorially in Figure 4.12 below

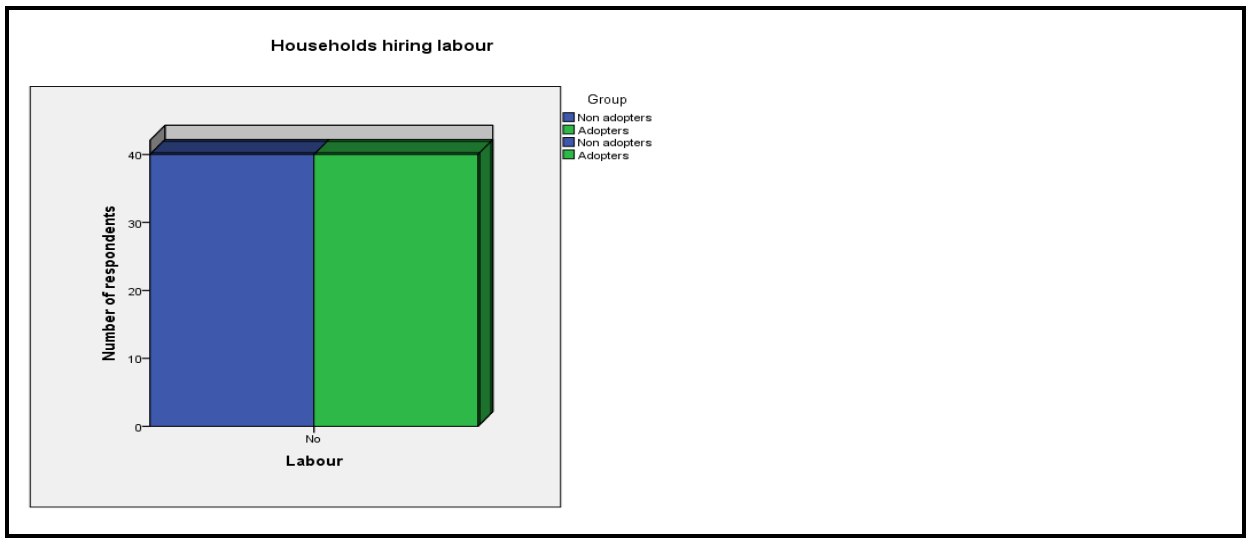

Figure 4. 12 Distribution of households hiring labour
Source: Field survey, 2013

Figure 4.12 above shows that data was collected from 40 respondents who were non- animal traction adopters and 40 who were adopters of which all of them were not hiring labour to help in the production process. The distribution for both of the groups was 100%. According

to these results it can be concluded that all 80 households did not have capital to hire labour or there were enough household members to help in the production process therefore there was no need to hire labour.

4.3.7 Household's sources of water for crop irrigation

The application of water has been an essential factor in raising productivity of agriculture and ensuring certainty in outputs (Altman et al., 2009). Water is essential to bring out the potential of the land and to enable improved varieties of plants to make full use of other yield-enhancing production factors. By raising productivity, sustainable water management helps to ensure better production for direct consumption. For vegetative growth and development plants require water in adequate quantities and at the right time. In this study household's sources of water for irrigation refers to where the households get water for crop irrigation. The information related to household's sources of water for crop irrigation is represented in Table 4.2 above and displayed pictorially in Figure 4.13 below.

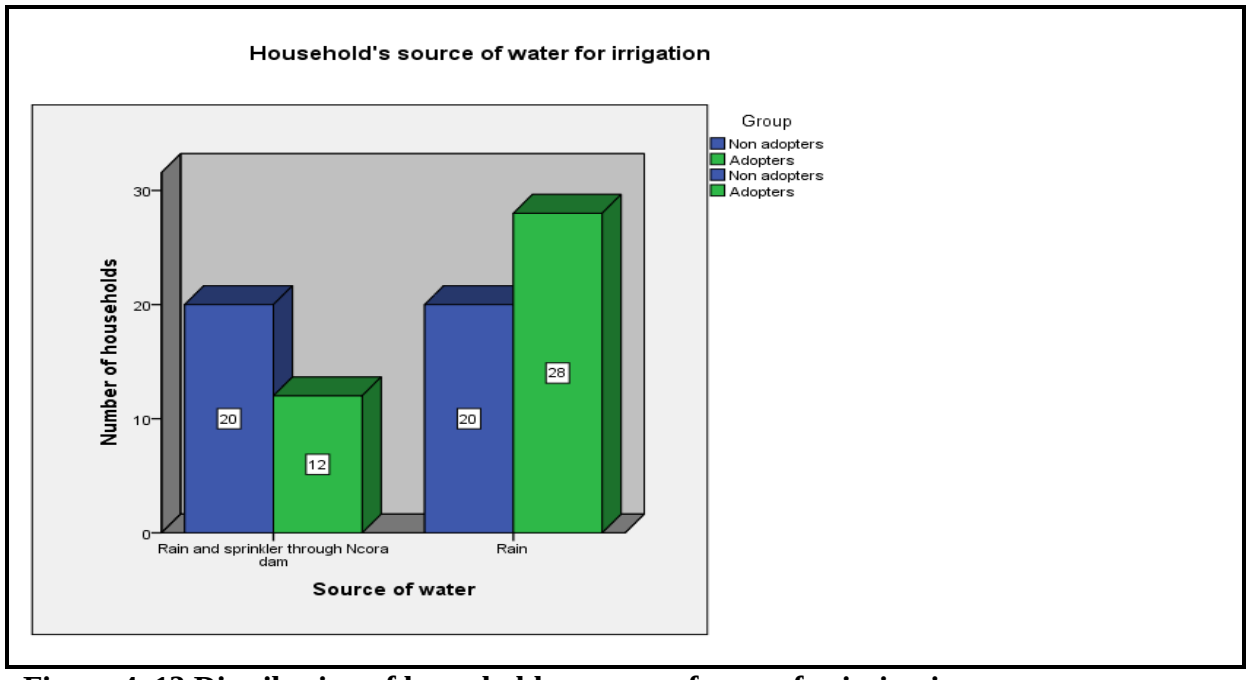

Figure 4. 13 Distribution of households sources of water for irrigation
Source: Field survey, 2013

Figure 4.13 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The household's sources of water for crop irrigation were categorised

into two following categories. Category 1: rain and sprinkler irrigation through Ncora dam and category 2: rain.

Out of all the 80 respondents interviewed 32 respondents were dependent on rain and sprinkler irrigation through Ncora dam as sources of water for crop irrigation, thus the distribution of the respondents was 40 % while 48 respondents were dependent on rain only as source of water for crop irrigation, thus the distribution of the respondents was 60 %. According to the information above it can be concluded even if it did not rain 40 % of the respondents still had water for crop irrigation from Ncora dam and some of the respondents said that there were sprinkles that were not working that is why most of them are dependent on the rain. If government can intervene and fix the problem of sprinkles water for crop irrigation will not be a problem.

4.4 Kind of technology used to produce food

Agricultural technology is the purposeful application of information in the design, production, and utilization of goods and services in the society of human activities (HSRC, 2010) Agricultural technology methods are usually applied in order to solve a problem, improve a pre-existing solution to a problem, achieve a goal, handle an applied input/output relation or perform a specific function. According to Figure 4.11 above respondents only acquired capital from informal sources and it might not enough to purchase improved agricultural technologies that could increase households' crops returns. Food production in rural areas is usually practised to alleviate household food insecurity (Simalenga & Joubert, 2004). Many rural households use outdated agricultural technologies produce food crops.

For this study the information that was collected, analysed and discussed in relation to kind of technology used to produce food included: type of technology used to produce food by each household (animal traction non adopters or adopters), number of years known and used technology to produce food, ownership of technology, type of production inputs purchased by households, quantities of inputs purchased by households, cropping practices most technology used for, quantities of crops produced by each household using technology, kind of impact that technology has on household food security, reasons for households to adopt and not adopt animal traction technology to produce food, number of households using animal traction, number of households encountering problems in the adoption of technology, kind of problems encountered by households in the successful adoption of technology and

possible and solutions to the problems faced by households in the successful adoption of technology. The results are presented in Table 4.3 while the details are presented in the next several sub-sections below.

Table 4. 3 Summary of Descriptive Statistics of the key variables for kind of technology used to produce food

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Typ of tech used to prodc food	80	2.0	5.0	7.0	489.0	6.113	.9412
Years using technology	80	2.0	1.0	3.0	151.0	1.888	.6559
Cropping prac tech used for	80	5.0	1.0	6.0	338.0	4.225	1.5176
HH having problems	80	.0	1.0	1.0	80.0	1.000	.0000
Kind of Pro encountered	80	2.0	1.0	3.0	131.0	1.638	.7159
Solutions to the pro	80	4.0	1.0	5.0	290.0	3.625	1.4176
Degree of food sec	80	1.0	1.0	2.0	133.0	1.663	.4758
Purp of produc crops	80	.0	2.0	2.0	160.0	2.000	.0000
Inputs purchased	80	5.0	1.0	6.0	447.0	5.588	.7061
Q. of inputs purchased	80	1.0	1.0	2.0	116.0	1.450	.5006
Tech ownership	80	2.0	1.0	3.0	105.0	1.313	.6078

Source field survey, 2013

4.4.1 Type of technology used to produce food by each household (animal traction adopter or non-adopter)

The type of the technology used during the production process may influence returns. The returns may be more or less than expected. According to Farrell (2000) improved technologies increase outputs as they are known be effective and less time consuming. The information collected and analysed related to type of technology used to produce food by

each household (animal traction adopter or non-adopter) is presented in Table 4.3 above and displayed pictorially in Figure 4.14 below.

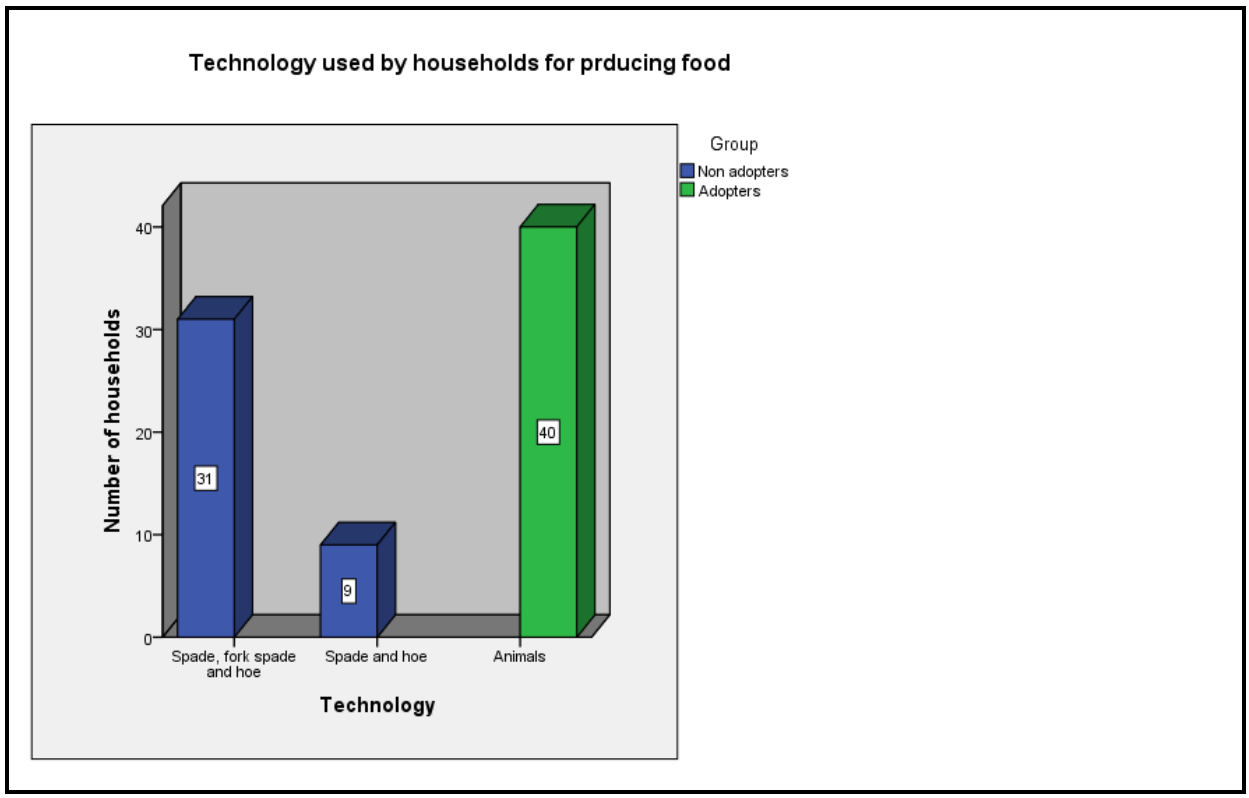

Figure 4. 14 Distribution of household's type of technology used to produce food
Source: Field survey, 2013

Figure 4.14 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Type of technology used to produce food by each household (animal traction adopter or non-adopter) was grouped into the three following categories: Category 1: spade, fork spade and hoe, category 2: spade and hoe and category 3: animals. Non-animal traction adopters out of all the 40 interviewed 31 respondents used spade, fork spade and hoe thus the distribution of the respondents was 77.5 % and 9 respondents used spade and hoe, thus the distribution of the respondents was 22.5 %. While animal adopters all of them used animals to produce food, thus the distribution of the respondents was 100%. According to these results respondents used outdated technologies to produce crops. This may be because of the lack of capital as discussed above in Figure 4.10. Improved agricultural like tractors are expensive to purchase, therefore this means if government does not intervene and help rural communities they will never produce better yields for their households.

4.4.2 Number of years known and used technology to produce food

The number of years using technology to produce food determines sound experience of how well does the farmer know how to use technology but this may be affected by the age of the farmer because as the famer gets older the lesser the drive he/ she has to produce crops. The collected and discussed information related to number of years using technology produce food is presented in Table 4.3 above and displayed pictorially in Figure 4.15 below.

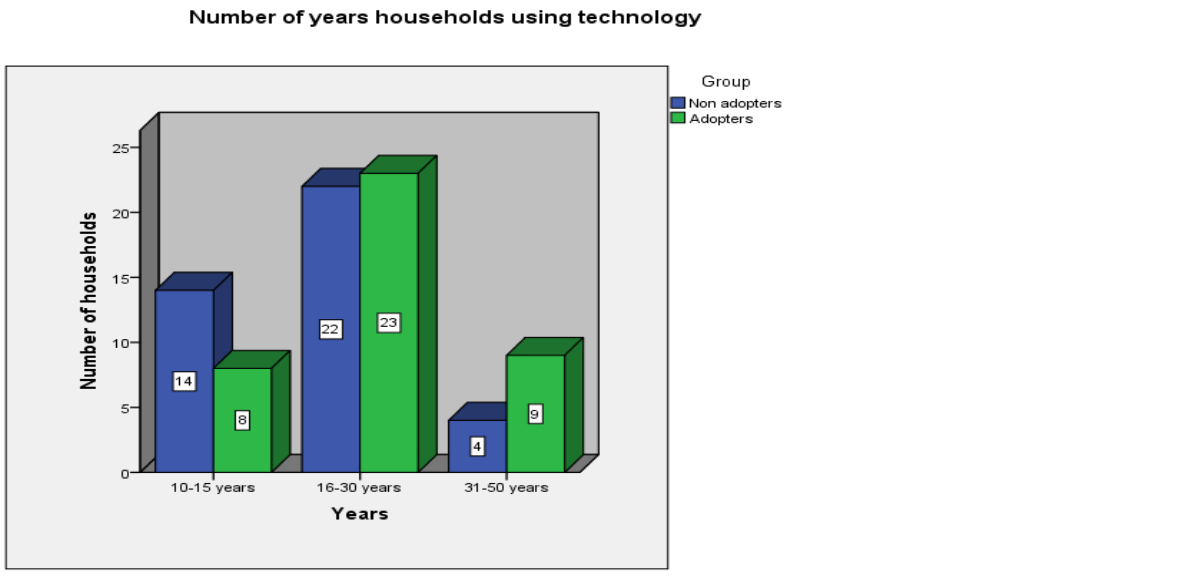

Figure 4. 15 Distribution of household's number of years using technology
Source: Field survey, 2013

Figure 4.15 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Number of years known and used technology to produce food was divided into three categories. Non animal traction adopters out of all the 40 interviewed 14 respondents fell under the years ranging between 10 to 15 years, thus the distribution of the respondents was 35 %, 22 respondents fell under the years ranging between 16 to 30 years, thus the distribution of the respondents was 55 % and 4 respondents fell under the years ranging between 31 to 50 years, thus the distribution of the respondents was 10 %. While animal traction adopters out of all the 40 interviewed 8 respondents fell under the years ranging between 10 to 15 years, thus the distribution of the respondents was 20 %, 23 respondents fell under the years ranging between 16 to 30 years, thus the distribution of the respondents was 57.5 % and 9 respondents fell under the years ranging between 31 to 50

years, thus the distribution of the respondents was 22.5 %. According to these results 45 respondents out of the entire 80 interviewed had 16 to 30 farming experience, thus the distribution of the respondents was 56.25 % and 13 respondents had 31 to 50 years of the experience using the technology, thus the distribution of the respondents was 16.25 %. Therefore it can be concluded that farmers were more experienced in the technology they used to produce food.

4.4.3 Ownership of technology

According to the results in Figure 4.14 above people in rural areas do not use improved technologies for crop cultivation because they lack capital to procure it. Households may own or borrow implements, tools and animals from neighbours or family. The information collected and discussed related to ownership of technology is presented in Table 4.3 above and also displayed pictorially in Figure 4.16.

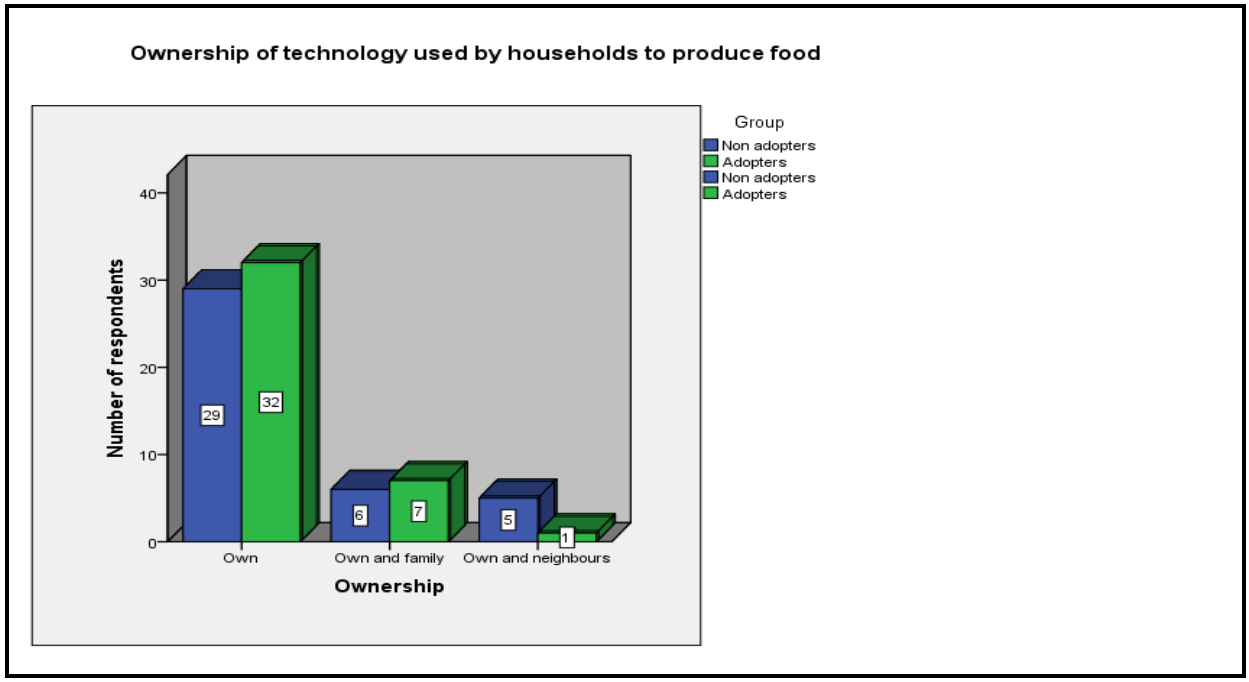

Figure 4. 16 Distribution of household's type of technology used to produce food
Source: Field survey, 2013

Figure 4.16 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Ownership of technology was divided into three following categories: category 1: Own, category 2: own and family and category 3: own and neighbours. Non animal traction adopters out of all the 40 interviewed 29 respondents used their own technology (animals), thus the distribution of the respondents was 72.5 %, 6 respondents used

their own and borrowed from family, the distribution of the respondents was 15 % and 5 respondents used their own technology and borrowed from neighbours, thus the distribution of the respondents was 12.5 %. While animal traction adopters out of all the 40 interviewed 32 respondents used their own technology , thus the distribution of the respondents was 80 %, 7 respondents used their own and borrowed from family thus the distribution of the respondents was 17.5 % and 1 respondent used own technology and borrowed from neighbours thus the distribution of the respondents was 2.5 %. These results illustrate that 61 respondents out all the 80 interviewed owned the technology they used for crop production thus the distribution of those respondents was 76.25 %. Animal traction users 32 out of 40 respondents owned the technology. According to these results it can be concluded that technology was available anytime for use since most of the respondents had full ownership of it.

4.4.4 Type of production inputs purchased by households

Phillips 1987 noted that inputs are important factors of production. There are different kinds of inputs needed in the production process. These may include seeds, fertilizer, seedlings, pesticides and herbicides. The collected and discussed information related to type of production inputs purchased by households is presented in Table 4.3 above and displayed pictorially in Figure 4.17 below.

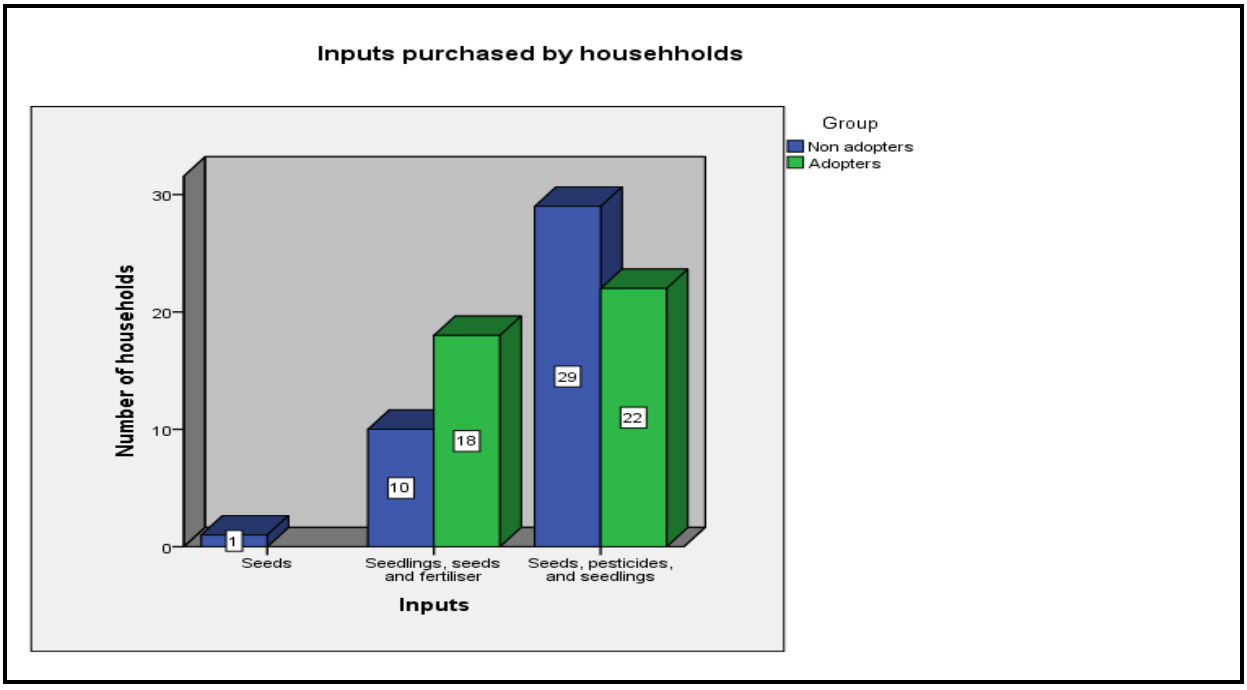

Figure 4. 17 Distribution of type of production inputs purchased by households
Source: Field survey 2013

Figure 4.17 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Type of production inputs purchased by households was divided into three following categories. Category 1: seeds, category 2: seedlings, seeds and fertiliser and category 3: seeds, pesticides and seedlings. Non animal traction adopters out of all the 40 interviewed 1 respondent purchased only seeds thus the distribution of the respondents was 2.5 %, 10 respondents purchased seedlings, seeds and fertiliser thus the distribution of the respondents was 25 % and 29 respondents purchased seeds, pesticides and seedlings thus the distribution of the respondents was 72.5 %. While animal traction adopters out of all the 40 interviewed 18 respondents purchased seedlings, seeds and fertiliser thus the distribution of the respondents was 45 % and 22 respondents purchased seeds, pesticides and seedlings thus the distribution of the respondents was 55 %. These results show that even though capital was a major constraint but households did manage to buy some production inputs from their own savings and also only 28 respondents out of all the 80 bought fertiliser and the distribution of the respondents was 35 %. Therefore it can be concluded that respondents used manure from animal droppings as their fertiliser.

4.4.5 Quantities of production inputs purchased by households

Households may purchase different quantities of inputs depending on the proportion of land they intend to cultivate and on having capital to buy inputs needed for production. The collected and discussed information related to quantities of production inputs purchased by households is presented in Table 4.3 above and displayed pictorially in Figure 4.18 below.

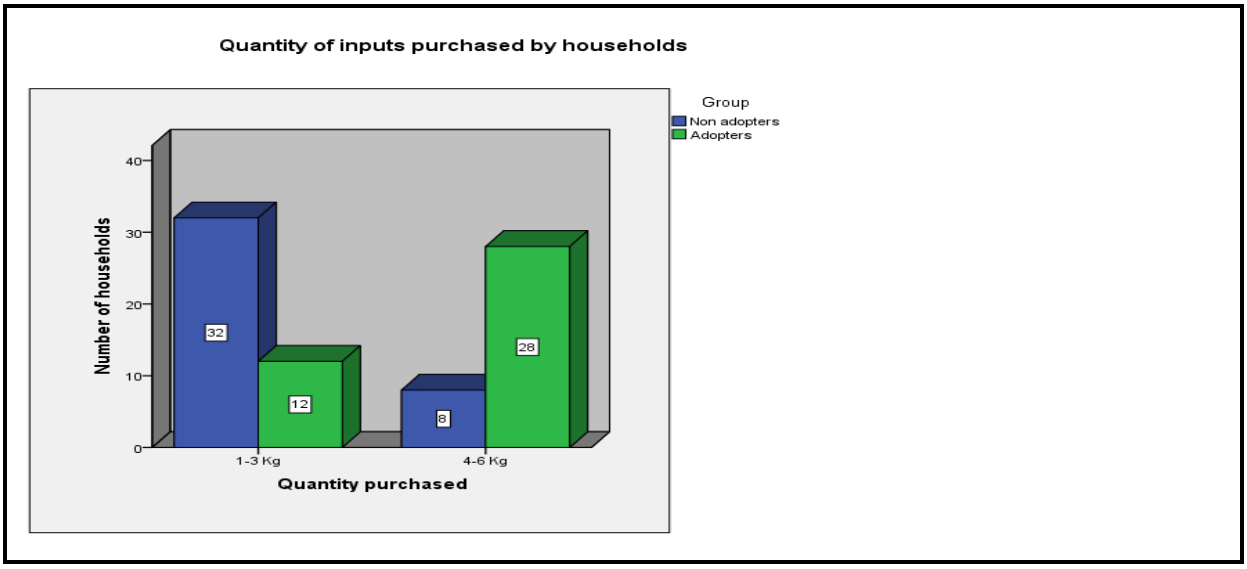

Figure 4. 18 Distribution of type of production inputs purchased by households
Source: Field survey, 2013

Figure 4.18 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Quantities of production inputs purchased by households were divided into two following categories. Category 1: 1 to 3 Kg's and category 2: 4 to 6 Kg's. Non animal traction adopters out of all the 40 interviewed 32 respondents fell under the quantities ranging between 1 to 3 Kg's thus the distribution of the respondents was 80 % and 8 respondents fell under the quantities ranging between 4 to 6 Kg's thus the distribution of the respondents was 20 %. While animal traction adopters out of all the 40 interviewed 12 respondents fell under the quantities ranging between 1 to 3 Kg's thus the distribution of the respondents was 30 % and 28 respondents fell under the quantities ranging between 4 to 6 Kg's thus the distribution of the respondents was 70 %. According to these results 44 respondents out of all the 80 respondents bought quantities of inputs ranging from 1 to 3 Kg's thus the distribution of the respondents was 55 %, this may be because respondents were lacking capital to purchase more production inputs. Also 28 animal traction adopters purchased larger quantities of production inputs than non-animal traction adopters ranging between 4 to 6 kg's. Therefore it can be concluded that animal traction adopters cultivated larger proportion of land than non-animal traction adopters because animal traction is less time consuming and can be used to plough larger areas and hoes, fork spade and spade are time consuming.

4.4.6 Cropping practices most technology used for

Household's technology can be used in various cropping practices in agriculture such as ploughing, planting, weeding and harvesting and harrowing (Joubert and Simalenga, 2004). The information collected and discussed related to cropping practices most animals used for is presented in Table 4.3 above and displayed pictorially in Figure 4.19 below.

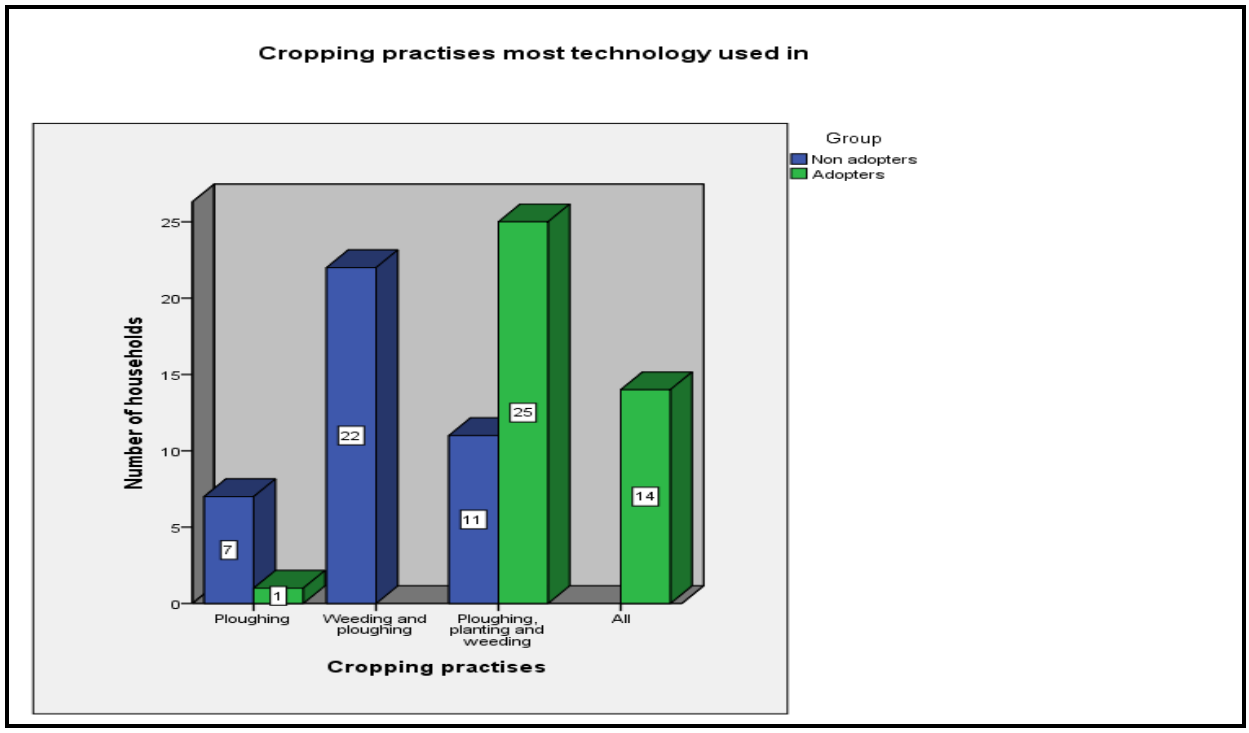

Figure 4. 19 Distribution of cropping practices most technology used for
Source: Field survey, 2013

Figure 4.19 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Cropping practices most technology used for was divided into four following categories. Category 1: ploughing, category 2: weeding and ploughing, category 3: ploughing, planting and weeding. Non animal traction adopters out of all the 40 interviewed 1 respondent purchased and category 4: all (ploughing, planting, weeding and transport of produce to home).

Non animal traction adopters out of all the 40 interviewed 7 respondents mostly used the technology for ploughing only and the distribution was 17.5 %, 22 respondents mostly used the technology for weeding and ploughing and distribution of the respondents was 55 % and 11 respondents mostly used the technology for ploughing, planting and weeding and the

distribution was 27.5 %. While animal traction adopters out of all the 40 interviewed 1 respondent mostly used the technology for ploughing only and distribution of the respondents was 2.5 %, 25 respondents mostly used the technology for weeding and ploughing, and distribution of the respondents was 62.5 % and 14 respondents mostly used the technology for all farming practises (ploughing, planting and weeding and transport of produce to home) and distribution of the respondents was 35 %. The results above show that animal traction was used in all the cropping practises while hoes, fork spade and spade were mostly used for weeding and ploughing only. Therefore it can be concluded that animal traction was suitable and effective for almost all the farming practises than hoes, fork spades and spades.

4.4.7 Number of months households harvest last

Number of month's household's harvest last may vary depending on household's food demands, household size and hectors of land cultivated. The collected and analysed information related to number of months household's harvest last is presented in Table 4.3 above and displayed pictorially in Figure 4.20 below

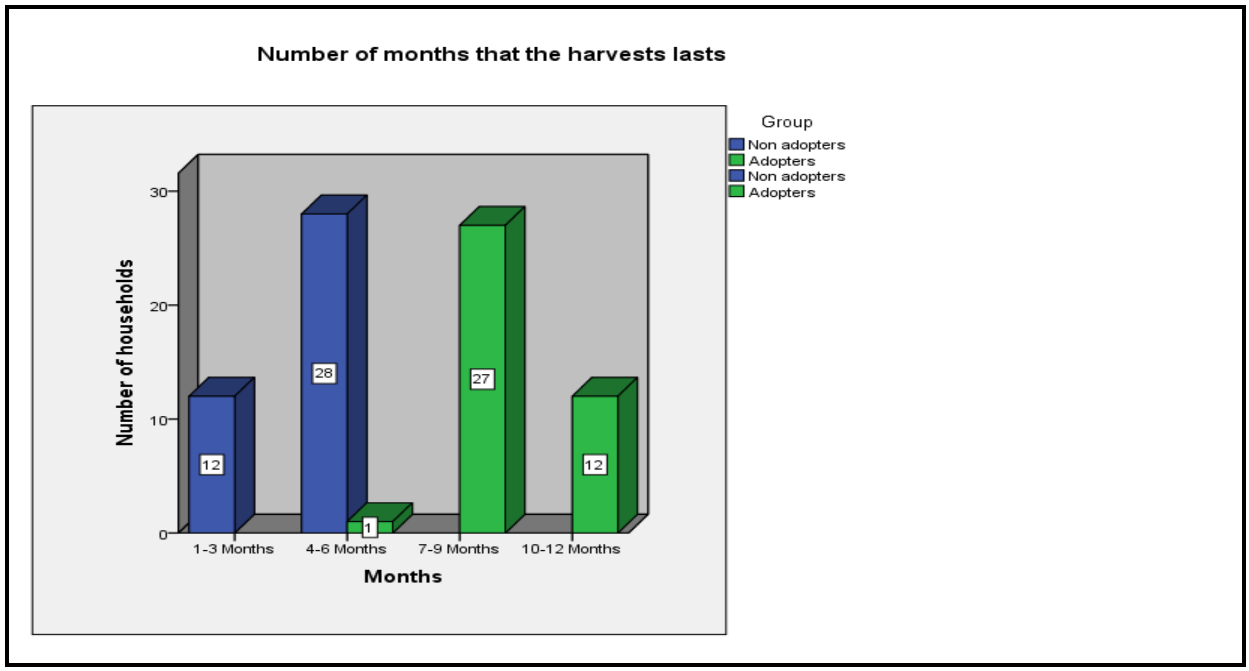

Figure 4. 20 Distribution of the number of month's households harvest last
Source: Field survey, 2013

Figure 4.20 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The number of month's household's harvest last was divided into four following categories. Category 1: 1 to 3 months, category 2: 4 to 6 months, category 3: 7 to 9

months and category 4: 10 to 12 months. Non animal traction adopters out of all the 40 interviewed 12 respondents their harvest lasted for 1 to 3 months and the distribution of the respondents was 30 % and 28 respondents their harvest lasted for 4 to 6 to months and the distribution of the respondents was 70 %. While animal traction adopters out of all the 40 interviewed 1 respondent the harvest lasted for 4 to 6 months and the distribution of the respondents was 2.5 %, 27 respondents their harvest lasted for 7 to 9 months and the distribution was 67.5 % and 12 respondents their harvest lasted for 10 to 12 months and the distribution of the respondents was 30 %. These results illustrate that the harvests of animal traction producers lasted longer than those of non-adopters. According to these results it can concluded that animal traction was suitable to cultivate larger hectares of land as illustrated in figure 4.9 above, it was not time consuming and it was used for almost all the cropping practises during the production process as shown in Figure 4.19 above. Figure 4.9 above shows than animal traction adopters had more household members than non-adopters therefore it can also be concluded that animal traction adopters produced more yields because they had household members to help during the production process or they produced more because they had many people to feed than non-adopters.

4.4.8 Impact of technology on household food production

Households use different types of technologies to produce food as indicated above by figure 4.15. These kinds of technologies may have different impact on household's level of food security; the impact may be positive or negative. The information collected and discussed related to kind of impact that technology has on household food security is presented in Table 4.3 above and displayed pictorially in Figure 4.21 below**.**

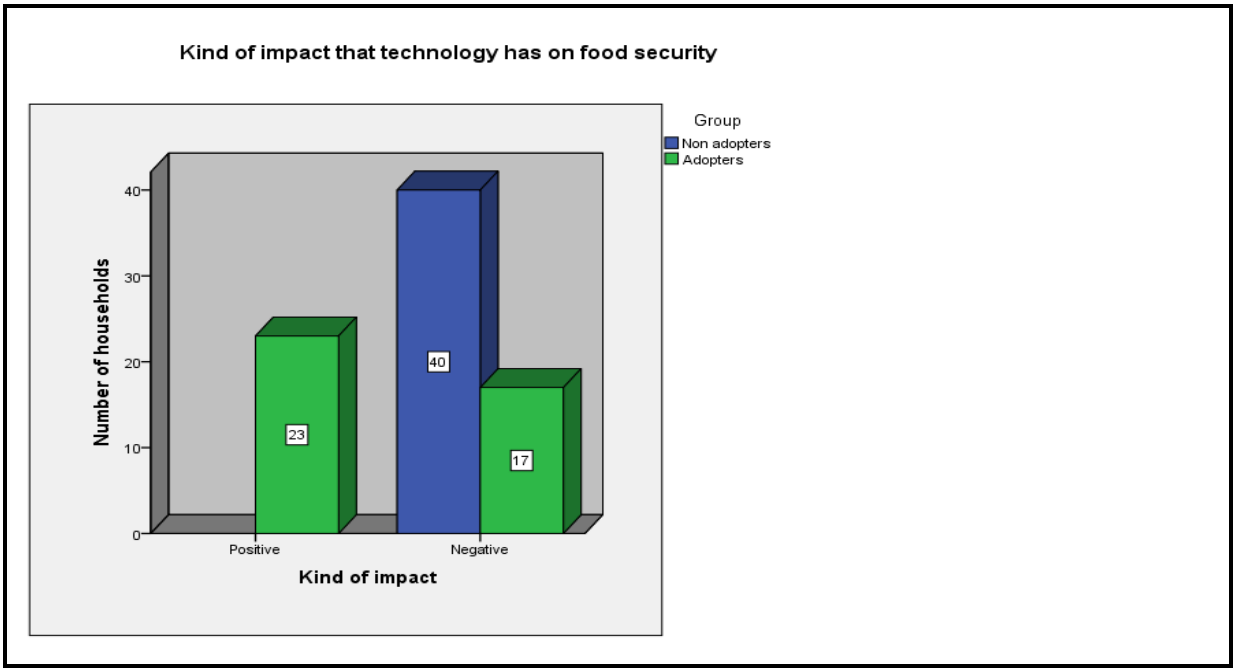

Figure 4. 21 Technology has on household food security
Source: Field survey Data, 2013

Figure 4.21 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The kind of impact that technology has on household food security was divided into two following categories. Category 1: positive and category 2: negative. Non animal traction adopters all the 40 interviewed respondents said "hoes, fork spade and spade they used to produce food had a negative impact on household food security" and the distribution of the respondents was 100 %. While for animal traction users out of all the 40 interviewed 23 respondents said "the use of animal traction technology had positive impact on household food security and the distribution of the respondents was 57.5 % and 17 respondents said "the use of animal traction technology had a negative impact on household food security" and the distribution of the respondents was 42.5 %. These results show that the technology used by non-animal traction adopters was not effective enough to produce higher yields than animal traction technology and 42.5 % respondents said "the use of animal traction technology had a negative impact on household food security". According to these results it can be concluded that if problems associated with animal traction could be addressed then animal traction would be a middle way that could be used by rural areas to fight food insecurities.

4.4.9 Reasons for households to adopt or not adopt animal traction technology to produce food

There could be a number of reasons resulting to households' not adopting or adopting animal traction technology to produce food. These reasons may differ as indicated in figure 4.15 above that households use different kinds of technologies for food production. The collected and discussed information related to reasons for households to adopt and not adopt animal traction technology to produce food is presented in Table 4.3 above and displayed pictorially in Figure 4.22 below

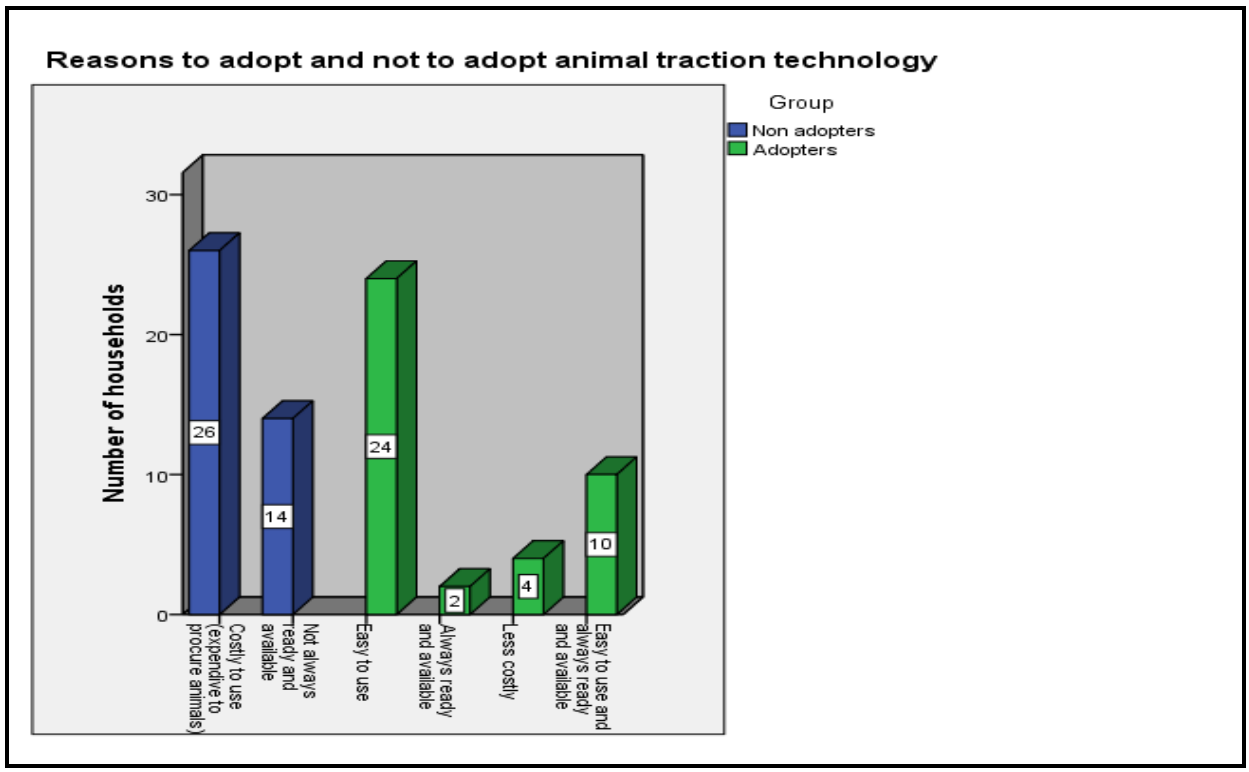

Figure 4. 22 Distribution of reasons for households to adopt and not adopt animal traction technology to produce food
Source: Field survey 2013

Figure 4.22 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Figure 4.22 above show reasons for households for not adopt and not adopt animal traction. Reasons for not adopting were categorised into two following categories. Category 1: costly to use (expensive to produce animals) and category 2: not always available ready and available. While reasons to adopt animal traction were categorised into four following categories, Category 1: easy to use, category 2: always ready

and available, category 3: less costly to use and category 4: easy to use and always ready and available.

Non animal traction adopters out of all the 40 interviewed 26 respondents did not use animal traction to produce food because it was costly for them to purchase animals and the distribution of the respondents was 65 % and 14 respondents did not use animal traction because it was not always ready and available and the distribution of the respondents was 35 %. While animals traction users out of all the 40 interviewed 24 respondents used animal traction because it was easy to use and the distribution of the respondents was 60 %, 2 respondents used animal traction because it was always ready and available to use and the distribution of the respondents was 5 %, 4 respondents used animal traction because it was less costly to use and the distribution of the respondents was 10 %, and 10 respondents used animal traction because it was to easy to use and always ready and available and the distribution of the respondents was 25 %. Figure 4.22 above shows that 26 respondents of non-animal traction adopters did not use animal traction because it was expensive to purchase animals, respondents said it was roughly around R8000.00 to R10.000 to purchase 1 ox, and only 4 animal traction adopters out of 80 said it was less costly therefore according to these results it can be concluded that animal traction was expensive to use, animal traction adopters used animals they already had years back.

Figure 4.22 above also illustrate that 14 non-animal traction adopters did not use animal traction because it was not always ready and available and 12 animal traction adopters out of 80 used it because it was always ready and available. According to this it can be concluded that animal traction can be always ready and available if the problems associated with it could be addressed, because respondents said, during dry season diseases hunger strikes and lead to poor nutritional and weak animal. Figure 4.22 above show that 34 animal traction adopters it was easy to use and the distribution of those respondents was 85 % therefore it can be concluded that animal traction was an easy technology to use for the households and this was because in rural areas animal traction has been used for many decades to produce food (Simalenga & Joubert, 2004). So the knowledge of using animal traction to produce food crops is passed from generations to generations.

4.4.10 Number of households encountering problems in the adoption of technology

Most farmers in rural areas are resource poor, lack necessary farming skills, and capital to purchase what is needed for production process. The collected and discussed information related to number of households encountering problems in the adoption of technology is presented in Table 4.3 above and displayed pictorially in Figure 4.23 below.

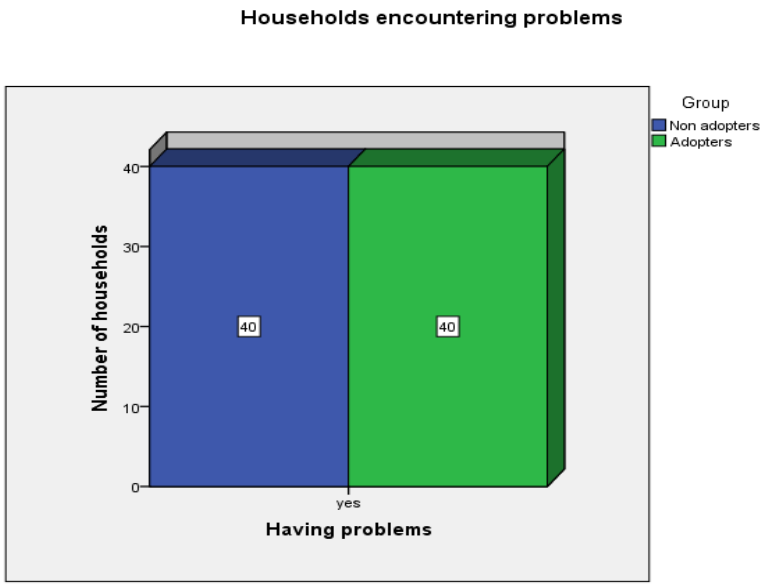

Figure 4. 23 Distribution of number of households encountering problems in the adoption of technology
Source: Field survey, 2013

Figure 4.23 above shows that data was collected from 40 respondents who were non- animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80 of which all of them encountered problems in the adoption of technology they used to produce food. The distribution for both of the groups was 100%. According to these results it can be concluded that households cultivated less hectares and produced less yields because of the problems they encountered in the use of technology.

4.4.11 Problems encountered by households in the successful adoption of technology

Households interviewed were using different types of technologies as indicated by figure 4.15 above. This means the problems faced by interviewed respondents will differ. The collected and discussed information related to problems encountered by households in the successful adoption of technology is presented in Table 4.3 above and displayed pictorially in Figure 4.24 below.

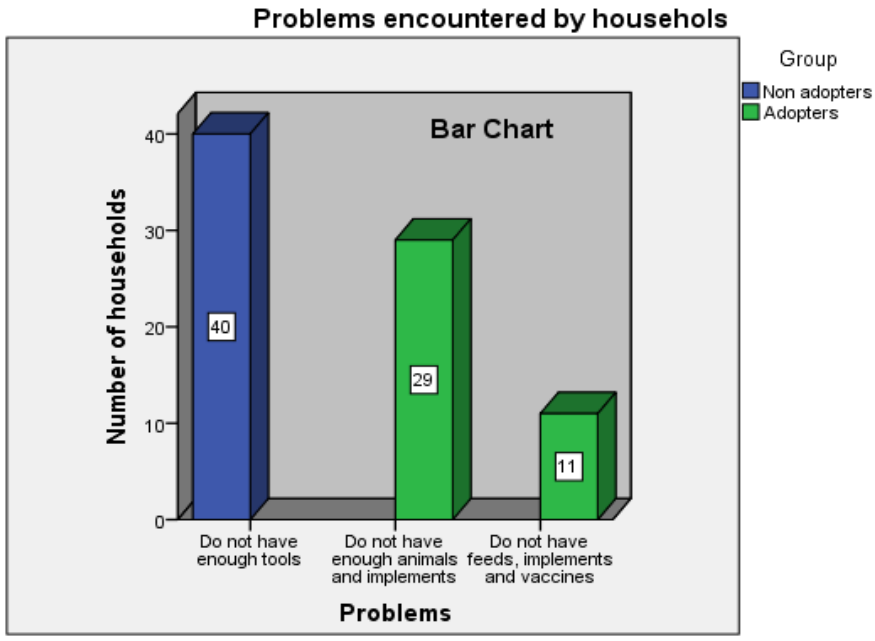

Figure 4. 24 Distribution of problems encountered by households in the successful adoption of technology
Source: Field Data, 2013

Figure 4.24 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Problems faced by households in the successful adoption of technology were categorised into three following categories. Category 1: were those who did not have enough tools, category 2: those who did not have enough animals and implements and category 3: those who did not have feeds, implements and vaccines.

All 40 non animal traction adopters out of all the 40 interviewed 40 respondents encountered a problem of not having enough tools and the distribution of the respondents was 100%. While animal traction users out of all the 40 interviewed 29 respondents encountered a problem of not having enough animals and implements and the distribution of the respondents was 72.5 % and 11 encountered a problem of not having having feeds for animals, implements and vaccines and the distribution was 27.5 %. According to the results above all non-animal traction adopters did have enough hoes, fork spades and spades, so these were there major problems they encountered and the distribution of the respondents was 100 %. Also 40 animal traction adopters encountered a problem of not having enough

animals, implements, vaccines and feeds, according to the results in Figure 4.24 the major problem faced by adopters was not having enough animals and implements.

4.4.12 Possible solutions to the problems encountered by households in the successful adoption of technology

Solutions to the problems faced by households in the successful adoption of technology can lead to better achievable yields thus leading to higher levels of household's degree of food security. The collected and discussed information related to possible solutions to the problems encountered by households in the successful adoption of technology is presented in Table 4.3 above and displayed pictorially in Figure 4.25 below.

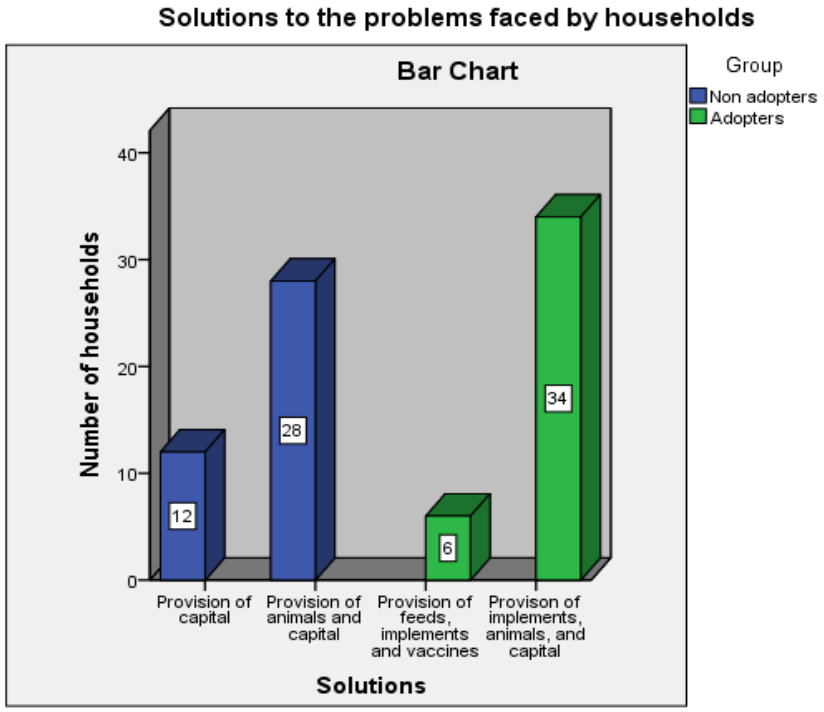

Figure 4. 25 Distribution of possible solutions to the problems encountered by households in the successful adoption of technology
Source, Field Data 2013

Figure 4.25 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Possible solutions to the problems faced by households in the successful adoption of technology were categorised into four following categories. Category 1: provision of capital, category 2: provision of animals and capital, category 3: provision of feeds, implements and vaccines and category 4: provision of implements, animals and capital.

Non animal traction adopters out of all the 40 interviewed 12 respondents wanted to be provided with capital and the distribution of the respondents was 30 % and 28 respondents wanted to be provided with animals and capital and the distribution was 70 %. While animals traction adopters out of all the 40 interviewed 6 respondents wanted to be provided with feeds, implements and vaccines and the distribution of the respondents was 15 % and 34 respondents wanted to be provided with implements, animals and capital and the distribution of the respondents was 85 %. The results above show that out the entire 80 respondents 74 respondents wanted to be provided with capital, according to these results capital was a major constraint in all of the households. Figure 4.25 also illustrate that 28 non animal traction adopters wanted to be provided with animals therefore according to these results it can be concluded that non- animal traction adopters also wanted to practise animal traction but they did not have capital to purchase working animals. Lastly the results also show that 34 animal traction adopters wanted to be provided with implements, animals and capital, therefore it can be concluded if animal traction adopters can be provided with what they need they would be able to use animal traction effectively and achieve better yields.

4.4.13 Quantities of crops produced by each household last season

Quantities of crops produced maybe less, more or normal than expected depending on the weather conditions, type of technology used, hectares cultivated, use of fertiliser, pesticides and availability of water. There were various types of crops that were produced by non-adopters and adopters of animal traction, the crops were grown for household's food security. Quantities of crops produced during the survey were hard to quantify as households only harvest when there is a need to eat, but for field crops like maize and beans they did measure as the yields of these crops were harvested all together at the same, but according to the information they gave interviewers about the number of months the harvest lasts, household sizes and households main stable foods it began to be easy to estimate roughly the Kg's they produce per crop. The results are presented in Table 4.4 and Table 4.5 below

Table 4. 4 Summary of Descriptive Statistics of the key variables of quantities of crops produced by each household last season

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Cabbage (kg)	80	4.0	.0	4.0	107.0	1.338	1.2723
Onion (Kg)	80	4.0	.0	4.0	114.0	1.425	1.2198
Maize (Kg)	80	4.0	.0	4.0	183.0	2.288	1.3797
Beans (Kg)	80	4.0	.0	4.0	147.0	1.838	1.2773
Carrot (Kg)	80	3.0	.0	3.0	127.0	1.588	1.1980
Butternut (Kg)	80	3.0	.0	3.0	127.0	1.588	1.1980
Beetroot (Kg)	80	4.0	.0	4.0	84.0	1.050	1.2719
Pumpkin (Kg)	80	4.0	.0	4.0	144.0	1.800	1.2055

Source: Field survey 2013

Table 4.4 shows that data was collected from 80 respondents, of which 40 were adopters and 40 were non- adopters of animal traction. The results in Table 4.5 above also show that the standard derivation of maize and beans were the highest of all the crops produced. Therefore it can be concluded that maize and beans were the main stable foods of the 80 household's interviewed.

Table 4. 5 Crops grown by the households last season

Crops grown	**Quantities of crops produced (Kg)**	**Type of Farmer**		**Total number of respondents Interviewed**
		Non animal traction adopters	**Adopters of animal traction**	
Maize	Not producing crop	10	0	10
	30-40 Kg	17	0	17
	41-69 Kg	13	0	13
	70-89 Kg	0	20	20
	90-150 Kg	0	20	20
Total		**40**	**40**	**80**
Beans	Not producing crop	6	12	18
	30-40 Kg	10	1	11
	41-69 Kg	24	0	24
	70-89 Kg	0	20	20
	90-150 Kg	0	7	7
Total	**40**	**40**	**80**	**80**
Pumpkin	Not producing crop	9	8	17
	30-40 Kg	14	0	14
	41-69 Kg	17	2	19
	70-89 Kg	0	28	28
	90-150 Kg	0	2	2
Total		**40**	**40**	**80**
Beetroot	Not producing crop	19	20	39
	30-40 Kg	19	0	19
	41-69 Kg	2	1	3
	70-89 Kg	0	17	17
	90-150 Kg	0	2	2
Total		**40**	**40**	**80**
Butternut	Not producing crop	9	14	23
	30-40 Kg	11	0	11
	41-69 Kg	20	2	22
	70-89 Kg	0	24	24
Total	40	40	80	80

Carrot	Not producing crop	9	10	19
	30-40 Kg	23	0	23
	41-69 Kg	8	2	10
	70-89 Kg	0	28	28
Total		40	40	80
Onion	Not producing crop	9	16	25
	30-40 Kg	19	0	19
	41-69 Kg	12	2	14
	70-89 Kg	0	21	21
	90-150 Kg	0	1	1
Total		**40**	**40**	**80**
Spinach	Not producing crop	5	18	23
	30-40 Kg	23	0	23
	41-69 Kg	11	1	12
	70-89 Kg	0	21	22
Total		**40**	**40**	**80**
Cabbage	Not producing crop	10	18	28
	30-40 Kg	21	0	21
	41-69 Kg	9	1	10
	70-89 Kg	0	18	18
	90-150 Kg	0	3	3
Total		**40**	**40**	**80**

Source: field survey 2013

4.4.13.1 Discussion of quantities of crops produced by households last season

The collected and discussed information related to quantities of crops produced by each household is presented in Table 4.6 above.

Table 4.6 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Crops produced buy households during the last season included maize, beans, potatoes, beetroot, butternut, carrot, onion, spinach and cabbage. Quantities of crops produced by households last season were divided into five following categories. Category 1: represented respondents who did not produce the crop during the season, category 2: represented respondents who produced Kg's ranging between 30 to 40, category 3: represented respondents who produced Kg's ranging between 41 to 69, category 4: represented respondents who produced Kg's ranging between 70 to 89 and category 5: represented respondents who produced Kg's ranging between 90 to 150.

The results above illustrate that quantities of crops produced by non-adopters were less than those produced by adapters. Quantities of crops produced by non-adopters fell under category 2 and 3 this means they produced quantities ranging from 30 to 40 Kg's for some crops and 41 to 69 for some crops, while quantities produced by adopters fell under category 4 and 5 this means they produced quantities ranging from 70 to 89 Kg's for some crops and 90 to 150 Kg's for some crops, besides 2 respondents that produced cabbage and spinach ranging between 41 to 69 Kg's. According to these results it can be concluded that animal traction was the most effective and not time consuming technology used to produce crops. Table 4.5also shows that out of the entire 80 households interviewed 70 respondents produced maize and distribution of the respondents was 87.5 %, 62 respondents produced beans and distribution of the respondents was 77.5 % and 63 respondents produced potatoes and distribution of the respondents was 78.75 %. Therefore it can be concluded that maize, beans and potatoes were stable foods with maize being the main stable food of the households.

4.5 Assistance received regarding the use of technology

Farmers in rural communities are usually known to be resource poor (Moreno and Sunding, 2003). Government and NGO's can assist farmers in many ways in the production of food crops. They can help by providing extension services, production inputs, draught animals,

implements, capital and tools required for food production. These could help households to attain better yields. In this study the information collected and analysed in respect to assistance received regarding the use of technology included: Number of households who have received assistance, kind of assistance received and if the assistance was helpful or not. The results are presented in Table 4.6 below while the details are presented in the next sub-section below.

Table 4. 6 Summary of Descriptive Statistics of the key variables for assistance received regarding the use of technology

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Assistance received	80	.0	1.0	1.0	80.0	1.000	.0000

Source: field survey 2013

4.5.1 Number of households who have received assistance concerning the use of technology

According to Moreno and Sunding, 2003, improved agricultural technologies are needed to increase crop yields. The information related to number of households who have received assistance produce crops is presented in Table 4.6 above and displayed pictorially in Figure 4.26 below.

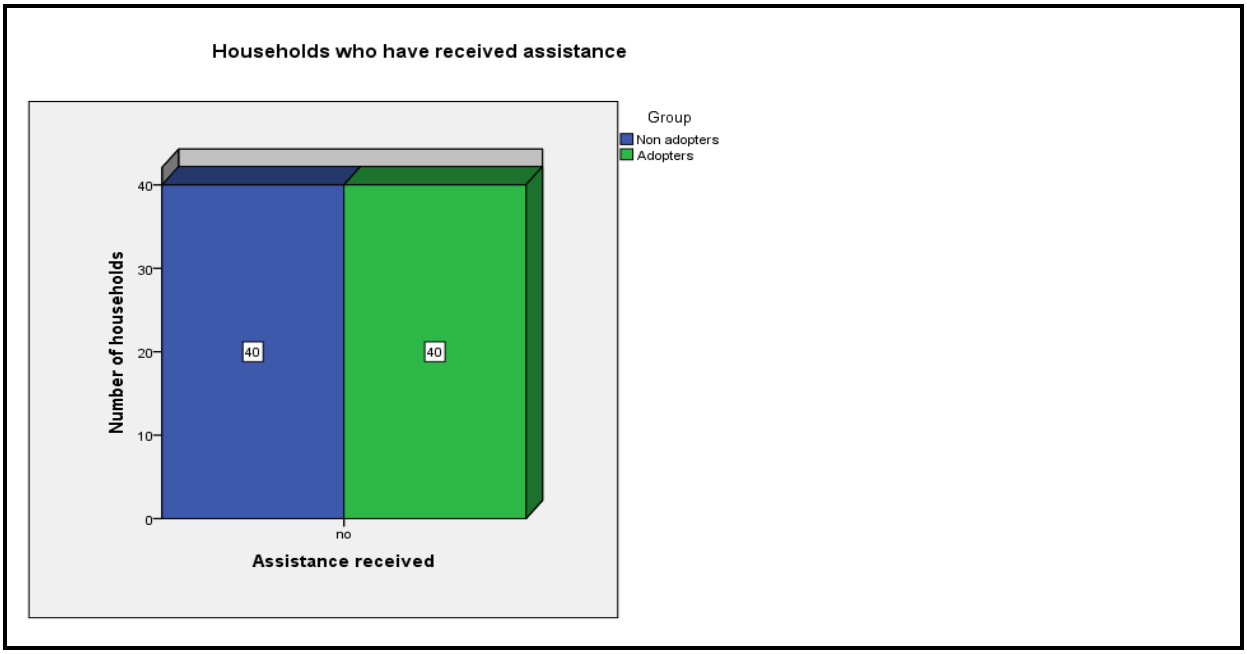

Figure 4. 26 Distribution of number of households who have received assistance concerning the use of technology

Source, Field survey 2013

Figure 4.26 above shows that data was collected from 40 respondents who were non- animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. All the respondents did not receive any assistance concerning the use of technology for food production. The distribution for both of the groups was 100%. According these findings it can be concluded that the households were finding their own ways to produce food for their families. The respondents used their indigenous technical knowledge on how to produce food using the technologies. This situation results in small and poor quantities of food being produced by rural people. The questions with regards to kind of assistance received and if the assistance was helpful or not were not asked since households did not receive any assistance so the questions were not applicable.

4.6 Food security levels of households

According to the World Food Summit organised in Rome in 1996 (FAO, 1996), food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active

and healthy life. According to Du Toit, (2011) in rural areas this is not always the case because government is unable to address food insecurities especially at household level.

The information described and analysed in relation to food security of households included how do households make sure that there's always enough to eat, households cutting the number of meals per day because there is not enough food to eat, household's main stable foods, number of households producing their main stable food, households buying complementary goods, households running out of money to buy food, household's degree of food security and households main purpose of crop production. The results are presented in Table 4.7 below and the details are presented in the next several sub-sections below.

Table 4. 7 Summary of Descriptive Statistics of the key variables for assistance received regarding the use of technology

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Means to make sure that theirs enough to eat	80	5.0	1.0	6.0	356.0	4.450	1.5582
HH running out of money to buy food	80	1.0	1.0	2.0	121.0	1.513	.5030
HH cutting meals	8	1.0	1.0	2.0	111.0	1.388	.4903
HH Producing stable foods	80	1.0	1.0	2.0	96.0	1.200	.4025
Main stable	80	1.0	1.0	2.0	145.0	1.813	.3928
HH buying complementary goods	80	.0	1.0	1.0	80.0	1.000	.0000
Level of food security in a HH	80	1.0	1.0	2.0	133.0	1.663	.4758
Purpose of producing crops	80	.0	2.0	2.0	160.0	2.000	.0000

Source field survey, 2013

4.6.1 How do households make sure that there's always enough to eat

To each and every household there should be enough food to eat in order for household members to meets their dietary needs for an active and healthy life. Households may have different ways to make sure that there's always enough to eat. For this study the information collected and analysed regarding this is presented in Table 4.7 above and displayed pictorially in Figure 4.27 below.

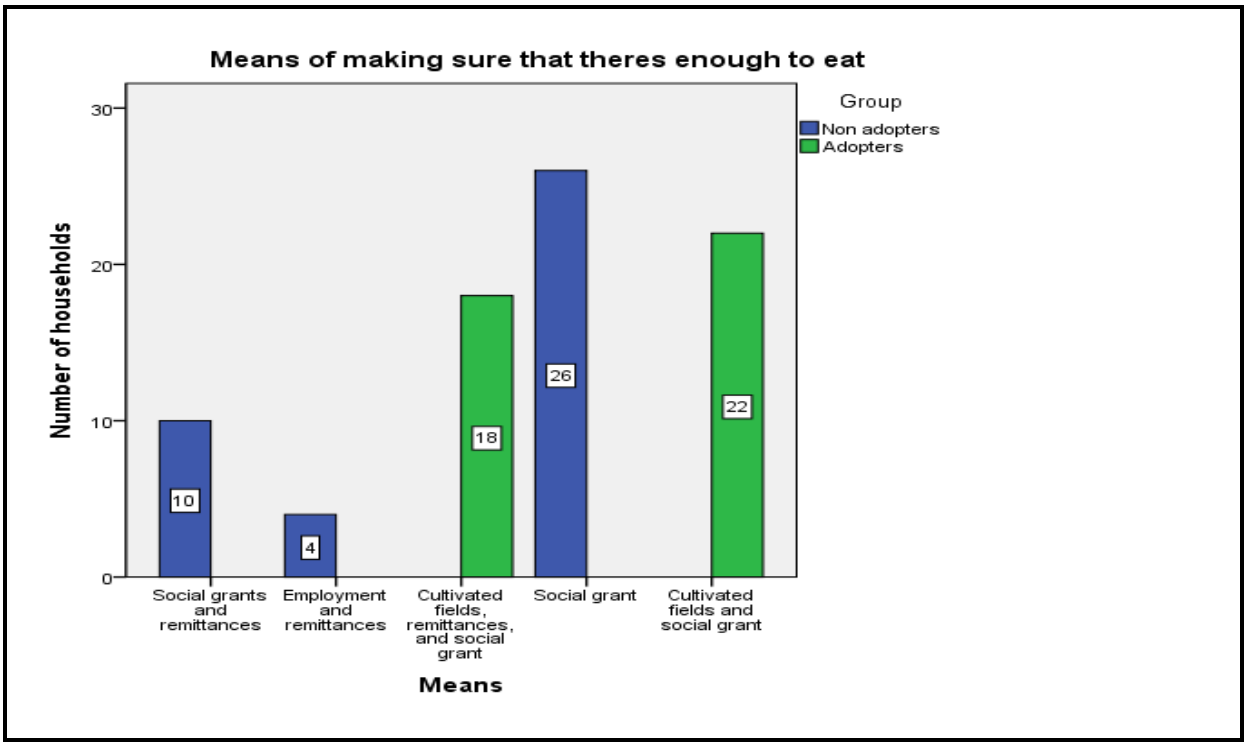

Figure 4. 27 Distribution of how do households making sure that there's always enough to eat
Source: Field survey, 2013

Figure 4.27 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The answers to the question of "how do households make sure that there's always enough to eat" were divided into five following categories. Category 1: social grants and remittances, category 2: employment and remittances, category 3: cultivated fields, remittances and social grant, category 4: social grants and category 5: cultivated fields and social grants.

Non animal traction adopters out of all the 40 interviewed 10 respondents they were dependent on social grants and remittances to make sure that there's always enough to eat

and the distribution of the respondents was 25 %. 40 respondents were dependent on employment and remittances to make sure that there's always enough to eat and the distribution of the respondents was 10 % and 26 were dependent on social grant to make sure that there's always enough to eat and the distribution was 65 %.While animal traction adopters out of all the 40 interviewed 18 respondents were dependent on cultivated fields, remittances and social grants to make sure that there's always enough to eat and the distribution of the respondents was 45 % and 22 respondents were dependent on cultivated fields and social grants to make sure that there's always enough to eat and the distribution was 55 %. The results above show that out of all the entire 80 respondents interviewed 74 respondents were getting social grants, therefore according to these results it can be concluded that social grant was a major source of income that households were dependent on it to make sure that there's always enough to eat and the distribution of the respondents was 92.5 % . Figure 4.27 above also shows that all 40 animal traction adopters were also dependent on cultivated fields besides social grants and remittances to make sure that there's always enough to eat and the distribution of the respondents was 100 %. According to these results it can be concluded that adopters of animal traction produced better yields than non-adopters that why they were also dependent on cultivated fields as source of food.

4.6.2 Households running out of money to buy food introduction above

Households may run or not run out of money to buy food this dependents on the income received by each household and number of household members that need to be feed. For this study the information collected and analysed regarding this is presented in Table 4.7 above and displayed pictorially in Figure 4.28 below.

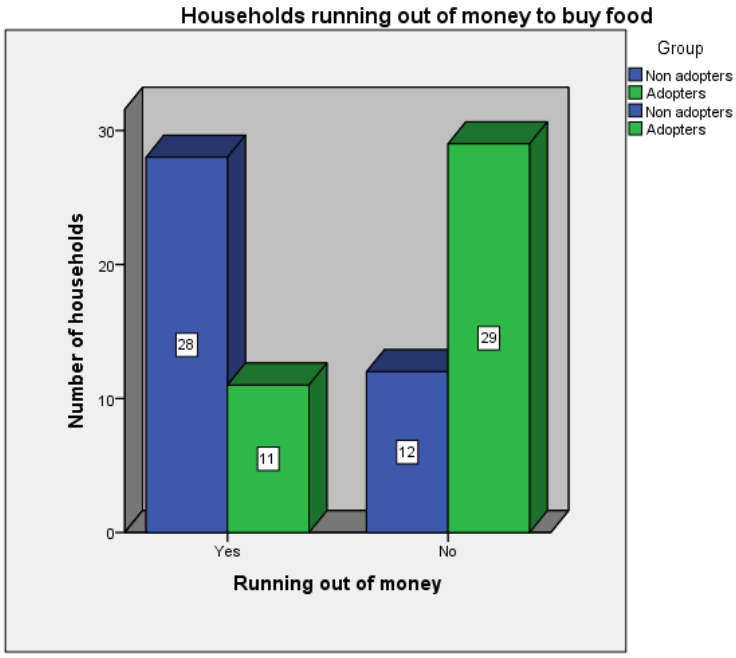

Figure 4. 28 Distribution of households running out of money to buy food

Source: Field survey, 2013

Figure 4.28 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The answers to the question of "do households run out of money to buy food" were divided into two following categories. Category 1: was meant for those who ran out of money to buy food and this category was presented by a yes answer to the question and category 2 was meant for those who did not run out of money to buy food and this category was presented by a no answer to the question.

Non animal traction adopters out of the entire 40 interviewed 28 answered "yes" they did sometimes run out of money to buy food and the distribution of the respondents was 70 % and 12 respondents answered "no" they did not run out of money to buy food and the distribution of the respondents was 30 %. While animal traction adopters out of all the 40 interviewed 11 answered "yes" they did sometimes run out of money to buy and the distribution of the respondents was 27.5 % and 29 respondents answered "no" they did not run out of money to buy food and the distribution was 72.5 % . The results above show that a majority of non-animal adopters ran out of money to buy food and majority of animal traction users did not run out of money to buy food. According to these results it can be concluded

that non-animal traction adopters used large proportion of their money to buy food while adopters did not have to spend much on groceries because they were also dependent on crops they produced.

4.6.3 Households cutting the number of meals per day because there is not enough food to eat

Households who do not have enough food to eat may cut the number of meals for each household member per day**.** This can result to nutritional problems. The information collected and analysed related to households cutting the number of meals per day because there is not enough food to eat is presented in Table 4.7 above and displayed pictorially in Figure 4.29 below.

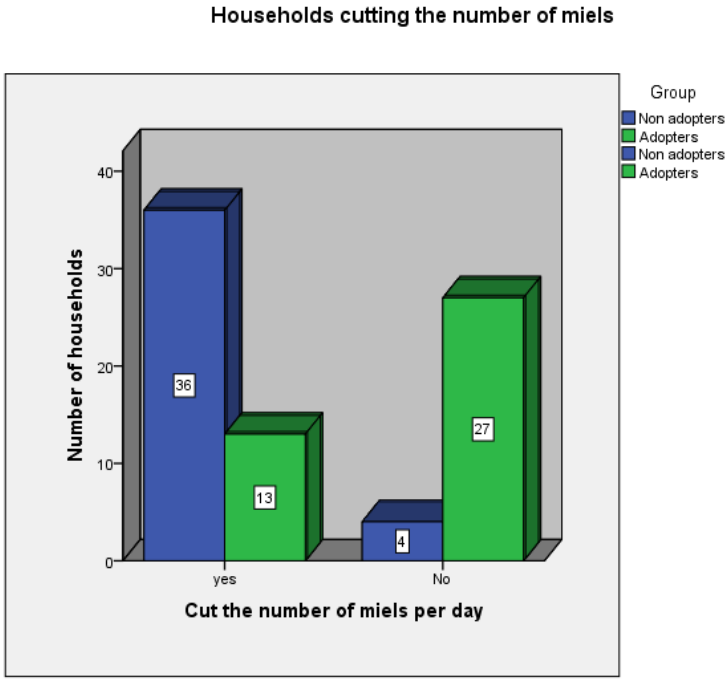

Figure 4. 29 Distribution of number of households cutting the meals per day because there is not enough food to eat

Source: Field survey, 2013

Figure 4.29 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The answers to the question of "do households cut the number of meals per day because there was not enough food to eat" were divided into two following

categories. Category 1: was meant for those who cut the number of meals per day because there was not enough food to eat and this category was presented by a “yes” answer to the question and category 2: was meant for those who did not cut the number of meals per day because there was enough food to eat and this category was presented by a “no” answer to the question.

Non animal traction adopters out of the entire 40 interviewed 36 respondents answered “yes” they did sometimes cut the number of meals per day because there was not enough food to eat and the distribution of the respondents was 90 % and 4 respondents answered “no” they did not cut the number of meals per day because there was not enough food to eat and the distribution of the respondents was 10 %. While animal traction adopters out of all the 40 interviewed 13 respondents answered “yes” they did sometimes cut the number of meals per day because there was not enough food to eat and the distribution of the respondents was 32.5 % and 27 respondents answered “no” they did not cut the number of meals per day because there was not enough food to eat food and the distribution of the respondents was 67.5 %. Figure 4.29 above illustrate that 36 non animal traction respondents cut their number of meals while 27 animal traction adopters did not cut their number of meals. According to these results it can be conclude that animal traction adopters were better food secured than non-adopters.

4.6.4 Household’s main stable foods

Although maize is known to be a stable food for Xhosas household’s main stable foods may differ as people have different food preferences. The information collected and analysed related to household’s main stable foods is presented in Table 4.7 above and displayed pictorially in Figure 4.30 below.

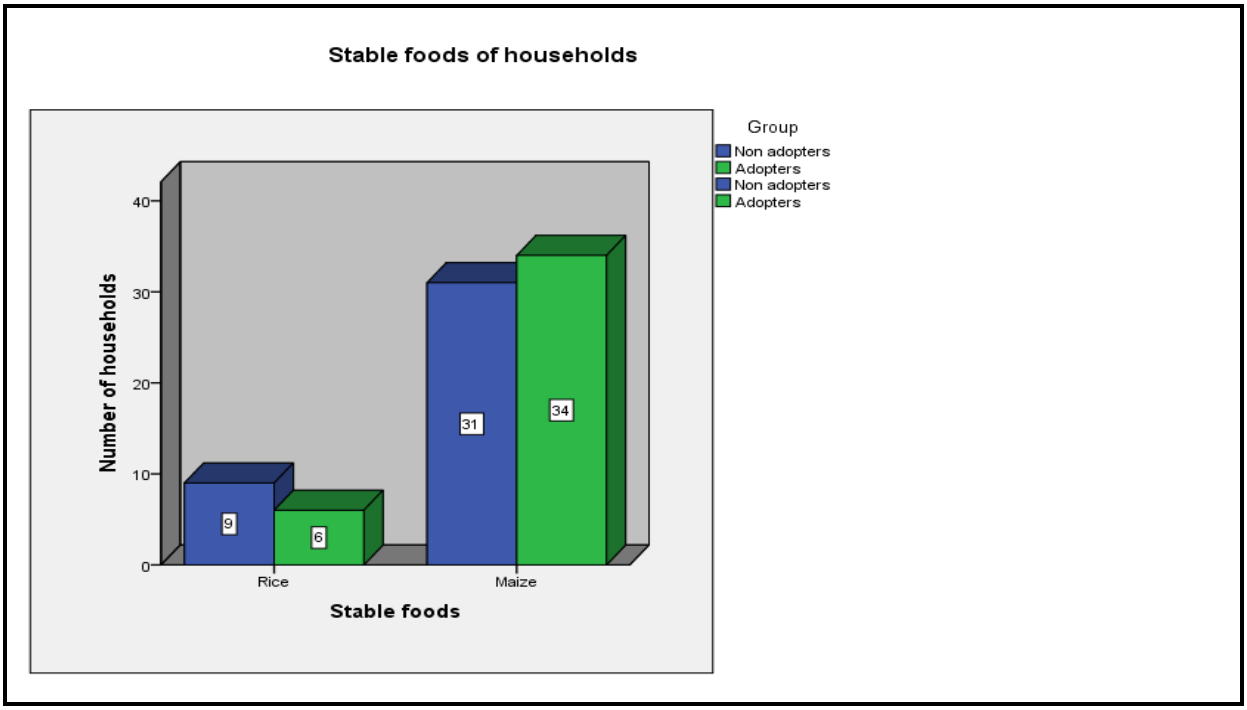

Figure 4. 30 Distribution of household's main stable foods

Source: Field survey, 2013

Figure 4.30 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Household's main stable foods were divided into two following categories. Category 1: Rice and category 2 Maize. Non animal traction adopters out of the entire 40 interviewed 9 respondents preferred rice as household's main stable food and the distribution of the respondents was 22.5 % and 31 respondents preferred maize as household's main stable food and the distribution of the respondents was 77.5 %. While animal traction adopters out of all the 40 interviewed 6 respondents preferred rice as household's main stable food and the distribution of the respondents was 15 % and 34 respondents preferred maize as household's main stable food and the distribution of the respondents was 85 %. Figure 4.30 above shows out 65 respondents out of all the 80 interviewed preferred maize as the main stable food than rice and the distribution of the respondents was 81.25 %. According to these results maize is the main stable food for almost all the households interviewed.

4.6.5 Number of households producing their main stable food

Households may produce or not produce their own stable depending on the production growth requirements of that particular crop preferred as stable food. The information collected and analysed related to number of households producing their main stable food is presented in Table 4.7 above and displayed pictorially in Figure 4.31 below.

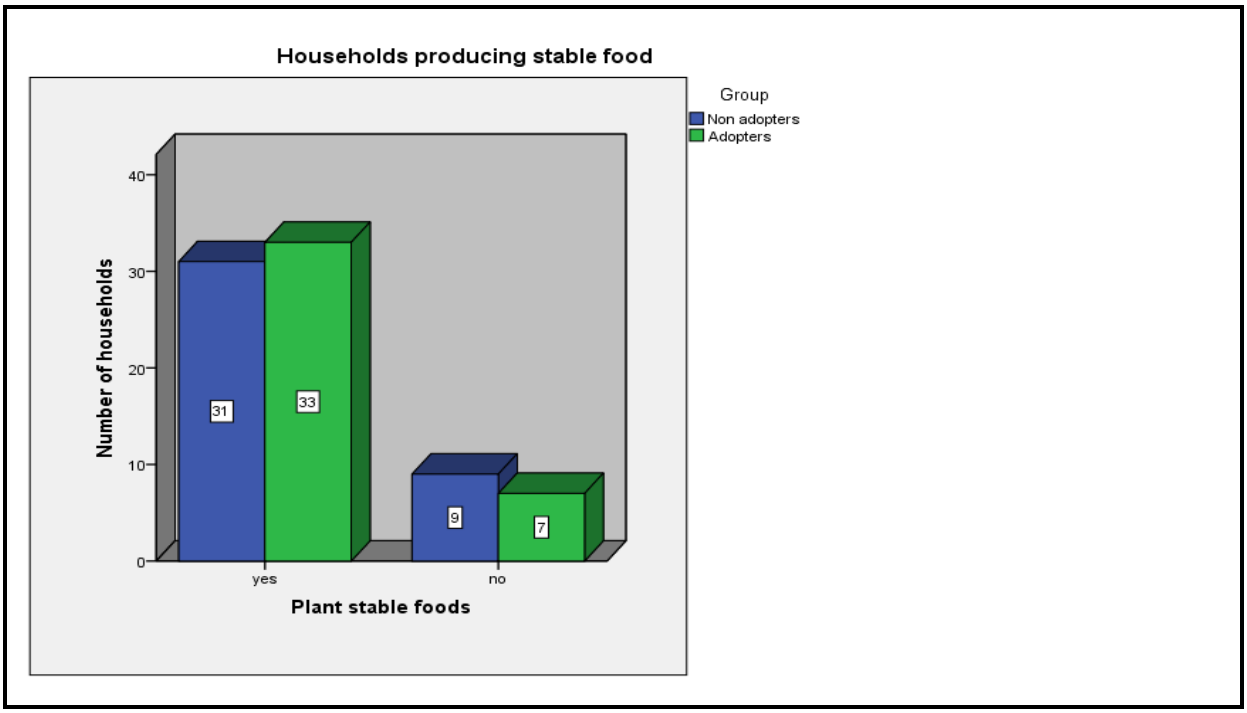

Figure 4. 31 Distribution of number of households producing their main stable food

Source: Field survey, 2013

Figure 4.31 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The answers to the question of "do households produce some of their stable food" were divided into two following categories. Category 1: was meant for those who produced some of their stable food and this category was presented by a "yes" answer to the question and category 2: was meant for those who did not producing some of their stable foods and this category was presented by a "no" answer to the question.

Non animal traction adopters out of the entire 40 interviewed 31 respondents answered "yes" they did produce some of their stable food and the distribution of the respondents was 77.5 % and 9 respondents answered "no" they did not produce some of their stable foods and the distribution was 22.5 %. While animal traction adopters out of all the 40 interviewed 33

respondents answered “yes” they did produce some of their stable foods and the distribution of the respondents was 82.5 % and 7 respondents answered “no” they did not produce some of their stable food and the distribution of the respondents was 17.5 %. Figure 4.31 above shows that out of the entire 80 respondents interviewed 64 respondents produced some of their stable food which is maize and the distribution of the respondents was 80 %. According to these results it can be concluded that if the problems encountered by households could be addressed households would be more food secured because they would produce their stable food in larger quantities that would last all year around.

4.6.6 Households buying complementary goods

In in study complementary goods refer to product that is used in conjunction with another product. Rural household’s complementary goods may differ according to preferences. The information collected and analysed related to households buying complementary goods is presented in Table 4.7 above and displayed pictorially in figure 4.32 below.

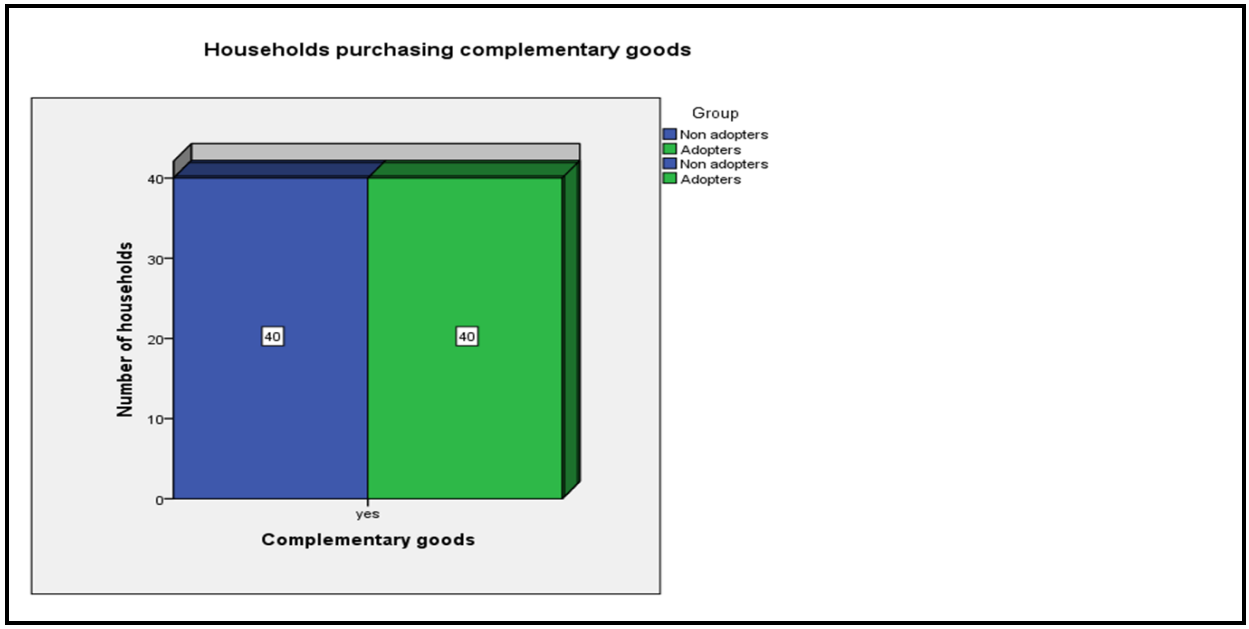

Figure 4. 32 Distribution of households buying complementary goods
Source: Field survey, 2013

Figure 4.32 above shows that data was collected from 40 respondents who were non- animal traction adopters and 40 who were adopters of which all of them were buying complementary goods. The distribution for both of the groups was 100%. According to these results it can be concluded that households bought complementary goods because they could not produce all

the products they need for consumption or they bought complementary goods to use them in conjunction with what they produced, so that what they produced can last longer.

4.6.7 Household's food security statuses with the use of technology

The food security statuses of households may differ as households have different food demands, number of household members, sources of income and hectares cultivated, yield of food produced and technology used in producing food. The information collected and analysed related to household's degree of food security is presented in Table 4.7 above and displayed pictorially in Figure 4.33 below.

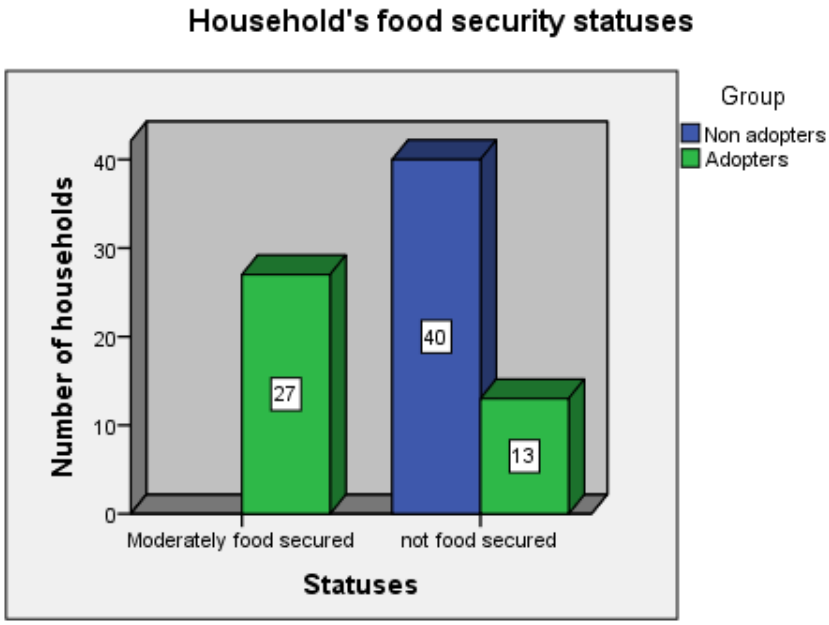

Figure 4. 33 Distribution of household's food security statuses

Source: Field survey, 2013

Figure 4.33 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Household's food security statuses were divided into two following categories. Category 1: Moderately food secured and category 2: not food secured. All 40 non animal traction adopters were not food secured and the distribution of the respondents was 100 %. While animal traction adopters out of the entire 40 interviewed 27 respondents were moderately food secured and the distribution of the respondents was 67.5 % and 13

respondents were not food secured foods and the distribution of the respondents was 32.5 %. Figure 4.33 above shows non animal traction adopters out of the entire 40 interviewed were not food, according to this it can be concluded that non adopters did not produce enough yields in order to be food secured this maybe because of the technology they used was no effective or they encountered lot of problems during the production process. Figure 4.31 above also illustrate that 27 out of 40 animal traction adopters were moderately food secured, according to this it can be concluded that if they did not encounter any problems during the production process they would be food secured. These results suggest that animal traction is one of the effective technologies that rural households can use to produce food for household food security.

4.6.8 Household's main purpose of crop production

Households may have different purposes of cultivating crops. Purposes may include producing crops for consumption, to feed livestock or for marketing. The information collected and analysed related to household's main purpose of crop production is presented in Table 4.7 above and displayed pictorially in Figure 4.34 below.

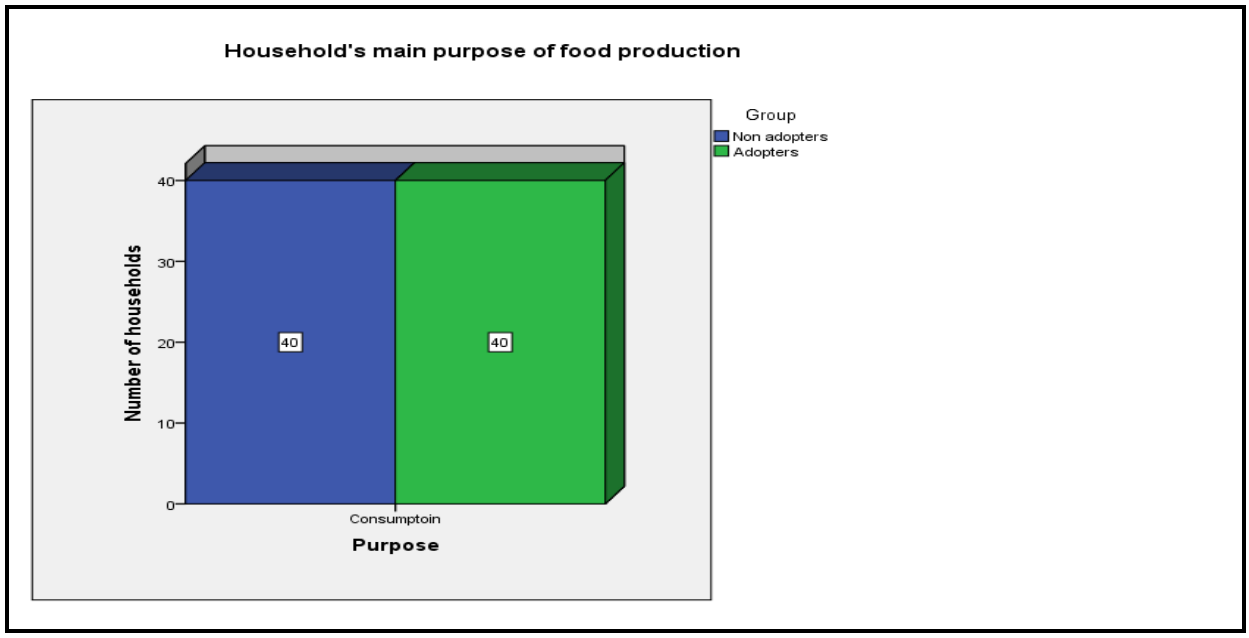

Figure 4. 34 Distribution of household's main purpose of crop production
Source: Field survey, 2013

Figure 4.34 above shows that data was collected from 40 respondents who were non- animal traction adopters and 40 who were adopters of which all of them were producing for the same purpose of consumption and the distribution for both of the groups was 100%. According to

these results it can be concluded that food in rural areas was mostly produced for household food security.

4.7 Marketing of produce

Rural communities normally sell their produce in order to have money to buy complementary goods, pay church contributions or funeral burial societies. They usually sell if there is a surplus from their produce because they usually do not have storage facilities so the produce perishes. The information which was analysed and described in relation to marketing of produce included number of households who normally market their produce, portion of the produce normally marketing and type of markets normally used for selling produce. The results are presented in Table 4.8 below while the details are presented in the next several sub-sections below.

Table 4. 8 Summary of Descriptive Statistics of the key variables for marketing of produce

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Do u market	80	1.0	1.0	2.0	154.0	1.925	.2651
Portion marketed	80	1.0	.0	1.0	6.0	.075	.2651
Markts used to sell produce	80	1.0	.0	1.0	6.0	.075	.2651

Source: Field survey 2013

4.7.1 Number of households who normally market their produce

Rural households are assumed not to be selling their produce because they do not produce enough food for marketing and consumption as there were many obstacles they encounter during the production process. The information gathered related to the number of respondents who normally market their produce is presented in Table 4.8 above and displayed pictorially in Figure 4.35 below.

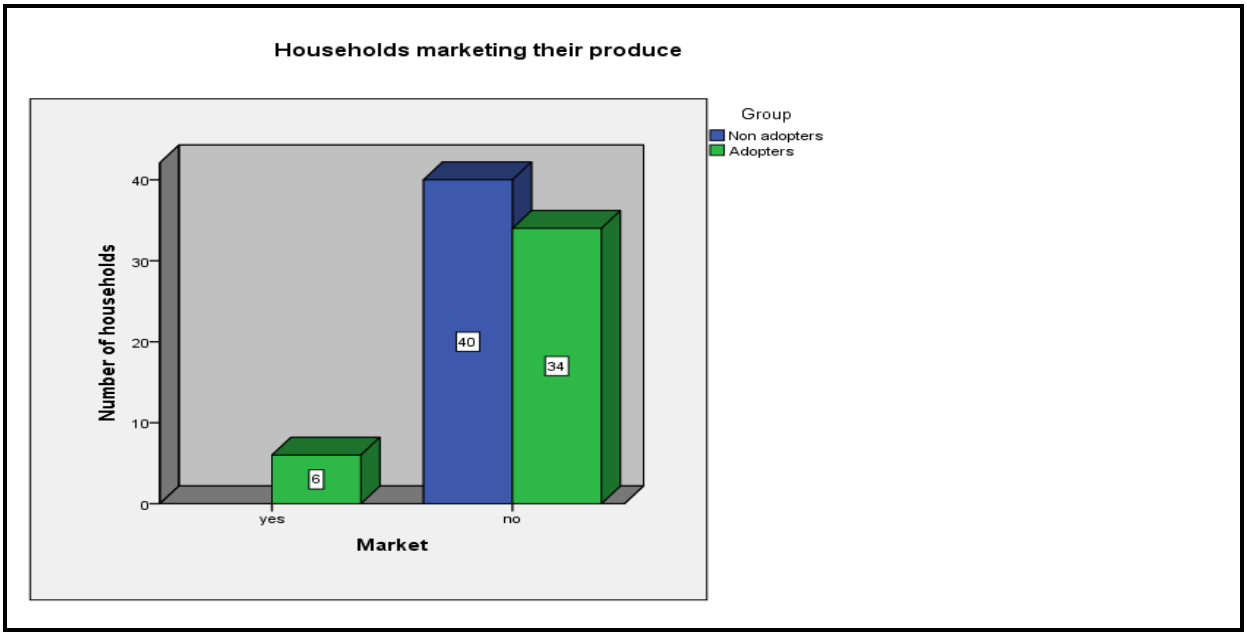

Figure 4. 35 Distribution of number of households who normally market their produce
Source: Field survey, 2013

Figure 4.35 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Non-animal traction adopters out of all the 40 interviewed none of them sold their produce and the distribution of the respondents was 100 %. While animal traction adopters out of all the 40 interviewed 6 respondents sold their produce and the distribution of the respondents was 15 % and 34 did not sell and the distribution of the respondents was 85 %. Figure 4.35 above shows that 92.5 % of the respondents out of the entire 80 interviewed did not sell their produce, according to these results it can be concluded that majority of households did not produce enough as to have surplus to sell . Also based on the results in figure 4.35 it can be concluded that animal traction adopters did produce more than the non-adopters because 15 % of the respondents out of 100 % sold their selling produce and the respondents said they only sold one produce which was maize. The assumption made that households do not sell their produce was wrong as 6 animal traction adopters sold their produce.

4.7.2 Portion of the produce normally marketing

Rural households are assumed to be using informal markets since their produce lacks quality, secondly they usually have no transport produce to nearest formal markets and roads are off poor state so they do not access markets easily. The information gathered related to the

portion of the produce normally marketed by household is presented in Table 4.8 above and displayed pictorially in Figure 4.36 below.

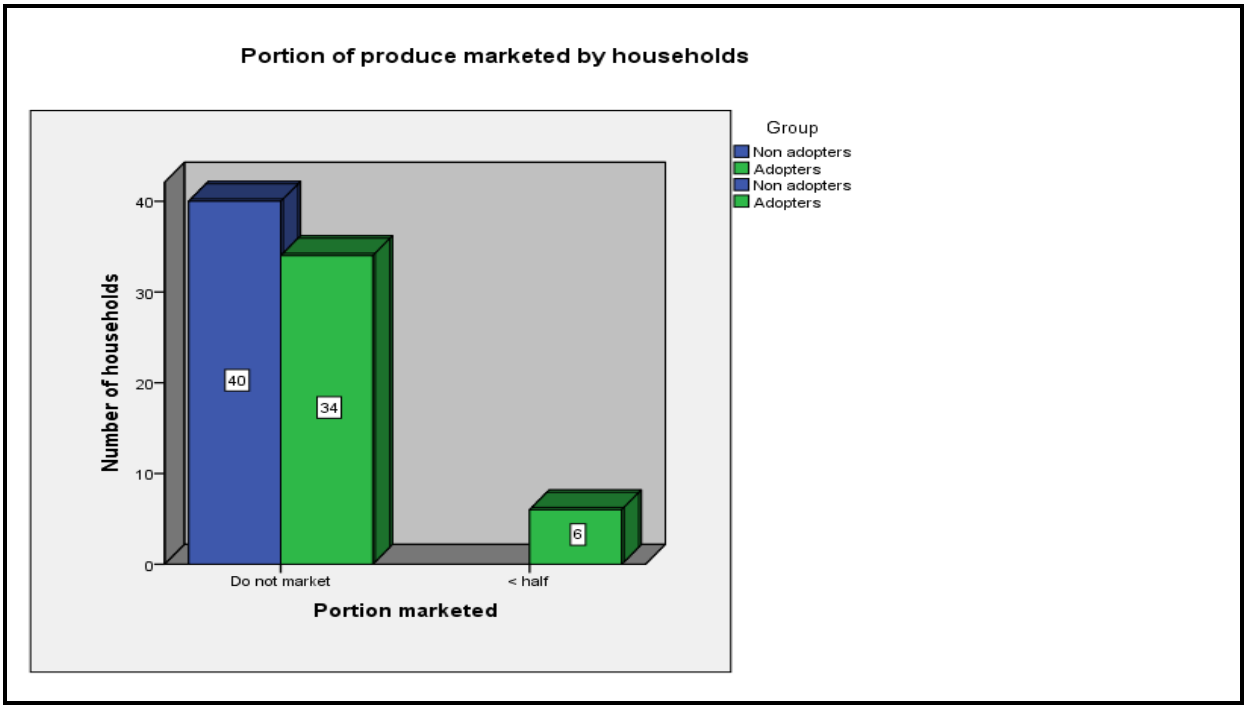

Figure 4. 36 Distribution of number of households who normally market their produce
Source: Field survey, 2013

Figure 4.36 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Out of the entire 80 respondents interviewed 74 respondents did not sell their produce and the distribution of the respondents was 92.5 %. So the question of portion marketed was not applicable to them. While animal traction adopters out of all the 40 interviewed, 6 respondents sold a portion of less than half of what they produced and the distribution of the respondents was 15 %. According to the above information it can be concluded that 92.5 % of the respondents did not produce enough for both consumption and marketing. Also figure 4.36 above shows that 15 % of animal traction adopters sold a portion of less than half of what they produced according to this it can be concluded that even animal traction users did not produce enough to market they only marketed since they did not had storage facilities so the produce was going to perish.

4.7.3 Type of markets normally used for selling produce

There are two types of markets used in marketing of agricultural products and these are informal markets and formal markets. People in rural areas normally use informal markets

because they do not meet the requirement standards of formal markets. The information collected related to type of markets used by households to market their produce is presented in Table 4.18 above and displayed pictorially in Figure 4.37 below

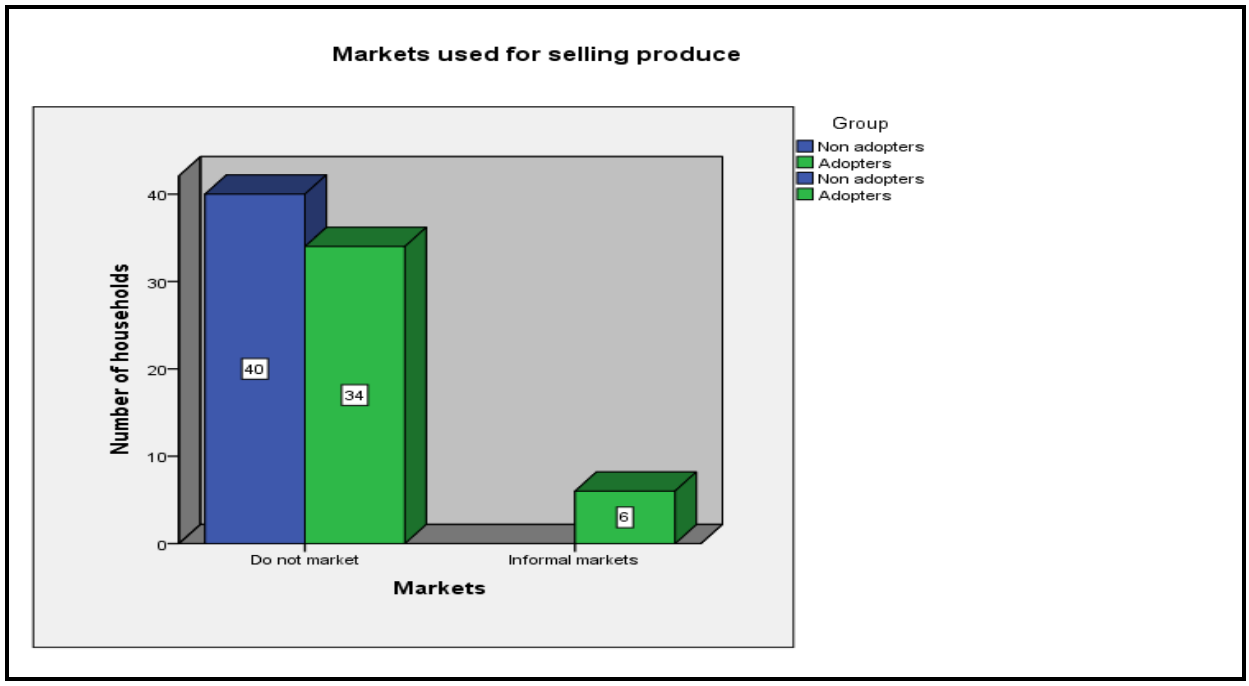

Figure 4. 37 Type of market distribution normally used for selling produce

Source: Field survey, 2013

Figure 4.37 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. Non-animal traction adopters out of all the 40 interviewed none of them sold their produce and the distribution of the respondents was 100 %. So the question of type of markets to used sell produce was not applicable to them. While 6 animal traction adopters used informal markets to sell their produce, they sold to neighbours and relatives and the distribution of the respondents was 15 %. According to the above information it can be concluded that respondents did not had an easy way of accessing formal markets or their produce did not meet the requirements standards of formal markets.

4.8 Credit for agricultural purposes

Agricultural credit is a form of investment of loan capital in agriculture (Labadarios, 2009). Aagricultural loans are categorized as short-term, intermediate-term or long-term, depending on their maturity. Short-term loans are often used for operating expenses, intermediate-term

loans are used to finance depreciable assets such as machinery, equipment, breeding livestock and improvements and long-term loans are used to acquire, construct and develop land and buildings, and usually are amortised over periods longer than 10 years. Agricultural credit is one of the most important productive resources in agriculture. It enables farmers to procure the agricultural production inputs necessary for agricultural purposes (Bellamy et al., 1981). The information described and analysed in relation to credit for agricultural purposes included number of households needing credit for agricultural purposes, needs for credit and number of households having collateral for credit acquisition. The results are presented in Table 4.9 below while the details are presented in the next several sub-sections below.

Table 4. 9 Summary of Descriptive Statistics of the key variables for credit for agricultural purposes

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
HH needing credit	80	.0	1.0	1.0	80.0	1.000	.0000
Collateral for credit	80	.0	1.0	1.0	80.0	1.000	.0000
Needs for credit	80	4.0	3.0	7.0	404.0	5.050	1.5903

Source field survey, 2013

4.8.1 Number of households needing credit for agricultural purposes

Agricultural credit plays a vital role in enhancing the agricultural productivity in developing and developed countries .The information collected related to number of households needing credit for agricultural purposes is presented in Table 4.9 above and displayed pictorially in Figure 4.38 below.

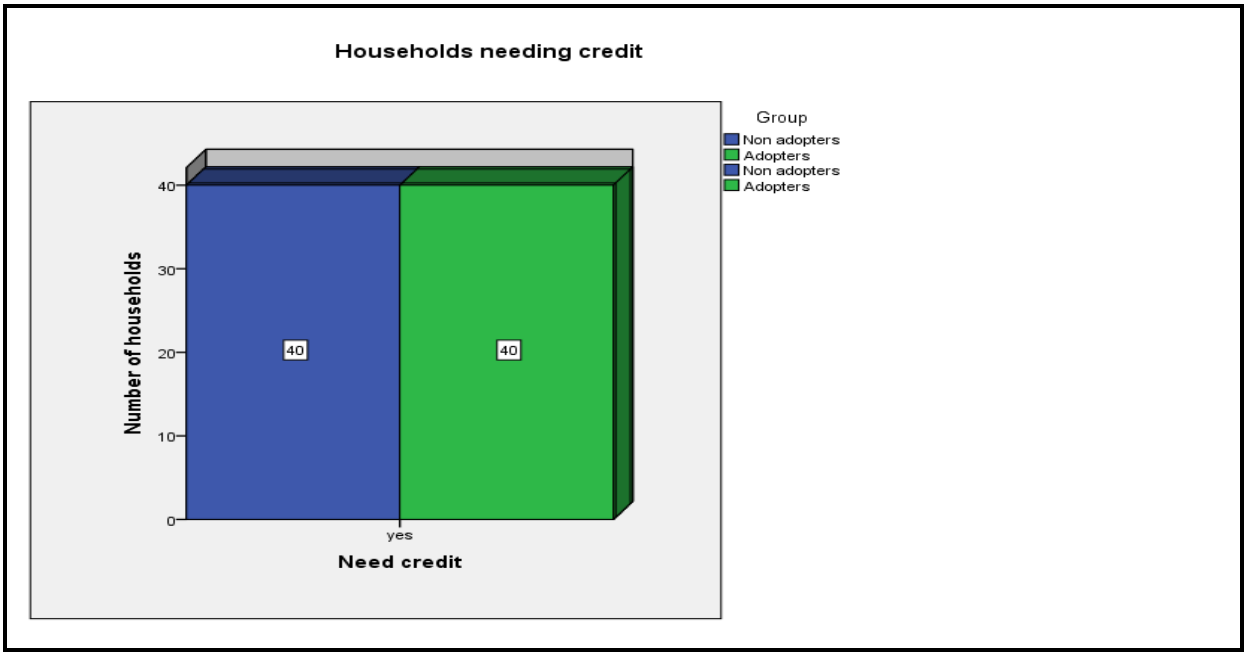

Figure 4. 38 Distribution of number of households needing credit for agricultural purposes
Source: Field Data, 2013

Figure 4.38 above shows that data was collected from 40 respondents who were non- animal traction adopters and 40 who were adopters of which all of them needed credit for agricultural purposes. The distribution for both of the groups was 100%. According to these results it can be concluded that households needed any finance that might be available for use.

4.8.2 Needs for credit

Households may need or need credit to make their agricultural production feasible (Ozowa, 1995). In rural areas of South Africa, growth and development of agriculture is significant for facing the challenges of rural poverty, food insecurity, unemployment and sustainability of natural resources (Acharya, 2005). Therefore, in small scale farming there is a need for agricultural credit from formal agricultural sources so that small scale farmers can be able to improve agricultural activities. The information collected related to needs for credit is presented in Table 4.9 above and displayed pictorially in Figure 4.39 below.

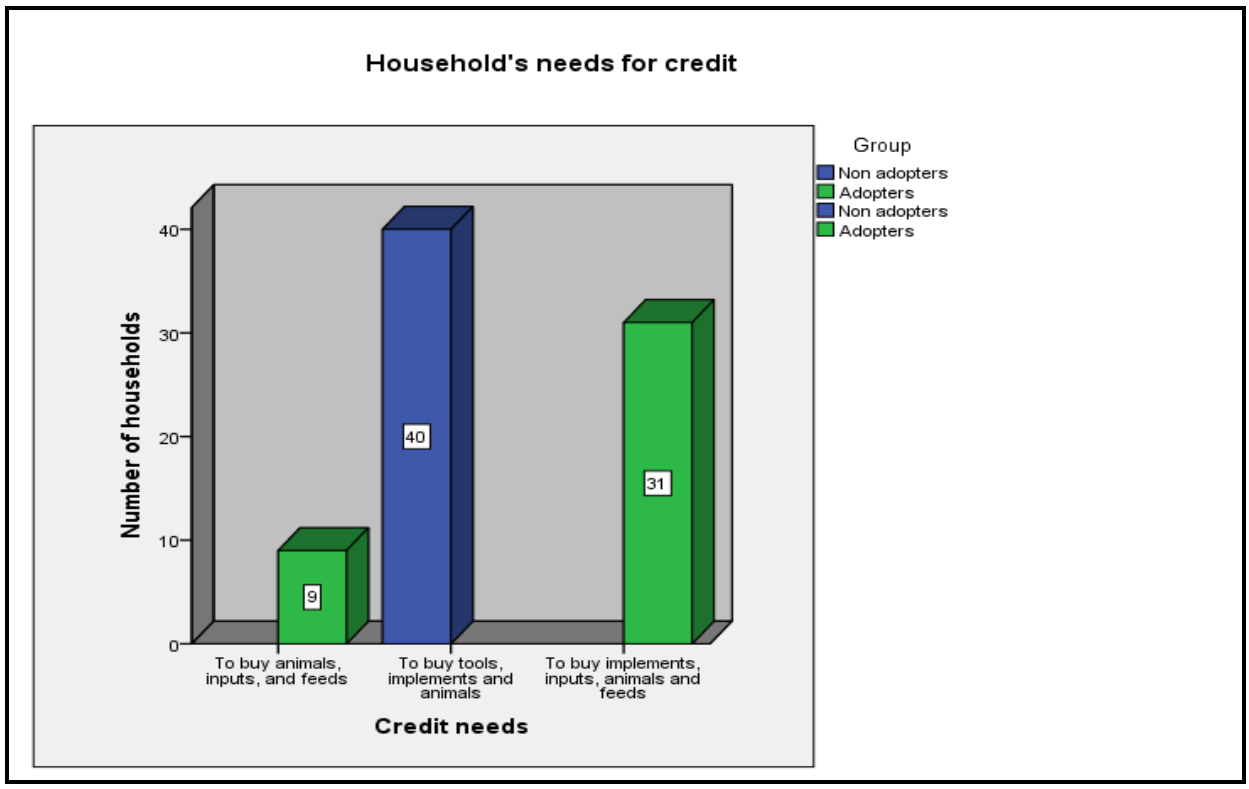

Figure 4. 39 Distribution of needs for credit
Source: Field survey, 2013

Figure 4.39 above shows that data was collected from a number of 40 respondents who were non animal traction adopters and 40 who were adopters. The total number of respondents interviewed was 80. The needs for credit were categorised into the three following groups: group one: to buy animals, inputs and feeds, group 2: to buy tools, implements and animals and group three: to buy implements, inputs, animals and feeds.

All 40 non-animal traction adopters interviewed needed credit to buy tools, implements and animals and the distribution of the respondents was 100 %. While animal traction users out of the entire 40 interviewed 9 respondents needed credit to buy animals, inputs and feeds and the distribution of the respondents was 2.5 % and 31 respondents needed credit to buy implements, inputs, animals and feeds and the distribution of the respondents was 77.5 %. According to these results the credit needs of non-animal traction users are similar to those of animal traction users. They all need it to buy animals and implements. Therefore it can be concluded that non animal traction users need credit to buy animals so that they can also adopt animal traction technology. As for animal traction users 77.5 % of the respondents needed a credit to buy implements, inputs, animals and feeds according to this it can be

concluded that shortage of implements, inputs, animals and feeds are is the major problem facing animal traction adopters.

4.8.3 Households having collateral for credit acquisition

According to Labadarios, (2009) collateral for credit is an asset pledged as security for repayment of a loan. In the event that a borrower defaults on the terms of a loan, the collateral may be sold, with the proceeds used to satisfy any remaining responsibilities. The information collected related to households having collateral for credit acquisition presented in Table 4.9 above and displayed pictorially in Figure 4.40.

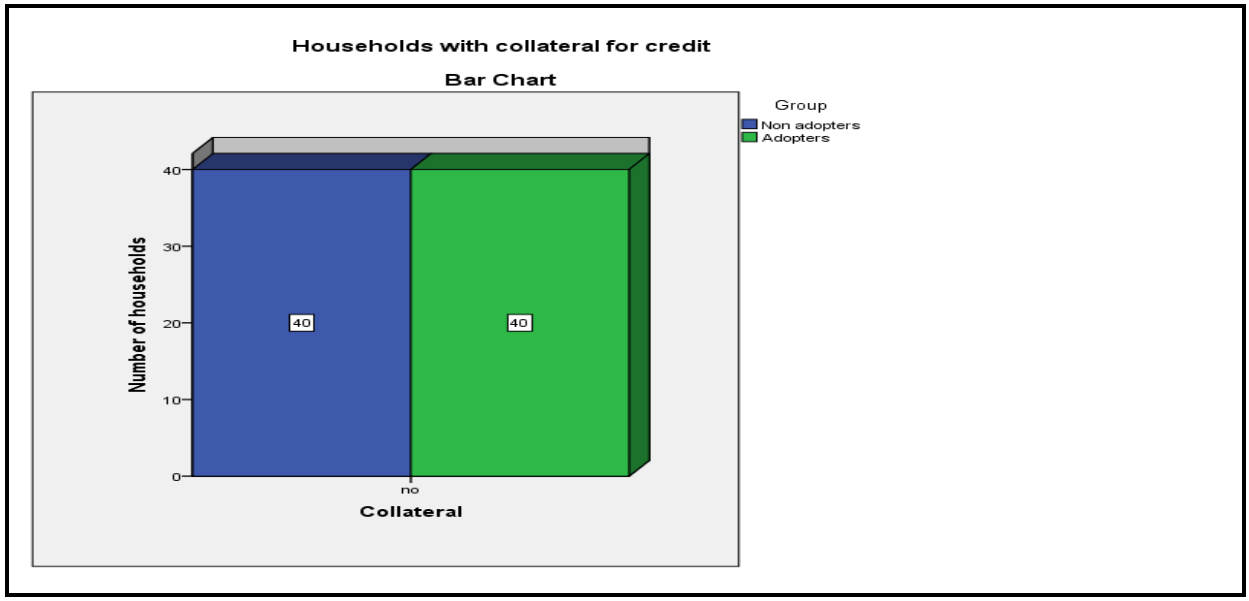

Figure 4. 40 Distribution of households having collateral for credit acquisition
Source: Field survey, 2013

Figure 4.40 above shows that data was collected from 40 respondents who were non- animal traction adopters and 40 who were adopters of which all 80 of them did not have collateral for credit acquisition and the distribution for both groups was 100%. According to these results it can be concluded that respondents did not have assets that are of high value that could be pledged as collateral for credit acquisition. According to these results in figure 4.40 above all respondents interviewed own some number of hectares ranging from 2 ha to 3ha but they cannot pledge the land as collateral because the land in rural areas has no value as compared to the land in urban areas. Therefore it can be concluded that respondents were resource poor and did not have valuable assets.

4.9 Multiple linear regression: adoption and non-adoption of animal traction and household food security

The broad objective of this study is to assess the impact of animal traction on rural household food security and one of the specific objectives are to identify the degree of food security between animal traction adopters and non-adopters. This section presents results accordance with these research objectives. Multiple linear regressions were done to examine the linear relationship between explanatory variables and a response variable, specifically focusing to assess the extent to which animal traction contributes to output of all the crops produced last season. T-tests were done to compare differences, relative contributions and effectiveness of animal traction and other farming technologies to food security in the project area as to identify the degree of food security between animal traction adopters and non-adopters by comparing means and standard derivations. The multiple linear regression model was employed determine significant variables that influence use animal of traction adoption choices and odds of households adopting animal traction in Damane rural village.

4.10 Impact of animal traction power on total output of all the crops produced through a multiple linear regression model

In this study, the variables were tested at the 5% significance level. Thus, if the significance value is greater than 0.05, then it shows that there is insufficient evidence to support that the independent variable influence a change away of the dependent variable, if the significance value is equal to or less than 0.05, then there is enough evidence to support a claim presented by the coefficient value. The results are presented in Table 4.10 below and details are discussed in the sub- sections below.

Table 4. 10 Factors affecting total output of all the crops produced last season

Variables	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	295.104	88.471		3.336	0.001
Source of inc	-17.478	6.623	-.167	-2.639	0.010**
HH cutting meals	52.306	20.443	.202	2.559	0.013**
Quantity of inputs purchased	16.431	7.025	.207	2.339	0.022**
HH producing stable foods	-5.290	20.257	-.017	-.261	0.795
Cropping practises	-4.566	7.354	-.054	-.621	0.537
Type of inputs purch	-14.653	11.714	-.081	-1.251	0.215
Problems encountered	36.702	25.098	.207	1.462	0.148
Reasons for using less land	16.184	13.680	.076	1.183	0.241
Group	91.036	42.324	.360	2.151	0.035**

Source: field survey 2013 Significance denoted as follows: **(5%)

4.10.1 Sources of income of households

Sources of income are significant at 5% level with a positive effect on ability of households to use animal traction for food production. These results suggest that sources of income had a strong positive relationship with animal traction power on the total output of crops produced. Therefore it can be concluded that better sources of income improved total crop total crop outputs.

4.10.2 Number of households cutting the number of meals a day because there was not enough to eat

Number of households cutting the number of meals a day because there was not enough to eat were significant at 5% level with a positive effect on ability of households to use animal traction for food production. This played an important role in encouraging households to use animal traction technology for food production. These results suggest that Number of households cutting the number of meals a day because there was not enough to eat had a strong positive relationship with animal traction power on the total output of crops produced.

4.10.3 Quantities of inputs purchased by households

Quantities of inputs purchased by households were significant at 5% level with a positive effect on ability of households to use animal traction for food production**.** These results suggest that quantities of inputs purchased by households had a strong positive relationship with animal traction power on the total output of crops produced. This was because animal traction adopters purchased larger quantities of inputs than non- animal traction adopters.

4.10.4 Group (adopters and non-adopters of animal traction)

Group (adopters and non-adopters of animal traction) were significant at 5% level with a positive effect on ability of households to use or not to use animal traction for food production**.** These results suggest that adopters and non-adopters of animal traction had a strong positive relationship with the use and non- use of animal traction power to produce food. Therefore it can be concluded that whether the respondents adopted or did not adopt animal traction power, all of them at the end of the season did have crop outputs.

4.11 Results of the t-tests and Levene's test for the equality of variance and means

T-tests were done to compare differences, determine effectiveness and relative contributions of animal traction and other farming technologies to food security in the project area as to identify the degree of food security between animal traction adopters and non-adopters by comparing means and standard derivations. Levene's test results are also presented which test the equality of variance amongst variables. On the purpose of determining effectiveness of animal traction and other farming technologies food security in the project area the T-test ran

the following variables the total number of hectares cultivated, cropping practises technology mostly used for and quantity of inputs purchased by households. The equality of means and variance from Levene's test were also done.

On the purpose of determining relative contribution of animal traction and other technologies to food security, variables that were analysed included maize and bean yields, total output of all the crops produced (maize, beans, cabbage, spinach, onion, carrots, pumpkin, butternut and beetroot), number of months the harvest lasts, households cutting the number of meals to eat because there was not enough to eat. The equality of means and variance from Levene's test were also done. The results are presented in sub sections below.

4.11.1 Results of the t-tests and Levene's test for the equality of variance and means for total number of Ha cultivated from the types of technology used for crop production

The total numbers of hectares cultivated were computed to compare differences in size of area that can be ploughed using animal compared traction compared to fork spades, spades and hoes. Table 4.11 below presents the t- tests results.

Table 4. 11 Total number of Ha cultivated from the types of technology used for crop production

Statistics	**Type**		**Ha cultivated**	
	Spade, fork spade and hoe	Animal traction power	Equal variances assumed	Equal variances not asssumed
Number of respondents	40	40		
Mean	0.6625	1.4275		
Std. Deviation	0.23717	0.46602		
Std. Error Mean	0.03750	0.07368		
F – Statistic			40.273	
Sig.			0.000***	
t- Statistic			-9.253	-9.253
Prob (t)			0.000***	0.000***
Degree of freedom			78	57.933
Mean Difference			0.76500	-0.76500
Std.Error Difference			0.08268	0.08268

Source: field survey 2013 Significance denoted as follows: ***(1%)

Table 4.11 shows there was a difference in the mean from both types of technology used. The mean for the use of spade, fork spade and hoes was 0.6625 ha for and for animal traction power use was 1.4275 ha. This indicated that animal power users cultivated more hectares of land than spade, fork spade and hoes users. According to these results it can be conclude that animal traction was effective, not time consuming and suitable for cultivating bigger areas in the protect area. Table 4.11 also shows that the probability was quite low 1% level (Sig. Value is 0.000). This is below the common 0.05 cut-off. At a level of 5%, there is a significant relationship between tractor and animal traction power which implies that total number hectares cultivated played an important role in both types of power for household food security, with animal traction having greater contribution to total number of hectares cultivated. So the standard deviation for use of spade, fork spade and hoes use was 0.23717 and 0.46602 for animal traction power use.

4.11.2 Results of the t-tests and Levene's test for the equality of variance and means for cropping practises technology mostly used for

Cropping practises technology mostly used for were computed to compare differences between the number of cropping practises that animal traction and hoes, fork spades and spades was used in Table 4.12 below presents the t- tests results.

Table 4. 12 Cropping practices technology mostly used for

Statistics	**Type**		**Cropping practices**	
	Spade, fork spade and hoe	Animal traction power	Equal variances assumed	Equal variances not asssumed
Number of respondents	40	40		
Mean	3.200	5.250		
Std. Deviation	1.3436	0.8397		
Std. Error Mean	0.2124	0.1328		
F – Statistic			7.076	
Sig.			0.009***	
t- Statistic			-8.183	-8.183
Prob (t)			0.000	0.000
Degree of freedom			78	65.435

Mean Difference			-2.0500	-2.0500
Std.Error Difference			0.2505	0.2505

Source: field survey 2013 Significance denoted as follows: ***(1%)

Table 4.12 shows there was a difference in the mean from both types of technology used. The mean for the use of spade, fork spade and hoes was 3.200 and for animal traction power use was 5.250. This indicated that animal power users used the animals in all the cropping practises (ploughing, planting and weeding) and non- animal traction users did not use the spade, fork spade and hoes in all the cropping practises. According to these results it can be conclude that animal traction power was effective, useful and applicable to all the cropping practises. Table 4.12 also shows that the probability was significant at 1% level. This was below the common 0.05 cut-off. Since the Sig. Value was below 0.005 there was sufficient evidence that show a significant difference between tractor and animal traction power that cropping practises technology mostly for played an important role in both types of power for household food security, with animal traction having greater contribution to household food security. So the standard deviation for use of spade, fork spade and hoes use was 1.3436 and 0.8397 for animal traction power use.

4.11.3 Results of the t-tests and Levene's test for the equality of variance and means for quantity of inputs purchased by households

Quantities of inputs purchased by households were computed to compare differences between the quantities of inputs purchased by households that use animal traction and hoes, fork spades and spades. Table 4.13 below presents the t- tests results.

Table 4. 13 Quantity of inputs purchased by households to be used for crop production for types of technology

Statistics	Type		Quantity of inputs	
	Spade, fork spade and hoe	Animal traction power	Equal variances assumed	Equal variances not asssumed
Number of respondents	40	40		
Mean	2.700	4.925		
Std. Deviation	0.9392	1.3280		
Std. Error Mean	0.1485	0.2100		
F – Statistic			7.7580	
Sig.			0.007***	
t- Statistic			-8.652	-8.652
Prob (t)			0.000	0.000
Degree of freedom			78	70.207
Mean Difference			-2.2250	-2.2250
Std.Error Difference			0.2572	0.2572

Source, field survey 2013 Significance denoted as follows: ***(1%)

Table 4.13 shows there was a difference in the mean from both types of technology used. The mean for the use of spade, fork spade and hoes was 2.700 and for animal traction power use was 4.925. This indicated that animal power users purchased larger quantities of inputs than spade, fork spade and hoes users. These results show animal traction power users had bigger areas to plant so they purchased larger quantities of inputs than non- animal traction users. Therefore it can be conclude that animal traction power was appropriate for planting bigger areas than spade, fork spade an hoes. Table 4.13 also shows that the probability was quite low at 1% level (Sig. Value is 0.007). This was below the common 0.05 cut-off. Since the Sig. Value was below 0.005 there was a significant difference between tractor and animal traction power which showed that quantity of inputs purchased by households played an important role in both types of power for household food security. So the standard deviation for use of spade, fork spade and hoes use was 0.9392 and 1.3280 for animal traction power use.

4.11.4 Results of the t-tests and Levene's test for the equality of variance and means for Maize yield from the types of technology used for production

Maize yields were computed to compare differences from the two types of technology used. Table 4.13 below presents the t- tests results.

Table 4. 14 Maize yields from the types of technology used for production

Statistics	**Type**		**Maize yield**	
	Spade, fork spade and hoe	Animal traction power	Equal variances assumed	Equal variances not asssumed
Number of respondents	40	40		
Mean	33.000	102.750		
Std. Deviation	20.5314	32.8155		
Std. Error Mean	3.2463	5.1886		
F – Statistic			13.530	
Sig.			0.000***	
t- Statistic			-11.396	-11.396
Prob (t)			.000	0.000
Degree of freedom			78	65.476
Mean Difference			-69.7500	-69.7500
Std.Error Difference			6.1205	6.1205

Source, field survey 2013 Significance denoted as follows: ***(1%)

Table 4.14 shows there was a difference in the mean from both types of technology used. The mean for the use of spade, fork spade and hoes was 33.000 kg and for animal traction power use was 102.750 kg. This indicated that animal power users produced larger yields of maize than spade, fork spade and hoes users. Therefore it can be conclude that animal traction power contributed positively to household food security than the use of spade, fork spade and hoes. The larger the yields produced the more the household has enough to eat at all times. Table 4.14 also shows that the probability was quite low at 1% level (Sig. Value is 0.000). This was below the common 0.05 cut-off. Since the Sig. Value was below 0.005 there was a significant difference between tractor and animal traction power which showed that maize yield produced played an important role in both types of power for household food security,

with animal traction having greater contribution to maize yields produced. So the standard deviation for use of spade, fork spade and hoes use was 20.5314 and 32.8155for animal traction power use.

4.11.5 Results of the t-tests and Levene's test for the equality of variance and means for Bean yields from the types of technology used for production

Bean yields were computed to compare differences from the two types of technology used. Table 4.15 below presents the t- tests results.

Table 4. 15 Bean yields produced from the types of technology used for crop production

Statistics	**Type**		**Bean yield**	
	Spade, fork spade and hoe	Animal traction power	Equal variances assumed	Equal variances not asssumed
Number of respondents	40	40		
Mean	42.500	60.125		
Std. Deviation	19.8391	45.2980		
Std. Error Mean	3.1368	7.1622		
F – Statistic			26.783	
Sig.			0.000***	
t- Statistic			-2.254	-2.254
Prob (t)			.027	.028
Degree of freedom			78	53.431
Mean Difference			-17.6250	-17.6250
Std.Error Difference			7.8190	7.8190

Source, field survey 2013 Significance denoted as follows: ***(1%)

Table 4.215 shows there was a difference in the mean from both types of technology used. The mean for the use of spade, fork spade and hoes was 42.500 kg and for animal traction power use was 60.125 kg. This indicated that animal power users produced larger quantities of beans yields than spade, fork spade and hoes users. Therefore it can be conclude that animal traction power contributed positively to household food security than the use of spade, fork spade and hoes. The larger the quantities of yields produced the more the household has enough to eat at all times. Table 4.15 also shows that the probability was quite low at 1% level (Sig. Value is 0.000). This was below the common 0.05 cut-off. Since the Sig. Value was below 0.005 there was a significant between tractor and animal traction power which

showed that bean yields produced played an important role in both types of power for household food security, with animal traction having greater contribution to bean yields produced. So the standard deviation for use of spade, fork spade and hoes use was 19.8391and 45.2980 for animal traction power use.

4.12.6 Total output of all the crops produced (maize, beans, cabbage, spinach, onion, carrots, pumpkin, butternut and beetroot) t- test results from the types of technology used by households

Total outputs of all the crops produced were computed to compare differences of total output from the two types of technology used. Table 4.16 below presents the t- tests results.

Table 4. 16 Total output of all the crops (maize, beans, cabbage, spinach, onion, carrots, pumpkin, butternut and beetroot) from the types of technology used for crop production

Statistics	**Type**		**Total output**	
	Spade, fork spade and hoe	Animal traction power	Equal variances assumed	Equal variances not asssumed
Number of respondents	40	40		
Mean	289.38	490.93		
Std. Deviation	47.437	98.504		
Std. Error Mean	7.500	15.575		
F – Statistic			13.109	
Sig.			0.001***	
t- Statistic			-11.659	-11.659
Prob (t)			.000	.000
Degree of freedom			78	56.166
Mean Difference			-201.550	-201.550
Std.Error Difference			17.287	17.287

Source: Field survey 2013 Significance denoted as follows: ***(1%)

Table 4.16 shows there was a difference in the mean from both types of technology used. The mean for the use of spade, fork spade and hoes was 289.38 kg and for animal traction power use was 490.93 kg. This indicated that animal power users produced larger total outputs of crops than spade, fork spade and hoes users. Therefore it can be conclude that animal traction

power contributed positively to household food security than the use of spade, fork spade and hoes. The larger the yields produced the more the household has enough to eat at all times. Table 4.16 also shows that the probability was quite low at 1% level (Sig. Value is 0.001). This was below the common 0.05 cut-off. Since the Sig. Value was below 0.005 there was a significant difference between tractor and animal traction power which showed that total output of crops played an important role in both types of power for household food security, with animal traction having greater contribution on total outputs of crops produced. So the standard deviation for use of spade, fork spade and hoes use was 47.437 and 98.504 for animal traction power use.

4.11.7 Results of the t-tests and Levene's test for the equality of variance and means for number of months the harvest lasts from the types of technology used by households

Number of months the harvest lasts was computed to compare differences in number of months the harvest lasts from the two types of technology used. Table 4.17 below presents the t- tests results

Table 4. 17 Number of months the harvest lasts produced from types of technology

Statistics	**Type**		**Number of months**	
	Spade, fork spade and hoe	Animal traction power	Equal variances assumed	Equal variances not asssumed
Number of respondents	40	40		
Mean	4.325	8.625		
Std. Deviation	1.3085	1.4796		
Std. Error Mean	0.2069	0.2339		
F – Statistic			0.620	
Sig.			0.433	
t- Statistic			-13.769	-13.769
Prob (t)			0.000	.0000
Degree of freedom			78	76.851
Mean Difference			-4.3000	-4.3000
Std.Error Difference			0.3123	0.3123

Source: Field survey 2013

Table 4.17 shows there was a difference in the mean from both types of technology used. The mean for the use of spade, fork spade and hoes was 4.325 and for animal traction power use was 8.625. These results indicated that the harvests of those who used animal traction power lasted longer than those using spade, fork spade and hoes. Animal traction users had enough to eat for more number of months than non- users animal traction power. Therefore it can be concluded that the use of animal traction power contributed positively to household food security than the use of spade, fork spade and hoes. The more the number of months the harvest lasts the more the household is food secured. Table 4.17 shows that the probability was 0.433. This was above the common 0.05 cut-off. Since the Sig. Value was high there is no significant difference between tractor and animal traction power which showed that number of moths the harvest lasts played an important role in both types of power for household food security. So the standard deviation for use of spade, fork spade and hoes use was 1.3085 and 1.4796 for animal traction power use.

4.11.8 Number of households cutting the number of meals because there was not enough to eat t- test results from the types of technology used by households

Numbers of households cutting the number of meals because there was not enough to eat were computed to compare differences from the two types of technology used. Table 4.18 below presents the t- tests results.

Table 4. 18 Numbers of households cutting the number of meals because there was not enough to eat

Statistics	**Type**		**Households cutting meals**	
	Spade, fork spade and hoe	Animal traction power	Equal variances assumed	Equal variances not asssumed
Number of respondents	40	40		
Mean	1.100	1.675		
Std. Deviation	0.3038	0.4743		
Std. Error Mean	0.0480	0.0750		
F – Statistic			30.910	
Sig.			0.000***	
t- Statistic			-6.456	-6.456
Prob (t)			.000	.000
Degree of freedom			78	66.390

Mean Difference			-.5750	-.5750
Std.Error Difference			.0891	.0891

Source: Field survey 2013 Significance denoted as follows: ***(1%)

Table 4.18 shows there was a difference in the mean from both types of technology used. The mean for the use of spade, fork spade and hoes was 1.100 and for animal traction power use was 1.675. These results indicated that a larger proportion of animal traction power users did not cut the number of meals because there was not enough to eat and a large proportion of spade, fork spade and hoes users did cut the number of meals to eat because there was not enough to eat. Therefore it can be conclude that animal traction power contributed positively to household food security than the use of spade, fork spade and hoes. Large proportion of animal traction users had enough to eat at all times than spade, fork spade and hoes users. Table 4.18 also shows that the probability was quite low at 1% level (Sig. Value is 0.000). This was below the common 0.05 cut-off. Since the Sig. Value was low, there was a significant difference between tractor and animal traction power which showed that households cutting the number of meals because there was not enough to eat played an important role in both types of power for household food security. So the standard deviation for use of spade, fork spade and hoes use was 0.3038 and 0.4743 for animal traction power use.

4.12 Binary logistic regression

This section presents the results of the binary logistic regression model and discusses the results of the significant variables that influence animal use of traction adoption choices and odds of households adopting animal traction in Damane rural village. According to Gujarati, (1992), the coefficient values measure the expected change in the logit for a unit change in each independent variable, all other independent variables being equal. The sign of the coefficient shows the direction of influence of the variable on the logit. It follows that a positive value indicates an increase in the likelihood that a household will change to the alternative option from the baseline group. On the other hand, a negative value shows that it is less likely that a household will consider the alternative (Gujarati, 1992; Pundo and Fraser, 2006). Therefore, in this study, a positive value implies an increase in the likelihood of

changing from non- use of animal traction to use of animal traction to produce food. The significance values (also known as p-values) show whether a change in the independent variable significantly influences the logit at a given level. In this study, the variables were tested at the 5% significance level. Thus, if the significance value is greater than 0.05, then it shows that there is insufficient evidence to support that the independent variable influence a change away from the baseline group. If the significance value is equal to or less than 0.05, then there is enough evidence to support a claim presented by the coefficient value. The odds ratio indicates the extent of the effect on the dependent variable caused by the predictor variables. Its value is obtained by calculating the anti-logarithm of each slope coefficient of predictor variables. A value greater than one implies greater probability of variable influence on the logit and a value less than one indicates that the variable is less likely to influence the logit. The standard error measures the standard deviation of the error in the value of a given variable (Hill et al., 2001; Gujarati, 1992). The results are presented in Table 4.19 below and discussed in the subsections below.

In the model, animal traction adoption choice, with two possibilities, viz. use of animal traction and non-use of animal traction, which have been set as the dependent variables. The variable of non-use of animal traction was accepted as the baseline group; therefore, it took the value of zero. Use of animal traction took the value of one. The model was used to determine the odds of households using animal traction to produce food versus household's not- using animal traction to produce food. It follows that Pi represents the probability of not using animal traction to produce food and (1 – Pi) represents the probability of using animal traction to produce food. The probability that the farmer prefers one technology compared to the other is restricted to lie between zero and one (0 _ Pi _ 1). It should be noted that logit (Pi) ranges from negative infinity to positive infinity (Gujarati, 1992)

Table 4. 19 Estimation of binary logistic regression for animal traction adoption and household food security

Variables	B	S.E. Coef.	Z. Value	df	Sig. (P.Value)	Odd Ratios	95% C.I.for odd ratios	
							Lower	Upper
Ha cultivate	5.620	2.468	5.187	1	0.023**	275.822	2.189	34753.331
Total output	.062	.031	3.991	1	0.046**	1.064	1.001	1.130
Cropping. Pract	2.371	1.297	3.342	1	0.068*	10.707	.843	136.007
HH.size	-.117	.600	.038	1	0.846	.890	.275	2.883
Constant	-35.465	16.284	4.743	1	0.029	.000		

Hormer& Limeshow test: Chi square	**0.166**
: Significance	**1.000**
-2 log likelihood ratio	**9.839[a]**
Cox and Snell R^2	**0.717**
Negelkererke R^2	**0.956**

Source: field survey 2013 Significance denoted as follows: * (10%), and **(5%)

4.12.1 Total number of hectares cultivated

A positive and significant at 5% level (0.023) relationship was found between animal traction adoption and total number of hectares cultivated. Total numbers of hectares cultivated are crucial to crop returns, the larger the area cultivated the larger the yields that can be achieved. This ca n result to households having enough food to eat at all times. The relationship implies that households tend to increase in animal traction adoption with the total number of hectares cultivated using animal traction. The value of the odds ratio (275.822) suggests a higher probability of the variable influence on the animal traction adoption choice and that an animal traction adopter will have 275.822 more chance to use animal traction in cultivating bigger area to produce more yields.

4.12.2 Total output of all the crops produced

There was sufficient evidence (significance value of 0.046) to support that total output is likely to encourage households to produce their food through animal traction use. The positive relationship at 5 % level suggests that a use of animal traction power in crop production results to better total outputs. The value of the odds ratio (1.064) suggests a higher probability of the variable influence on the animal traction adoption choice and that an animal traction adopter will have 1.064 more chance to achieve better total output.

4.12.3 Cropping practises mostly technology used for

A positive and significant at 10% level (0.068) relationship was found between animal traction adoption and cropping practises mostly technology used for. The positive relationship suggests that a use of animal traction power in all the cropping practises results in households shifting from non-adoption to adoption of animal traction. The odds ratios (10.707) suggest that an animal traction adopter will have 10.707 more chance to use animal traction in all the cropping practises (ploughing, planting and weeding) to produce more yields.

4.12.4 Goodness of the fit

The goodness-of-fit test for a logistic regression model measures the suitability of the model to a given data set. An adequate fit corresponds to a finding of non-significance for the tests (Hill et al, 2001). The results of the omnibus test of model confidents were not significant with P> 1.000. The chi- square value for the Hosmer and Lemeshow test was 0.166 with a significance level of 1.000. This value is greater than 0.05 indicating support for the model. The model as a whole explained between 0.717 (Cox and Snell R square) and was insignificant ($\rho > 0.05$) suggesting that the model was fit to the data well. In other words a non-significant Hosmer and Lemeshow chi-square statistic indicated that a model had adequate fit and 0.956 (Nagelkerke R square) of the variability in the households ability to adopt animal traction for their food production status.

10.13 Chapter summary

In this chapter different statistical analyses were conducted to address the research questions posed at the beginning of this dissertation. The analyses done included multiple linear regression, T-tests and binary logistic regression analyses. On the multiple linear regressions this chapter provided empirical evidence of the factors determining the key factors influencing differences in total yield of all the crops produced as well as determining the impact of animal traction on agricultural productivity. The statistically significant at 5% level were sources of income for households, number of households cutting the number of meals a day because there was not enough to eat, quantity of inputs purchased by households and groups. On the T- tests ran this chapter provided empirical evidence of the effectiveness and contribution of animal traction and other technologies on household food security. Animal traction was found to be more effective and having greater contributions to household food security when the means of the two technologies were compared, the variables were significant at 1% level. Last but not least this chapter provided empirical evidence of factors influencing use of animal traction in crop production choices amongst rural households at Damane village. The factors influencing use of animal traction choices were defined and tested using a binary logistic regression model. The statistically significant at 5% and 10% respectively variables were cropping practises mostly technology used for, total output of all the crops produced and total number of hectares cultivated. Based on the results of this study, several suggestions can be made on how resource poor households can be actively involved in animal traction adoption in order to fight food insecurities.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND POLICIY IMPLICATIONS

5.1 Introduction

The dissertation broadly covered the issues around agricultural productivity with the use and non-use of animal traction. Animal traction technology has the potential to fight poverty in rural communities in South Africa. Unfortunately, the government has neglected animal traction in country. This chapter will present the summary of the research findings and draws conclusions on the basis of the analysis. The broad objective of the study was to assess the impact of animal traction on rural household food security. More specifically, the study aimed to identify the degree of food security between animal traction adopters and non-adopters, identify the problems encountered by farmers in the project area in the successful adoption and development of animal traction, Identify if animal traction is affordable and easy to use and technology for rural people.

According to the information collected and analysed animal traction has an impact on household food security, the degree of food security differs between animal traction adopters and non-adopters, households were having problems in the successful adoption and development of animal traction and animal traction was not affordable and cheap technology to use, they could not afford to procure animals since they were dependent on old age pension.

5.2 Summary

This part will summarise all the chapters of the study. These include literature review, methodology and study results found.

5.2.1 Literature review

The literature review of this study discussed poverty, food insecurity and the impact of animal traction on food security, constraints that impede the adoption and development of animal traction, development of animal traction in rural areas of South Africa: overcoming

constrains associated with in animal traction, the importance of improved agricultural technologies, the role of national and provincial governments in developing sustainable agriculture in rural areas and the importance of agricultural investment in agriculture.

This section outlined that researches that have been done, animal traction was found to be middle way that could alleviate household food insecurities. However strategies and ideas that were found to be useful regarding the development and adoption of animal traction have not been implemented. The food produced by rural households is used mainly to supplement the food purchased during those times of the year when seasonal crops are harvested. Own food production by households is important because it helps in times when the income-earner is unable to provide money for food purchases. The contribution of own food production to rural households is that it help to increase food security status of the household.

The government should be encouraged to provide people with more implements, spares and animals. It should also employ more extension workers in order to advise and supervise people in rural areas. If animal traction can be well developed in rural areas it can be used as a tool for fighting food insecurities.

5.2.2 Research methodology

The selected area for the study was Damane rural community in Cofimvaba town in Eastern Cape, South Africa. It is located in the Intsika Yethu Local Municipality of the Chris Hani District Municipality. 80 structured questionnaires were used to collect information. The information was collected from 40 households that were using animal traction to produce food and 40 that were not using animal traction to produce food. In this study various types of analyses were carried out to analyse data.

Data analysis involved the use of descriptive statistics, multiple linear regressions, T-test and the binomial logistic regression model. The main descriptive indicators that were employed were frequency and mean values. The multiple linear regressions model was used to examine the linear relationship between explanatory variables and a response variable, specifically focusing to assess the extent to which animal traction contributes to output of all the crops produced last season. The T-test T-tests were computed to compare differences, relative

contributions and effectiveness of animal traction and other farming technologies household food security in the project area. The binary logistic regression model was used to determine factors influencing animal traction adoption choices and odds of households adopting animal traction in Damane rural village. Binomial logistic regression model was chosen because it is useful in analysing data where the researcher is interested in finding the likelihood of a certain event occurring.

5.2.3 Descriptive results

Descriptive results provided information related to demographic characteristics, agricultural production process of the households, kind of technology used to produce food, assistance received from government regarding the use of technology, household's food security statuses, marketing of produce and credit for agricultural purposes.

The demographic characteristics results showed that the youngest household head was 30 years old and the oldest was 70 year's old .This suggests that animal traction in rural areas was only practised by older people. This may be because young people migrate to rural areas for better jobs. The results also showed that there were 59 males and 21 females. This means that farming in rural areas was practised by both males and females with larger proportion of males than females. This is because males are more physically stronger than females. Males also are capable of handling heavy implements used in animal traction operations. The educational levels of many household heads are generally low as 48.75% did not attend school at all and also 42.5% who had attended secondary school. 65 respondents out of 80 had social grant as a major source of income a total income R1200.00 per month.

Agricultural production process of the household's results showed that all 80 households had access to land. 66 respondents out of 80 cultivated less of their available land because of the lack of capital.

Kind of technology used to produce food showed 26 non animal traction adopters did not use animal traction to produce food because it was costly for them to purchase animals and the distribution of the respondents was 65%. The major problem encountered by house households was not having enough animals, spares and implements.

5.2.4 Results of the models used

Results of the models revealed significant differences between animal traction adopters and non- adopters. The results suggested that animal adopters are more productive than non – adopters in the productivity of all the crops produced last season. This was because animal traction was suitable and effective for cultivating bigger areas of land thus contributing positively to household food security than hoes, fork and fork spades. The results of the multiple linear regressions in table 4.13 above show that sources of income, quantities of inputs purchased by households, number of households cutting meals because there was not enough to eat and groups had a strong positive linear relationship at 5% level with animal traction power on the total output of crops produced. This was because animal traction was effective for cultivating bigger areas of land. This resulted in adopters purchased larger quantities of inputs thus achieving more total outputs than non- adopters. The results of the of T- test in table 4.14 above showed that animal traction was effective and having greater contributions to household food security compared to spades, fork spades and hoes when the total number of hectares cultivated, cropping practises mostly technology used for and quantity of inputs purchased by households were computed to determine differences in means and standard derivations values and all these variables were significant at 1% level. The results of the of binary logistic regression model in table 4.30 showed probability that households would adopt animal traction and factors that would influence their choice to shift from non- use to use of animal traction include cropping practises mostly animal traction used for, total output of all the crops produced and total number of hectares cultivated using animal traction and they were statistically significant at 5% and 10% respectively.

5.3 Conclusion

The thesis assessed the impact of animal traction on rural household food security. Using data collected at Damane rural village of Cofimvaba in the Eastern Cape. Descriptive statistics, multiple linear regression, t- test and binary logistic regression models were used to assess the impact of animal traction on household food security. The results of the analyses showed that animal traction had a positive impact on household food security. Animal traction was found to be effective and most suitable technology on household agricultural productivity.

Having the observations from the different results allowed to derive conclusions regarding the impact of animal power on agricultural productivity in the village. Therefore the overall

conclusion from the analysis is that an improvement in animal traction power is essential as it can be used as a middle way towards improving household food security levels in the project area. Animal power should be seen as the easy to use and readily available technology for resource poor farmers. It can empower rural communities especially resource poor farmers in the country. Draught animals will be able to serve rural communities in many key areas such as transport, food security, and the reduction of drudgery in rural life.

5.4 Recommendations

Since animal traction plays a major role in household food security its development should be taken into consideration. Government should intervene and to try to provide all the relevant and necessary resources needed for better adoption and development of animal traction especially in rural areas where households use animal traction for food production. Rural dwellers find animal draught power easy to use, before the planning and implementation of strategies aimed at improving household food security, rural communities should be consulted and asked what they need in order to produce food efficiently, what the challenges do they face in production and how they think those challenges should be addressed. Most people have indigenous technical knowledge of how to use animal draught power to produce food therefore they should be subsidised with animal traction equipment's and animals to grow crops, and be given access to productive land. It is also noted in the literature review that for a rapid development and adoption of animal traction in rural areas. Effective and sufficient extension services should be provided to people, people should be educated about good management of draught animals; for example, the provision of adequate housing, working periods and how to use animal draught power effectively in order to produce high yields. Government should make sure that extension officers are aware of the publications produced by animal traction researchers, ATNESA and SANAT networks as they contain a lot of information how animal animals should be treated and handled for better performance.

Promotion of animal traction workshops, networking, and information exchange can also lead to sustainable development of animal traction in the rural areas of South Africa. Animal traction workshops and networks link animal traction specialists all over the world. Networks and workshops help to improve knowledge and information exchange and to promote relevant research, development, training and policies concerning the use of animal draught power, and to learn from the experiences of other African countries through multidisciplinary

teams. Governments and Nongovernmental organizations should support the animal traction networks ATNESA and SANAT in conducting these workshops for better development and adoption of animal draught power. Government should also intervene and address the issues related to veterinary services in rural areas. There should be provision of effective veterinary services in rural areas. People have insufficient knowledge on how to keep animals in good health.

5.5 Policy implications

Policies that strengthen the development of animal traction for improved household food security are also recommended. Households can produce food for their households using cost effective and easy to use technology. People generally lack relevant understanding and knowledge of animal traction, therefore studies concerning the development of animal traction should be added in the educational and training curricular of primary, secondary schools and also in the colleges and universities. The department of agriculture should include the development of animal traction on into its national agricultural policy to increase the support provided to farmers by the government to acquire relevant knowledge and skills on the way to better utilise the land acquired under the land reform programme.

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APPENDICES

THE QUESTIONNAIRE

APPENDIX 1

University of Fort Hare
Together in Excellence

Department of Agricultural Economics and Extension

Faculty of Science and Agriculture

University of Fort Hare

Alice

QUESTIONNAIRE

AN ASSESSMENT OF THE IMPACT OF ANIMAL TRACTION ON RURAL HOUSEHOLD FOOD SECURITY: A CASE STUDY OF INTSIKA YETHU LOCAL MUNICIPALITY.

Name of household head	
Name of the village	
Questionnaire No:	
Date of the interview	

1. **DEMOGRAPHIC INFORMATION**

A. Gender of the household head	Male	1
	Female	2

B. Age of the household head	In years	

C. Marital status	Single	1	Married	2	Divorce	3	Window	4

D. Household size	

E. WHAT IS THE HIGHEST EDUCATIONAL LEVEL THE HEAD OF HOUSEHOLD HAS COMPLETED?

No formal educatio	Primary school only	Secondary/High sch	Tertiary educati	Other (specify)
1.	2.	3.	4.	5.

F. What is the major source of income for the household?

1 employment a remittances	2.Employment	3.Farming	4.Social grants	5.Remittance	Other (spec

2. AGRICULTURAL PRODUCTION PROCESS OF THE SURVEYED HOUSEHOLDS

A. Do you own the land which you are using crop production?

1: YES		2: NO	

B. Number of Ha owning

1. <1 ha	2. 1 ha	3. > 1 ha	4. <2 ha	5. 2 ha	6. >2 ha
7. OTHER					

C. Number of Ha cultivated

1. <1 ha	2. 1 ha	3. > 1 ha	4. <2 ha	5. 2 ha	6. >2 ha
7. OTHER					

D. If you are utilizing less of the available land what are the reasons?

1. land not suitable for cultivat	2= lack of capital;	3.lack of water for irrigation

E. Source of capital for farming

1.Own savings, stockvel and remittances;	2. Own savings and stokvel

F. Do you hire labour (hireLbr)

1= No	**2 = Yes**

1.Rain and sprinkler through Ncora dam	2= River	3= Rain

3. **KIND OF TECHNOLOGY USED TO PRODUCE FOOD USED**

A. What do you use to produce food

1.Animals	2.Spade, fork spade and hoe

B. How many years have you known and used animal draught power to produce food?

1. 10 years	2. 20 years	3. 50 years	4 .Other (specify)

D. Do you use your own animals?

1= No	**2 = Yes**

E. **Type of inputs purchased**

1= Seeds	2= Fertiliser	3= Seedlings	4= Pesticides	5= Seedlings	6= Seeds

F. Quantity of inputs usually purchased

1= 1 to 3 Kg;	2= 4 to 6 Kg

G. Cropping practises most technology used for

1 = Ploughing	2= Planting	3= Weeding	4= Transport produce to home	5= Ploughing	; 6= All	

H. Quantity of crops produced last season in each of the following crops??

Potatoes	Cabbage	Spinach	Maize	onion	beans	carrots	other
1.	2.	3.	4	5	6	7	8

I. Number of months the harvest lasts

1= 1 to 3 months	2= 4 to 6 months	3= 7 to 9 months	4= 10 to 12 months

J. What impact does the technology has on household food security

1= Positive	2= Negative

K. Reasons for adopting and not for adopting animal traction

: 1= Costly to use (expensive to procure animals);	2= Not easy to use	3= Not always ready and available	4= Easy to use	5= Always ready and available	6= Less costly;	7= Easy to use and always ready and available

L. Do you encounter any problems regarding the use of technology

1= No	**2 = Yes**

M. What are the problems

1= Do not have enough tools	2= Do not have enough animals and implements	3= Do not have feeds, implements and vaccines

N. How can the problems be addressed?

1= Provision of capital	2= Provision of tools	3= Provision of animals and capital	4= Provision of feeds, implements
5= Provision of implementation, animals, and capital			

4. **ASSISTANCE RECEIVED REGARDING THE USE OF TECHNOLOGY**

A. **Have you ever received any assistance from government regarding animal traction?**

1 = yes	2. No

B. If yes what kind of assistance did you received?

1.Subsidies	2.monetary	3.Advisory	4.Training	5.Other (specify

B. Was the assistance helpful to you?

1: YES		2: NO	

If YES how was it useful?.....

.....

.....

If NO how was it not useful.....

.....

....

H. Has the use of animal traction made you more food secured?

1: YES		2: NO	

5. HOUSEHOLD FOOD SECURITY LEVELS OF HOUSEHOLDS

A. Does your household ever run out of money to buy food?

1: Yes		2: No	

B. Do you ever cut the size of meals or skip any because there is not enough food in the house?

1: Yes		2: No	

C. How is your household currently ensuring that there is enough food for everyone in the household?

1.Social grants	2. Cultivated fields	3.Cultivated home gardens	4.Remittances from other areas	5.Employment

D. . What are the main stable foods for the household?

1. Rice	2. Maize	4. other (specify)	

E. .Did your household plant or harvest any staple crops during the past 12 months?

1: Yes		2: No	

I. Does your household buy any complementary good

1: Yes		2: No	

J. Are you food secured with the technology you are using

1= Moderately food secured	2= food secured

K. Purpose of producing crops

1. **for marketing**	2. **for consumption**

6. MARKETING O F PRODUCE

A. Do you normally market your produce?

1: YES		2: NO	

B. If yes what portion do you normally market?

< half	half	>half	all	Other (specify)

1.	2.	3		5

C. Which markets do you usually use for selling your produce?

Formal markets	Informal markets	I do not sell	Other (specify)
1.	2.	3	4

D. Do you encounter any problems in marketing your produce?

1: YES		2: NO	

E. If yes which problems do you encounter?

< half	half	>half	all	Other (specify)
1.	2.	3	4	5

5. CREDIT ACQUISITION FOR AGRICULTURAL PURPORSE

A. Do you need credit for farming?

1: YES		2: NO	

B. If yes what do you need credit for?

Buy inputs	For fencing	labour	to buy animals, inputs, and fee	to buy tools, implemen animal
1.	2.	3	4.	5

C. Do you have collateral for credit acquisition

1= No		**2= Yes**	