

**TO EVALUATE THE EFFECT OF SELECTED SOCIAL ECONOMIC FACTORS ON  
SWEET POTATO VINE CONSERVATION METHODS ADOPTED BY THE FARMERS  
OF KORO SUB-COUNTY, GULU DISTRICT**

by

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**2013-B053-10002**

A research report presented to

Uganda Martyrs University  
*Making a Difference*

**FACULTY OF AGRICULTURE**

in partial fulfillment of the requirements for the award of the degree

**Bachelor of Science in Agriculture**

**UGANDA MARTYRS UNIVERSITY**

Supervisor: Kabango Freddie

August 2017

## **DEDICATION**

This dissertation is dedicated to my siblings Sandra, Gloria, Richard and Charles. I have only set the benchmark and pray that you will achieve beyond and above me always.

## ACKNOWLEDGEMENT

I would like to acknowledge everyone who has made this research work and the entire course possible for me. The entire university teaching team for the knowledge accorded to us during the learning period. Special recognition to my supervisor Mr. Freddie Kabango for his encouragement, you have really inspired me; the seed you have sown will live on in me.

My loving and adorable mother, Rose Angela Adoch, I know that by now I should have started to help you take care of my little siblings yet you gave me all the time to complete my education. You have always said later is better than now, you are the best gift to me ever.

My friend Eric Okori for timely submitting my application forms, I wouldn't have completed with this lot without your selfless and timely sacrifice.

Not forgetting also my friend Mr. Odwar Denis who encouraged me a lot in the process of writing this book and also helped edit my work.

Bornmax Otim, those words of encouragement you have always spoken into my ears have not been in vain and this is what I have to show for it. I thank you.

The entire class of 2013-2017, through updates and challenging ourselves ,one to another to work harder by setting paces in coursework submission and completion of research. I couldn't have been anywhere than in this class.

## **LIST OF ACRONYMS**

SPVD- Sweet Potato Virus Disease

SPFMV -Sweet Potato Feathery Mottle Virus

SPCSV-Sweet Potato ChloroticStunt Virus

VSLA- Village Savings and Loans Association

NAADS- National Agricultural Advisory Services

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## ABSTRACT

This research focused on examining the effect of selected social-economic factors on sweet potatoes vine conservation methods adopted by the farmers of Koro Sub- County, Gulu district. The study used a cross sectional research design which involved using qualitative and quantitative research methods to collect and analyze data.

Farmers selected as respondents were selected by random sampling, 15 farmers per parish with experience in sweet potatoes growing and vine conservation. The data was collected using questionnaire method. 35% male and 65% female were interviewed. This implies that more females were involved in sweet potatoes growing than male. Male concentrated on cash crops like coffee, cotton and agricultural processing in the trading centers.

The community was still segregating roles of women and men. 47.6% had attained secondary education, 27% had primary level and 25.4% had attained tertiary level of education, education influenced the way farmers' access information on sweet potatoes vine conservation. The highly educated preferred television, newspapers and radio publications, while less educated mainly used a radio as source of agricultural information.

The age bracket of 31- 40 years was dominant in sweet potatoes growing activities. Between the age brackets 21-30, involvement in sweet potatoes growing reduces. The youth and other able bodied have adapted other options of income than agriculture like; boda boda ridding, processing, telecoms and saloons, leaving only the aged with the hoe.

Gender, though more female were involved in sweet potato growing by 65%, only 50% of the women were allocated at least 3 acres of land for sweet potato growing by their husbands, especially in men headed households.

The recommendation reveals that farmer's knowledge on conservation of sweet potato vines were mostly watering/valley bottom production. Farmers need to be educated to adopt the use of other methods like, triple 'S', and rapid multiplication. Most of the youth are engaged in other income generating activities like boba boda riding and small scale businesses other than sweet potato vine conservation and production and other agricultural production. Youths should be mobilized in groups and encouraged to engage in crop production and also benefit from the on-going government program like operation wealth creation.

The general community should also come out to promote sweet potato vine conservation with the youth; popularizing agriculture through songs, drama, cultural and religious leader engagement and introducing agricultural clubs at schools. These would help promote food security in Koro Sub- County. Most of the men like engaging in what give them money directly like micro-businesses and less engaged in sweet potato production and vine conservation. The district must liaise with other commercial structures to add value and market sweet potatoes, so that farmers are able to sell their sweet potatoes at a good price and it becomes one of the prioritized agricultural products.

# CHAPTER ONE

## GENERAL INTRODUCTION

### **1.0 Introduction**

The study evaluated the effect of selected social economic factors on sweet potato vine conservation methods adopted by the farmers of Koro Sub-County, Gulu district. There are gaps in terms of education level of farmers, age factor and farmers' participation in terms of gender in sweet potato vine conservation.

This chapter consists of the background of the study, the problem statement, research objectives, conceptual framework, research questions, scope, and significance of the study and justification of the study.

### **1.1 Background**

Botanically sweet potatoes or Spanish potatoes are called *Ipomoea batatas* (L.) Lam, belongs to the morning glory family Convolvulaceae and originated from Latin America. Sweet potatoes ranks as the world's seventh most important food crop, after wheat, rice, maize, potatoes, barley and cassava. More than 133 million tones are produced globally per year.

Historically, sweet potatoes has been a lifesaving disaster crop, for example the Japanese used it when typhoons demolished their rice fields, and it kept millions from starvation in famine-plagued China in the early 1960s and in Uganda, when a virus ravaged cassava crops in the 1990s rural communities depended on sweet potatoes to keep hunger at bay. Sweet potatoes are high in carbohydrates and vitamin 'A' and can produce more edible energy per hectare per day than wheat, rice or cassava, FAO (2013). It has abundant uses, ranging from consumption of fresh roots or leaves to processing into animal feed, starch, flour, candy and alcohol. The crop can be grown in

poor soils with little fertilizer and has hardy nature and broad adaptability. Uganda is the main sweet potato-growing country in Africa Anon (2002), with production of over 2.7 million tones, mostly for human consumption and the second leading producer after China at 117 metric tons globally FAO (2003).

Although Uganda is the second largest producer of sweet potato after China, farmers still realize low yields, averaging only 4,500 kg per hectare 1800 kg per acre compared to 30,000 kg per hectare 12,000 kg per acre obtained on research stations. The wide yield gap is due to a number of reasons, including; use of local varieties with low yield potential, pests and diseases, shortage of planting materials, non-availability of improved varieties, and poor crop husbandry practices such as poor seed bed preparation, low or high plant population, late planting, late weeding and poor soil fertility management.

Timely access to quality planting materials/seed in their adequate quantities still remains a major challenge for small scale farmers in developing countries. This is largely due to the limited coverage of formal seed systems in these developing countries. This makes farmers to continue depending on local/informal seed systems.

According to Almekinders, (2000) farmers' produced, selected and stored seed is still the predominant source of seed in the world. This is particularly the case in developing countries. Almekinders, 2000also noted that only 1% of rice growers in Tanzania (an example for East Africa) depend on a formal seed system while 99% use informal seed sources.

The inability of formal, centralized seed production systems to meet the complex and diverse seed requirements is also a major reason for the low adoption of modern varieties of seed among smallscale farmers in developing countries Soniia, (2004). Drawing on experiences in Uganda with

the common bean, Soniia, (2004) proposed seed production by Farmer Seed Enterprises (FSEs) as a strategy for meeting dual objectives of sustainably distribute and promote modern crop varieties and establishing a regular source of “clean” seed of either local or modern varieties. FSEs will particularly be very beneficial to Potato farmers because potatoes are vegetatively propagated and it’s planting material is bulky, difficult to store and transport. This makes it of little importance to seed companies because it brings little profit Soniia, (2004).

A good seed system for sweet potato can best succeed when FSEs can effectively propagate and multiply sweet potato planting materials to suit its market demands in time.

This is easily achieved in areas with adequate residual moisture content all year round to support vine sprouting and multiplication. However, it is particularly precarious in areas with long dry spells which makes propagation and multiplication of vines during the dry season very difficult.

Since sweet potatoes forms a major staple food and a potential income earner for many communities that lie within the regions with long dry spells, current instability in rain patterns, frequent droughts and extended dry spells in Northern Uganda pose a significant risk to the livelihoods of such communities.

A research in effective conservation and multiplication of vegetatively propagated crops like sweet potatoes in areas with long dry spells is inevitable. Success in these areas will avail farmer seed enterprises with mechanisms to produce quality planting materials in adequate amounts in the right time for the success of the crop in the gardens. This research sought to avail such solutions.

## 1.2 Research Problem

Agriculture is the back born of Uganda's economy contributing 24% of the GDP and employs over 82% of the labour force Abola (2015). Farmers engaged in subsistence, semi-commercial and commercial farming. At least 10 million Ugandans faced food insecurity according to the January 2017 National Food Security Assessment Report in the areas of lango, Aholi ,Teso and Karamoja and the leaders appealed for help as the locals resorted to survive on wild plants, handouts and food donations. Sweet potato is vegetatively propagated whose usual source of planting material for farmers without access to areas without residual moisture during the dry season is the vines left in the field from the previous season's crop. In such areas, the vines become desiccated. Left over roots re-sprout with the onset of rains but up to two months are needed to produce sufficient vines for planting and for the vines to mature. As a result, the amount of planting material is limited, restricting the total area that can be planted. Sweet potato is planted late thus reducing the potential for high root production with greater risk of transmitting pests and diseases from one season to the next through using potato vines which could have been affected by pest and diseases in the old season and planting the same vines in the new season. The tools used for cutting the vines should be managed well so that infection is not carried to the next season.

This has a socio- economic connotation because in most cases farmers cannot afford the cost of agricultural trainings, to enhance healthy conservation of sweet potato vines and proper management of the agricultural tools used in the conservation and plantation of sweet potatoes.

Therefore the research study is aimed at providing a documented account of how education level, age aggregation, gender related issues and socio- economic factors can affect the conservation of sweet potato vines in Koro Sub- County, Gulu district.

### **1.3 Objectives of the study**

#### **1.3.1 General Objective**

To evaluate the effect of selected social economic factors on sweet potato vine conservation method adopted by the farmers in Koro Sub- County Gulu district.

#### **1.3.2 Specific Objectives**

- i. To examine the effect of education level on sweet potato vine conservation methods adopted in Koro Sub-County, Gulu district.
- ii. To investigate the effect of age on the sweet potato vine conservation method adopted in Koro Sub-County, Gulu district.
- iii. To determine the relationship between farmers' gender and sweet potato vine conservation method adopted in Koro Sub-County, Gulu district.

### **1.4 Research Questions**

- i. What is the effect of education level on sweet potato vine conservation methods adopted by farmers in Koro Sub-County, Gulu district?
- ii. What is the effect of age on the sweet potato conservation method adopted by farmers in Koro Sub-County, Gulu district?
- iii. What is the relationship between farmer's gender and sweet potato conservation method adopted by farmers in Koro Sub-County, Gulu district?

### **1.5 Scope of the study**

### **1.5.1 Content Scope**

The study focused on evaluating the effect of selected social economic factors in sweet potato vine conservation adopted for domestic and commercial potato production with specific focus on effect of education, age and gender in sweet potato conservation method adopted by the farmers in Koro Sub-County, Gulu district. It focused on all farmers who grow sweet potatoes irrespective of being trained in vine conservation in the Sub- County.

### **1.5.2 Geographical Scope**

The study was conducted in Koro Sub- County, Gulu district located in Northern Uganda. The Sub-County has 5 parishes with 35 villages, it has vast virgin land, and fertile used to plant different crops like sorghum, sweet potatoes, sesame, cassava, millet, vegetables among others.

### **1.5.3 Time Scope**

The study covered the period between 2013- July, 2017. The choices of the time frame was vital as it covered the period between the beginning and the end of the course.

## **1.6 Significance of the Study**

The study is significant because it serves as a guiding tool to extension workers in conducting community training to sweet potato farmers. It also contributes in building capacity of the sweet potato farmers and improvement in the production of sweet potatoes in large quantity if well utilized.

The information in this research may also be used as a reference point for researcher interested studying more about other aspects of sweet potato growing in different parts of the country and world over.

### **1.7 Justification of the study**

Sweet potatoes is one of the main staple food crop grown in Gulu district for domestic and commercial purpose but due to prolonged dry spell, water deficiency causes stunted growth leading to 30 - 50% yield loss in most farmers' fields. The weevils during the dry season also destroy the tubers before harvesting and finding planting material is not easy for most farmers (Talengera, 2013). The government and it's agencies could have initiated research and educate the farmers in sweet potatoes on the different methods of vine conservation and help farmers to market their harvested sweet potatoes to boost the farmer's income. This research will bridge the gap since it has alternatives to vine conservations methods and provided statistical observations basing on education level, age factor and gender as far as vine conservation in concerned. There are also recommendations in this work which when taken into consideration will definitely reduce the gaps identified.

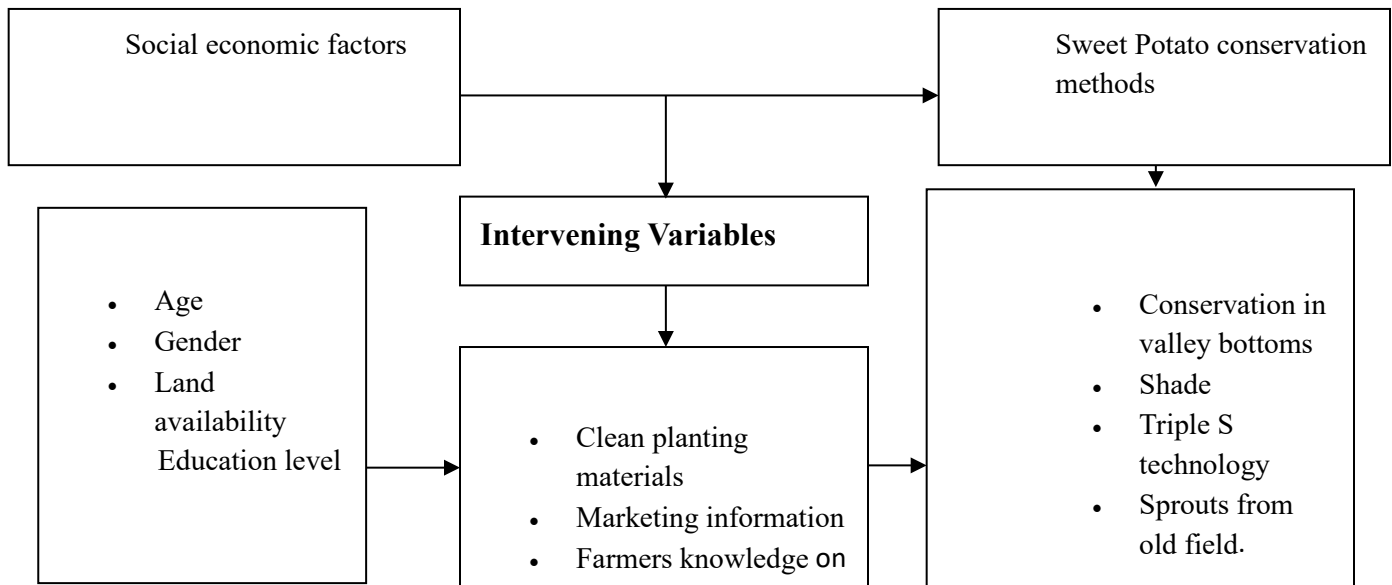
### **1.8 Conceptual framework**

The conceptual framework drawn below shows the relationship between the independent and dependent variables. The independent variable comprise of social economic factors like; age, education level, land availability and gender while the dependent variable consist of sweet potato conservation methods like; the valley bottoms, shade, triple technology and sprouts from old fields. The intervening variables include; clean planting materials, market information, farmers' knowledge and natural sprouting.

## Conceptual Framework

### Independent variable

### Dependent variable



Source: Researcher's Model 2017

## CHAPTER TWO

### LITERATURE REVIEW

#### **2.0 Introduction**

This chapter reviewed the available literature related to evaluating the effects of socio-economic factors in the methods of vine conservation adopted by farmers. The review is conceptualized under theory about sweet potatoes, the specific objectives of the study focused primarily on the effect of education, age and gender in sweet potato vine conservation methods adopted by farmers in Koro Sub-County, Gulu district and a summary of literature reviewed.

#### **2.1 Theoretical review of sweet potatoes**

Sweet potato (*Ipomoea batatas*) is an important crop in Uganda and is ranked third in importance as a food crop after banana and cassava Bashaasha *et al.*, (1995). Globally, Uganda is among the top leading producer of sweet potato after China and Nigeria, FAO (2013). However, yields of sweet potato at farm levels are relatively low averaging 4.2 t/ha FAO, (2002). The low sweet potato yields at farm levels are attributable to a number of production constraints of which Sweet Potato Virus Disease (SPVD) caused by the dual infection of the sweet potato feathery mottle virus (SPFMV) and Sweet potato chlorotic stunt virus (SPCSV) is the most important (Geddes, 1990, Bashaasha *et al.*, 1995; Aitua *et al.*, 1998a, b; Karyeija *et al.*, 1998, Bua *et al.*, 2001, 2005, 2006). Yield loss attributable to SPVD is variable but loss of up to 98% has been recorded in Uganda. Other factors include limited access to quality planting materials and unreliable weather patterns, Karyeija *et al.* (1998). Vegetatively propagated planting crops such as sweet potato are particularly not popular because they bring little profit to seed companies for several reasons including but not limited to uncertain and fluctuating demand caused by competition from farm-saved seed, low

multiplication rates, transportation, storage difficulties and strong regional specific preferences Almekinders, (2000).

Over time, sweet potato farmers have developed their own practices which to a large extent reflect the influence of mono-modal and bi-modal rainfall patterns. Farmers source planting material from their own fields, neighbors, friends or kin Namanda, Gibson *et al*, (2011). The exchange of planting material is either done freely or sold; the modality depending on the geographical or social proximity of the source, time in the season and presence of strong root markets Barker, Andrade *et al*, (2009). Sweet potato vines conservation and multiplication in areas with longer dry spells greatly affect the following; availability of vines at the on-set of rains, time of planting and harvesting of sweet potato roots, food availability. Over time, sweet potato conservation and multiplication methods have evolved, in bi-modal rainfall areas, sequential planters ensures that such crop is in the ground for most of the year, and vines are harvested from one crop to plant the next one. In un-moral areas with a long dry season, practices include the use of ‘volunteer’ planting material from sprouting roots which have been left in the ground from the previous crop. The predominant sources of planting material are from the farmer’s own field or from friends or neighbors. However, these practices result in limited amounts of planting material being available at the start of the rains and contribute to the build-up of pests and diseases leading to sub-optimal root crop production.

## **2.2 Effect of education level on sweet potato vine conservation methods adopted by farmers**

Education is broadly defined as the act of acquiring knowledge, skills, values, attitudes and best practices Asenso-Okyere *et al*, (2000). Education can be divided into two broad categories namely formal and informal education. Formal education has been recognized as the most effective way

to develop the human potential. Formal education represents all forms of education that requires people to acquire education or skills through a structured system or institution recognized by the Ministry of Education Asenso- Okyere *et al*, (2000). People who pass through these centers of education are presented with some certificate of award in recognition of the successful completion of the programme. Formal education in Ghana is divided into three divisions and these are: i. Basic Education (Primary and Junior Secondary), Secondary Education, Tertiary Education, Informal education largely deals with the education of adults or people not following the formal classroom education culminating in the award of certificates or degrees Asenso- Okyere *et al*,(2000). To a large extent, informal means of education are aimed at making people either functionally literate or enable them acquire some skill or vocation.

There are three basic types of informal education and these are: i. Adult Education (Non-formal Education) ii. Artisanal Training (Apprenticeship) iii. Extension Education. The functional literacy programme is action-oriented and is designed to address the educational needs of adults, especially the rural poor with emphasis on women and girls. Extension Education programmes is managed by the Ministry of Food and Agriculture (MOFA) and COCOBOD and has been largely limited to agricultural services. Formal extension education are concerned with the training of personnel to recognize farmers' problems, identify farmers' training needs, design training programmes and, above all, plan intelligent and appreciable extension programmes for the rural people.

The various forms of informal extension education given to farmers include technical; the division came about after 1987, when the Educational Reform Programme was initiated. Previously we had Basic Education (Primary School of 6 years and Middle school of 4 years). University of Ghana advice on production, multiplication and supply of improved planting materials, advice to women farmers on home management and nutrition, among others Asenso-Okyere *el al*, (2000) Education,

as one of the components of human capital has long been recognized as one of the major cutting edges of development and growth of the economies of developing countries. Education is a major instrument for economic and social development.

According to World Bank (1995), education is central to its strategy for helping countries to reduce poverty and improve their living standards through sustainable growth and investment in people. The two-fold strategy, according to the World Bank (1990) calls for promoting the productive use of labour - the principal asset of the poor and providing basic social services to the poor. Education is critical for and contributes to economic growth and poverty reduction (Becker, 1964 and 1993; Singh et al, 1986; World Bank, 1986 and 1995; Peaslee, 1965 and 1969), but by itself it will not generate growth (World Bank, 1995). The strongest growth comes about when investment in both human and physical capital takes place in economies with competitive markets World Bank, (1995). It contributes to growth both through increased individual productivity brought about by the acquisition of skills and attitudes and through the accumulation of knowledge. Indeed, education produces the knowledge, skills, values and attitudes that are used in the productive sectors of the economy of most countries to earn income and generally for development. Improved attitudes, beliefs and habits may lead to greater willingness to accept risk, adopt innovations, save for investment and generally to embrace productive practices (Appleton and Balihuta, 1996; Cotlear, 1990). A large part of economic growth stems from improvement in the quality of the labour force, including increased education and better health, together with technological progress and 13 University of Ghana <http://ugspace.ug.edu.gh> economies of scale (Becker, 1993; Schultz, 1964; Denison, 1967; World Bank, 1991). A report by the World Bank (1995) has observed that investment in education leads to the accumulation of human capital, key to increased incomes and sustained economic growth. The accumulation of human capital-knowledge as noted by Romer

(1986) facilitates the development of new technologies and is a source of self-sustaining growth (Lucas, 1988; Barro, 1991). The role of human capital in the development process has attracted a lot of attention (Schultz, 1964 and 1972; Becker, 1964 and 1993; Welch, 1970). Growth theorists such as Romer (1986, 1990), Lucas (1988, 1993) and Azariadis and Drazen (1990) have shown that the accumulation of human capital can sustain long-term growth. Economies develop and grow as a result of increased productivity in all sectors and this can only be achieved if the labour forces in these important sectors are well educated. The labour force should as a matter of fact possess all the requisite skills, ideas and attitude that will aid them to increase productivity and achieve high rates of return to investment (Psacharopoulos, 1984; Becker, 1993; Weale, 1993) by embarking on value for money projects and programmes. The outstanding economic development of the human capital concept has provided economists with a useful framework for investigating the relationship between education and productivity in the agricultural sector and income (Hansen 1970; Knight, 1987). Human capital analysis assumes that schooling raises earnings and productivity in the agricultural sector mainly by providing knowledge, skills and a way of analyzing problems. As stated by Becker (1993) an alternative view, however, denies that schooling does much to improve productivity, and instead it stresses "credentialism"- that degrees and educational qualification convey information about the underlying abilities, persistence, and other valuable traits of people. Becker admits that credentialism exist but explains that it does not explain most of the positive association between earnings from agricultural activities and schooling. He used the linear two-staged least squares to estimate micro-economic evidence on the impact of education on farm productivity. The conclusions however varied, depending on where the data used in the analysis is taken from. Generally, while it has been established that better-educated workers earn higher wages in the modern sector (Fafchamps and Quisumbing, 1998), it

remains a contentious issue whether education raises farm productivity. Studies using survey data from Asia, South America and other developed countries have come out with a positive effect of education on farm productivity (Jamison and Moock, 1984; Lockheed, Jamison and Lau, 1980; Philips, 1994, King, 1980). But evidence from Africa indicate otherwise- low rates of return to formal schooling and sometimes negative marginal effects ( Moock, 1981; Appiah-Kubi *et al*, 2001 Weir, 1999) Food security is achieved when all people at all times have access to sufficient food for a healthy and productive life (Haddad, 1997). Siamwalla and Valdes (1984) however define food security as the ability of countries, regions or households to meet their required levels of food consumption all times. Food security has three main components: food availability, food access, and food utilization. Food availability refers to the need to produce sufficient food in a way that generates income for small-scale producers while not depleting the natural resource base, and to the need to get this food into markets for sale at prices that consumers can afford.

The second component relates to people's ability to get economic access to food. Economic access is typically constrained by income: If households cannot generate sufficient income to purchase food, they lack and entitlements to that food. The final component concerns an individual's ability to use food consumed for growth, nutrition, and health: in an environment lacking clean water, sanitation, child care, and health facilities, the ability to use food to promote health and nutrition will be impaired, particularly for young infants. Many countries aspire to achieve food security, which is not synonymous with food self sufficiency. Self-sufficiency in food supply refers to the internal capacity of a country or household to supply all the food it requires, whereas food security does not require self-sufficiency in food supply. Food security can be achieved by importing food or buying food, as long as one has the capacity to import additional food or buying it from others without involving undue supply risks. We have supply-side and demand-side factors determining

food security in the country. Supply of food is affected by the national resource endowment, availability of technology and its dissemination (for food production, storage and preservation), prices, market opportunities and ability to augment own production with external supplies when the need arises. On the demand side, food security is affected by household incomes and economic assets (including stock of animals), prices, demographic factors such as number, gender and age composition of household and socio-cultural factors like health and sanitation status, educational level, cultural norms and food composition habits. Food Security can be achieved through increased agricultural productivity. But agricultural productivity is low among traditional peasant Ghanaian farmers who apply low productivity enhancing inputs such as fertilizers and agrochemicals. Though growth in agricultural production and increases in agricultural productivity have been the main objectives of the agricultural policies of the past and present governments, sustained success has eluded policy-makers on both counts Nyanteng and Seini (2000). Achieving food security would ultimately lead to adequate food consumption and export of surpluses. Food security in its entire dimension cannot be achieved in a vacuum. It can only be achieved if food crop producers and livestock farmers are technically efficient in their production. But high cost of inputs, low application of these inputs and slow rate of adoption among others, constrain productivity. Education has for long been an investment and good in the economy of many nations, in several developed countries less than 5% of the Economically Active Population (EAP) is involved in agriculture but they are able to produce more for home consumption and for export. The level of education of farmers in these countries plays a major role in agricultural production. The situation is quite different in Ghana, where more than 50% of the EAP are into agriculture and its related activities but food security attainment is a problem with occasional shortages of food mostly in the northern savannah areas of the country. This can lead to transitory food insecurity,

which could be temporary or transient, arising from temporary shortfalls in food supply relative to requirements, or because of a temporary loss of adequate effective purchasing power for food. The factors that lead to temporary food insecurity include seasonal and annual fluctuation in food production, natural catastrophes, temporary loss of employment etc. It is believed that the more educated the producer is, the more he or she is likely to move into the production of high income earning crops or animals whenever any of these causes are prevalent in an area Philips *et al*, 1990). According to Okai (1997) a positive technological intervention is needed to improve the performance of the agricultural sector through recombination of resources. The ability to do this can only come from farmers who have more knowledge in modern farming and can shift resources from the production of one crop to the other. In Ghana, agriculture accounts for about 60-70% of the labour force as stated earlier in the study and contributes about 40 percent of GDP but budgetary outlays are inadequate. Small holder agriculture dominates with most of the farming population in the rural area. Although technological research has come out with improved modern methods of farming, adoption rates are low among farm households in Ghana. Even those who have adopted these modern farm methods are unable to expand their holdings due to a number of reasons.

### **2.3 The effect of age on the sweet potato vine conservation method adopted by the farmers**

The Ugandan population is to a large extent comprised of a high and increasing cohort of young people, close to 78% of the population is below the age of thirty. Evidence reveals that youth engagement in agriculture is declining amidst rising youth unemployment yet the services and industrial sectors despite growing at considerably faster rates have not created enough jobs for the burgeoning youthful labour force. This may have implications on food security, unemployment, and underemployment and may undermine the government efforts to drive economic growth

through agriculture. Using data from the Uganda National Panel Survey data of 2005/6 and 2009/10, we examine youth employment dynamics across the different sectors and further provide insights into the determinants of youth participation in agriculture. Using the Uganda Census of Agriculture 2008/09, we further document the challenges and constraints inherent to the youth in agricultural production relative to adults. The findings reveal that youthful farmers are concentrated more in agricultural production. Furthermore, a relatively lower percentage of youth use improved inputs (such as improved seeds, fertilizers, agricultural chemicals and veterinary drugs). With this poor rate of adoption of appropriate inputs, productivity is likely to remain low and constrain the youth to subsistence farming. Furthermore, the youth are disenfranchised in the ownership and management of critical assets in agricultural production, especially land. Land tenure issues continue to impede many youths from engaging in agriculture, with the majority of youth using land without exclusive ownership rights. In addition, the results point to the fact that the youth are less likely to access credit, extension services and social capital (farmer group membership), all key factors in agricultural transformation. The in-depth analysis results seem to suggest that the youth with at least secondary education, males (both married and unmarried) and those youth residing in households with a large share of adults are less likely to engage in agriculture.

Although Uganda has enjoyed relatively high economic growth rates over the past decade, formal job creation has been lower than the rate at which the labour force is growing. Challenges still remain on bridging the gap between economic growth and jobs creation and in turn address the growing unemployment especially among the youth UBOS (2012). With a high population growth rate of 3.2 % per annum, Uganda is going through a young population bulge with close to 78% of its population below the age of thirty. The youth (18-30 years) represent approximately 21% (close

to 7 million) of the population and they comprise about 64% of the unemployed persons in Uganda (Uganda Bureau of Statistics (UBOS) 2012). In 2011/12, youth unemployment rate stood at 5.1%, above the unemployment rate of 1.9 % amongst those aged 31-64 years and was even higher among the youth in greater Kampala areas at 15% (UBOS 2012). Levels of underemployment, vulnerable employment are even higher than the above levels of unemployment since only a few youth can afford to remain unemployed – they often engage in part time work even for a few hours just to make ends meet. It is thus not surprising that there are high levels of working poor i.e. those who are employed but they live below the poverty line. Creating decent employment opportunities for this rapidly increasing youthful labour force as MDG 1 target 1B3 stipulates is a challenge that has reached a level of priority for Uganda’s development agenda. It is also evident from the Uganda National Household Survey (UNHS) data that the youth are more at a disadvantage in securing gainful employment today compared to six years ago. While many still view formal job creation in the formal wage sector as the solution to youth unemployment, prospects of finding this kind of employment is limited as the number of people entering the labour force far outweighs the number of jobs available in the formal wage sector. Brooks *et al.*, (2012) and Kararach *et al.*, (2011) reveal that creation of non-agricultural jobs may not happen in the short run; as such agriculture is likely to continue being a source of employment and livelihood in the medium to long term especially for countries that heavily depend on agriculture. The 2008 World Bank “Agriculture for development report” further points out the enormous potential of agriculture in offering employment (World Bank 2008). Nationally, the agricultural sector is being prioritized, indeed the current five-year National Development Plan (NDP) 2010-2015 identifies agriculture as one of the core growth sectors. Despite the recognition of employment creation within the sector, youth participation in agriculture especially as farmers is declining not only in Uganda but in other

African countries alike (FAC, 2010). Apparently, the agriculture sector is not looked at as a viable sector of employment and remains highly unattractive to the youth due to the risks, intensive nature and low profitability (FAO, 2012). Most of the youth engaged in agriculture are vulnerably employed as own account workers and contributing family workers with little or no income accruing to them. While the exodus of the youth from the agriculture sector (of 9.0%) might seem to be higher than that of the prime age group (of 3.4%), the majority of the youth continue to derive their livelihood from agriculture. Some would argue that this movement away from agriculture is a sign of structural transformation of the economy; but the pattern has not brought with it the required job growth needed to absorb the increasing young labour force and as such high levels of underemployment are being experienced in the services and industrial sectors (UBOS, 2009). Despite its low growth rates and declining share in terms of contribution to GDP, agriculture remains the mainstay for both skilled and unskilled labour, at least in the short- and medium term and could be a viable solution to tackling Uganda's rising youth unemployment as the industrial sector picks pace. Thus attracting and maintaining the youth in agriculture does not only mean improvements in the on-going unemployment levels but will enhance exploiting their capabilities for national development in terms of increased agricultural outputs and productivity. Achieving this would require critical understanding of the challenges faced by the youth at the production node of the agricultural value chain and the prospects of youth engagement in agriculture.

#### **2.4 The relationship between farmers' gender and sweet potato conservation method adopted**

In Uganda, about a third of the population lives in extreme poverty. Most households depend on rain-fed agriculture as their main source of income, with the agricultural sector employing over three-quarters of the labor force (83% of women and 71% of men) but only accounting for 24% of gross domestic product. Women contribute 70% to 75% of agricultural food production. A survey

conducted in 2009, reported that 6.3% households in Uganda were food insecure and 21.3% households were at risk of becoming food insecure. In 2005, the average intake per person per day (1,971) was still far below the value of 2,300 calories recommended by the World Health Organization (WHO). Most agricultural production is by poor farmers, who depend on sweet potato (*Ipomoea batatas* (L.) Lam.), as their primary source of food and income. Sweet potato is globally the sixth most important food crop after rice (*Oryza* spp.), wheat (*Triticum aestivum*L.), potato (*Solanum tuberosum* L.), maize (*Zea mays* L.) and cassava (*Manihot esculenta* Crantz), but it is the fifth most important food crop in developing countries . Each year, more than 105 million metric tons of sweet potatoes are produced worldwide, with 95% of this being grown in developing countries. In Uganda, as in many other countries in Sub-Saharan Africa, sweet potato is mainly cultivated by women and often referred to as a ‘female crop’. Sweet potato is important as a staple and food security crop in many countries in Africa.

Achieving food security is a prerequisite to realizing the first and the third United Nations millennium development goals (MDGs) that are concerned with reducing the proportion of people who suffer from hunger and, promoting gender equality and empowering women, respectively. In Africa’s agricultural sector, women are responsible for producing 80% of the food, as opposed to men who tend to engage more in income-generating activities such as cash crop production, perhaps because of their responsibility of availing food for the family. Despite this essential contribution to household food production and provision, access to resources such as appropriate technologies, modern farming methods, markets, credit and extension services for women is limited.

Several studies have shown that access to information is vital for improving agricultural production especially in rural areas where agriculture is the main source of livelihood. Oladele points to language as one of the main factors influencing access to agricultural information disseminated through radio and television in Nigeria. The language of radio and television broadcasts in an ethnically diverse country such as Uganda may increase agricultural information uptake by farmers, compared to use of official languages that are not understood by most farmers.

Gender of household heads, as revealed in a study conducted in Ethiopia, influenced participation in governmental extension programs, with male-headed households taking dominance (75%). Factors such as age, farm size, religion, education level and income were reported to have a significant effect on accessibility to extension services by women. Technology adoption among cowpea (*Vigna unguiculata* L. Walp.) growers in Uganda was however, shown not to be influenced by gender.

Gender is a key factor in explaining the variation in access to social services in rural low-income communities in Uganda; it would therefore be useful to separately analyze accessibility of male- and female-headed households to social support services in sweet potato production. Much as women are greatly involved in the sweet potato value chain in Uganda, factors such as culture, traditions, gender roles and responsibilities, and land ownership could be affecting the access of women sweet potato farmers to agricultural information or credit in Uganda. Observations of gender-based access to agricultural information, extension services or credit have been observed in Sudan, Malawi, Nigeria, and Kenya. The fact that women are often involved in household chores gives them little time to receive extension services, unlike their male counterparts. Little or no detailed individual information on empirical studies on women sweet potato farmers' access to and

use of agricultural information, credit and extension services in Uganda is available. The lack of such information is therefore an obstacle to reducing gender bias in access to social services and consequently hinders poverty reduction and economic development programs.

The contribution of women to food security cannot be overlooked. There is a need for access to proper and relevant agricultural information, credit and extension services if sweet potato production is to be increased. An understanding of gender differences in accessibility may go a long way in explaining barriers to technology adoption and factors facilitating sweet potato production.

The current study is part of a bigger research project aimed at understanding how farmers perceive the effects of changes in climatic variables, and how they have adjusted their farming practices to cope with the changes in climate. The aim to highlight gender differences that are often overlooked in sweet potato production and also access to crop production resources. I assume that male-headed and female-headed households do not have similar crop production skills or access to resources that would increase crop production and productivity. I also believe that comparisons between male-headed and female-headed households are key to explaining differences in market, training, production, and new technology adoption and information access.

## **2.5 Summary of literature review**

The literature reviewed provided an introduction on research topic guided by three key objectives, influence of education, age and gender as socio-economic factors in the method of sweet potato vine conservation adopted by the farmers of Koro Sub- County in Gulu district. The literature explains the role of socio-economic factors in relation to agriculture and sweet potato farming among farmers.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.0 Introduction**

This chapter indicates how data for the study was collected, analyzed and interpreted in order to answer the research questions thereby meeting the purpose of this study. It therefore comprise research design, study population, determination of sample size, sampling techniques, data collection methods, data collection instruments, quality control, data collection procedures, data analysis, measurement of variables, ethical considerations and study limitations.

#### **3.1 Research Design**

According to Amin (2005) a research design is a conceptual structure where research is conducted and it constitutes blue print for collection, measurement and analysis of data. There are several

study designs which may be experimental like a case study, longitudinal, cross-Sectional, correlation and experimental designs. However for this particular study it used cross-sectional survey design using both qualitative and quantitative approaches. The study used qualitative and quantitative approaches because qualitative method provided in depth explanation to events while quantitative enabled quantification of the study finding using frequencies and percentage Mugada *et al* (1999).

### **3.2 Area of the Study**

The study was carried out among sweet potato growing farmers in Koro Sub- County located 15 km from Gulu district. This area was selected because it is one of the leading producers of sweet potato in the district. Understanding the way farmers conserve sweet potato vine would help to identify the factors beneath the methods adopted, challenges and possible solutions in order to improve on sweet potato production in the district.

### **3.3 Population of the Study**

A study population is a group of individuals or objects known to have similar characteristics from which the study findings are generalized Amin (2005). Koro Sub- County has a total population of 15,000 people (UBOS 2014). This study therefore targeted 75 sweet potato growing farmers from which the sample population was drawn. This consisted of local leaders, Sub- County technical staff and sweet potato growing farmers.

### **3.4 Sample size and Technique**

According to Sekaran (2003), a sample is a subset of the population. It comprises some selected members who are referred to as elements or respondents. Sampling is a process of selecting sufficient number of elements from the population so that it's possible to generate such

characteristics of a given population. Sample size therefore is the total number of elements selected to represent the population of the study.

A sample is a smaller collection of units from a population used to determine truths about that population, Burns (2000). Since the area is reachable, purposive and random sampling will be applied in selecting the sample for this study. The sample population for the research will be drawn from 75 individuals giving a sample of 63 respondents Krejcie & D.W. Morgan (1970). The sample will be distributed in such a way that it will comprise of local leaders, sweet potato farmers and Sub- County technical staff.

A sampling technique is the identification of the specific process by which the entities of the sample was selected. There are two sampling approaches that is, probability and non-probability sampling technique. Probability involves selecting a sample in such a way that all elements in the population have the same chance of being selected while non-probability, the element in the population do not have a well-defined chance of being selected Amin (2005).

Table 1 below indicates the sample size and sample technique explored during this particular study.

**Table 1: Showing Sample Size used in the study**

<b>NO</b>	<b>Categories of respondents</b>	<b>Estimated population</b>	<b>Sample size</b>	<b>Sampling technique</b>
1	Sweet potato farmers	56	52	Purposive sampling
2	Local leaders	10	6	Purposive sampling
5	Sub- County technical staff	09	05	Purposive sampling

	<b>Total.</b>	<b>75</b>	<b>63</b>	
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**Source: Primary data 2017**

### **3.5 Sampling Method**

The sampling methods used for selection of respondents were random and purposive sampling.

Random sample was used on farmers because they are so many cannot be interviewed all.

Purposive sampling was chosen because there were some technocrats picked because of their special roles in sweet potatoes farming.

### **3.6 Data collection Methods**

According to Finn, *et al.*, (2008), the researcher collected data using both primary and secondary data collection methods. These methods included application of questionnaire, primary and secondary data collection methods which helped in collecting the necessary data for analysis.

#### **3.6.1 Self-administered Questionnaires**

This was used to collect primary data from sweet potato farmers and production department officers and it involved the use of a semi-structured questionnaire. The method of survey using a semi-structured questionnaire was deemed appropriate since part of the questionnaire offered the staff a choice of picking their answers from a given set of alternatives while the other part of the questionnaire allowed them to qualify their responses as noted by (Amin, 2005).

#### **3.6.2 Secondary data collection Methods**

Secondary data collection methods involve reviewing all available literature related to the topic of study. Data was obtained from secondary sources like newspapers, magazines, books among others.

### **3.6.3 Primary data collection Methods**

It is a method which involves obtaining first-hand information from the target respondents without referring to old literature. In most cases the objects of key aspect of the research topic were targeted. The researcher used, interview, questionnaires and observations.

### **3.7 Data collection Instruments**

An interview guide is developed and applied on key informants because they are thought to be more informed about the subject under focus sekaran (2005). Their verbal responses are perceived valuable, original, evidenced and objective, which rendered and added meaning to the results of the study. This tool was also used to allow the researcher modify the responses of respondents where necessary. According to Narayan, (1996) the researcher prefers the interviews especially in qualitative research because of the lack of predetermined structure which allows free association with interviewees in order to yield a broader explanation of the issues in question. Respondents were encouraged to relate and talk freely with the interviewer when sharing a conversation. The in-depth interviews with the respondents were therefore thought to create rapport and encourage free and relaxed conversation which would yield quality data.

A questionnaire was administered to the selected respondents to fill the questions therein at their own convenience and grace period was requested for picking the filled questionnaires. The questionnaires were open and closed ended format which allowed free to substantiation of their opinions. The questionnaires were administered to technical officers and local leaders.

The researcher obtained a letter from Uganda Martyrs University introducing her to the SubCounty and specifying that the data to be collected was solely for study purposes. Upon obtaining the requisite permission, the researcher proceeded with data collection starting with giving out

questionnaires to Koro Sub-County staff. After that interviews were conducted with randomly selected farmers.

### **3.9 Validity and Reliability**

Reliability is the degree to which an instrument measures the same way each time it is used under the same conditions with the same subjects, Sekaran (2001). Data collection instruments were pretested on 15 respondents from all categories in order to ascertain their dependability, accuracy and ability to elicit the necessary and adequate responses. The respondents were requested to make constructive criticisms, positive changes and suggestions which were adopted for purposes of improving the final research instruments. Alpha values for each variable under study were not less than 0.6. All the statements under each variable were subjected to this test, which proved to be above 0.6 and declared reliable.

Validity is the extent to which an instrument measures what it is meant to measure, Mbabazi (2006). In this case, before the researcher applied the instruments, they stood validated by examining their contents, whether they could measure to the assumed attributes, free from bias, contamination and deficiency. This helped to ensure that bias and deficiency were minimized as much as possible to set dependable responses for the study, where the ratio of 0.7 was based on to declare the instruments valid.

### **3.9 Data processing and Analysis**

Analysis is the computation of certain measures, searching for patterns of relationships that exist among groups of data, Denscompe (2008) and Kothari (2011). The data collected was analyzed using qualitative and quantitative methods using SPSS that allows selecting freely group data to

compare results. Descriptive and analytical comments on every issue presented by the respondents were captured with accompanying statistics.

### **3.10 Ethical Considerations**

The researcher respected the dignity of the respondents and treated the information given by them with uttermost confidentiality and for research purpose only.

The researcher was keen not to ask provocative or sensitive questions to the respondents especially questions that touch the private life and even those which degrade respondents' dignity.

An introductory letter from the university was used to introduce the researcher to the respondents during data collection.

Permission was sought from the respondents before approaching their homes and working premises and at their convenient times only.

## **CHAPTER FOUR**

### **DATA PRESENTATION, ANALYSIS AND INTERPRETATION**

#### **4.0 Introduction**

This chapter focuses on data presentation, analysis, interpretation and discussion of the findings. The findings have been analyzed with statistical breakdowns accompanied with detailed qualitative narratives for clear and better understanding. It contains two sub-sections which include the demographic data of the respondents and the socio-economic factors in sweet potato vine conservation methods adopted by the farmers. The data presentation and analysis were examined to meet the objectives of; examining the effect of education level on sweet potato vine conservation, investigate the effect of age on the sweet potato vine conservation and determining the relationship between farmer's gender and sweet potato conservation methods. A total of 70 questionnaires were distributed but, 63 were returned on time giving response rate of 90% which is representative. Some questionnaires, 10% were not returned on time hence were not considered in the analysis.

#### **4.1 Demographic Data of Respondent**

The study sought to capture key characteristics of the respondents including, gender, age range, education level, occupation and period taken in growing sweet potato. The findings are presented using graphs, pie-charts and tables.

#### 4.1.1 Occupation of the respondents

This was another social aspect considered in the occupation of the respondents. Even if it does not directly points at the objectives, it is relevant to know that different categories of human resources are participating in the sweet potato vine conservation at the community level. This has been aggregated as below;

**Table 2: Showing occupation of the respondents**

<b>Occupation</b>	<b>Frequency</b>	<b>Percentage</b>
Peasants	32	50.8%
Self Employed	18	28.6%
Private Employed	08	12.7%
<u>Government Employees</u>	05	7.9%
<b>Total</b>	<b>63</b>	<b>100</b>

*Source: Primary data 2017*

According to the results in table 2 above, it indicates the participation in sweet potato vine conservation at the community level by cross section of human resources; 50.8% peasants, 28.6% self employed, 12.7% private employed and 7.9% government employed. This indicates that different institutions are participating to ensure that sweet potato vine conservation is undertaken by farmers in the community.

#### 4.2 Examining the effect of education on sweet potato vine conservation methods adopted in Koro Sub- County, Gulu district

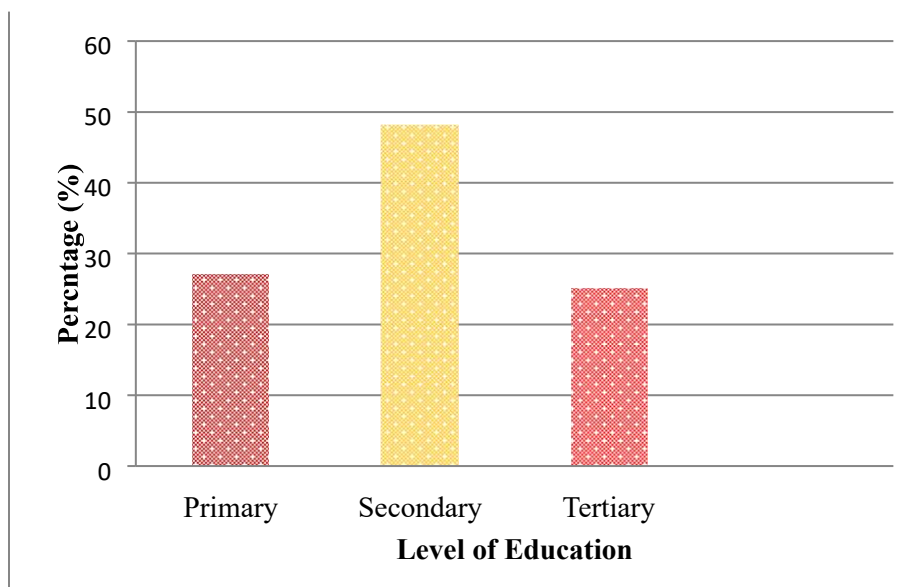
**Table 3: Showing education level of respondents**

<b>Education Level</b>	<b>Frequency</b>	<b>Percentage</b>
Primary	17	27.0%
Secondary	30	47.6%
Tertiary/university	16	25.4%
<b>Total</b>	<b>63</b>	<b>100</b>

**Source: Primary data 2017**

According to the statistics in table 3 above, 27.0% of the respondents were primary leavers, 47.6% were secondary leavers and 25.4% were graduates from higher institutions of learning. Due to small gap in literacy levels, most questions were understood by majority making the general understanding and provision of information appropriate to suit the target population.

**Figure 41: Showing the educational level of the respondents**



**Source: Researcher, 2017**

Figure 1 above shows that majority of the respondents, 48% attained secondary education level, 25% attained Diplomas, Degrees and Masters, while 27% were of primary level. This indicates that education level has influence in sweet potato vine conservation since secondary education and tertiary education are considered the basic and in this research they constituted 73%, leaving less educated at primary level with only 27%. This means that educated farmers are at the core of mobilizing farmers for trainings, and conserving sweet potato vines in the community.

Putting into consideration the different levels of education attained by the respondents, they have taken different time periods in the production of sweet potato vines as indicated in table 4 below;

**Table 4: Showing time taken in sweet potato vine conservation**

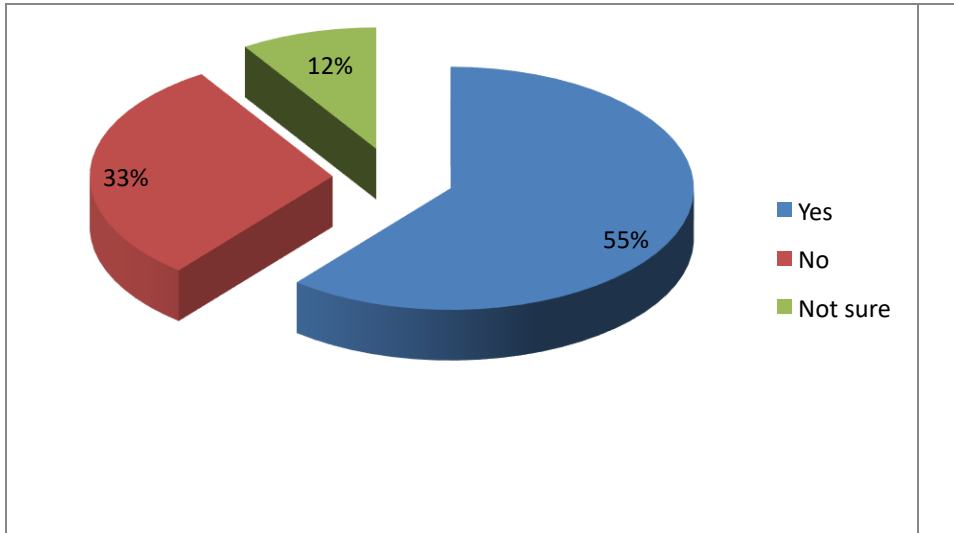
<b>Years</b>	<b>Frequency</b>	<b>Percentage</b>
1-2	11	17.5%
3-5	20	31.7%
6-7	15	23.8%
8 & above	17	27.0%
<b>Total</b>	<b>63</b>	<b>100</b>

**Source: primary data 2017**

The above statistics in table 4 indicate, majority of respondents 31.7% spent more time growing sweet potato vine conservation for a period of 3-5 years, followed by 27.0% who had grown for over 8 years and 23.8% had grown for 6 -7 years while least number 17.5% spent 1-2 years in sweet potato conservation. The percentage above indicates that majority of the respondents involved in this research had taken many years in the conservation of the sweet potato vines and production. They were able to answer questions and give opinions out of their experiences in sweet potato vine conservation. The more time one took growing sweet potatoes implies more knowledge attained through community training and other engagements.

Questions were also asked with the respondents to determine participation/involvement of the participants in sweet potato vine conservation. This is clearly indicated in figure 2 below;

**Figure 52:2-Showing : Showing participation of respondents in sweet potato vine conservation**



**Source: primary data 2017**

According to the statistics in figure 2 above, 55% agreed with the statement that they always participate in sweet potato vine conservation, followed by those who disagreed at 33% and the least response came from those who were not sure 12%. The question sought participants' involvement in vine conservation.

**Table 5: Showing percentage in response to questions by respondents**

	<b>Response</b>	<b>frequency</b>	<b>Percentage</b>
Do you grow sweet potatoes	Yes	54.8	87
	No	8.2	13
<b>Total</b>		<b>63</b>	<b>100</b>
How farmers get information on s/potato growing	TV	5.0	8
	Radio	32.8	52
	Newspapers	3.2	5
	Market	22.0	35
<b>Total</b>		<b>63</b>	<b>100</b>
Materials used to plant sweet potatoes	Vines	39.0	62
	Tubers	14.5	23
	Ratoons/sprouts	6.3	10
	Any other	3.2	5
<b>Total</b>		<b>63</b>	<b>100</b>
How to conserve vines in dry season	Plant under shade	6	<b>10</b>
	Triple 'S'	6	<b>9</b>
	Watering	44	<b>70</b>
	Burring underground of the vines	7	<b>11</b>
<b>Total</b>		<b>63</b>	<b>100</b>

time vines take to sprout	1 week	28	45
	2 weeks	16	25
	3 weeks	6	10
	Not sure	13	20
<b>Total</b>		<b>63</b>	<b>100</b>
	Cash book	6	12

Records kept by farmers	Input supply	40	60
	Annual yields	12	20
	Market information	5	8
<b>Total</b>		<b>63</b>	<b>100</b>
Whether farmer was engaged in other activities.	yes	54	85
	No	9	15
<b>Total</b>		<b>63</b>	<b>100</b>
System of farming used	Mono cropping	20	32
	Mixed cropping with food crop	30	48
	Intercropping with tree crop	13	20
<b>Total</b>		<b>63</b>	<b>100</b>
	Beans	28	45

Other crops grown	Cassava	8	12
	sugarcane	13	20
	vegetables	14	23
<b>Total</b>		<b>63</b>	<b>100</b>
Practices to boost yields	Add organic manure	30	48
	Pruning	6	10
	Weeding	16	25
	mulching	11	17
<b>Total</b>		<b>63</b>	<b>100</b>
Other ways to conserve sweet potato vines.	mulching	16	25
	Covering with soil	18	28
	Using tubers	9	15
	Burring under ground	20	32
<b>Total</b>		<b>63</b>	<b>100</b>

**Source: primary data 2017**

From table 5 above, it shows that 87% of the farmers had grown sweet potatoes; only 13% had not grown sweet potatoes. The great percentage of respondents above implies sweet potato growing is dominant due to the fact that it is the main staple food, with women being the heads of welfare in the family they much focus on table crops.

Findings still indicate that farmers use different planting materials with vines being the most commonly used at 62%, potato tubers at 23%, ratoons/sprouts at 10% and the least number of

respondents 5% were not sure of what they were using. Vines were most preferred by majority due to the fact that it sprouts quickly, high yielding and rapid multiplication. 5% of the respondents were not sure of what they were using because some use a combination tubers or vines.

Findings also indicate that watering was one of the ways farmers conserved sweet potato vines at 70%, others could bury the roots underground to preserve represented by 11%, 5% use triple 'S' to conserve their vines and 14% plant under shade trees. The variation in the method of conservation adopted reflected much on education with those with education knowledge preferred use of Triple 'S' technology while burying underground and planting under big shade tree was an indigenous knowledge embedded in less educated farmers.

The findings indicate that on the period taken by vines to sprout, farmers gave varied responses, 45% of respondents said it takes one week, 25% said it takes 2 weeks, 20% were not sure on how long it takes and only 10% said it take 3 weeks. The levels of understanding in the sprouting period of the vine indicate that most farmers do not attain trainings and those who were not sure did not belong to any farmer group /association yet community trainings are done in group basis by development partners and government agencies like operation wealth creation, World Vision and others.

Findings indicate that the numbers of respondents who engaged in any other activities besides sweet potato growing, 80% said yes and 15% were not engaged in any other activity. These other activities included retail business, bakery, vegetable production and sale, bricklaying, tradition dance groups, VSLA among others. The main reason respondents gave for diversifying their enterprises other than sweet potato growing was to guard against climate change risks which leaves them with heavy losses. Unpredictable rainfall, pests and disease outbreak were key culprits

pointed. The major challenges for maintaining varieties were: land limitation (identified by 70% of the respondents); loss of planting material due to prolonged drought events (63%); lack of training in better conservation techniques (47%); and loss of planting materials due to animals and pests (19%). Respondents who rented land and female farmers whose husbands allocate land use indicated land limitation as a key constraint. The male owner tended to have different priorities for land use compared to the woman farmers, influencing the size of land allocated for sweet potato production, and potential for diversity preservation on-farm. This may explain the significant association between land ownership and maintenance of varieties. Prolonged drought events have resulted in loss of planting material in farmers fields. To cope with this constraint, respondents use various strategies, including planting the vines near wetlands, on riverbanks, or within banana plantations. However, very few of the respondents had access to wetlands or had resources for irrigation. Lack of information about conservation methods, which was cited by nearly 50% of the farmers, indicates that there is need to incorporate training on conservation of planting material as part of any new sweet potato variety release package. Inadequate training of farmers in conservation practices has also been identified as a key constraint to conservation of other crops such as coffee in El Salvador ( Méndez 2008), potato in the Andes (De Haan2009), and sorghum in Ethiopia ( Asratet al. 2010). For low access to agricultural information by female farmers included illiteracy, religion or cultural barriers, gender bias, and immense gender-specific responsibilities that include taking care of children, ensuring that the family has food and doing household chores.

Findings indicate that a number of farming systems are practiced, with most farmers doing mix farming with mainly food crops at 48%, 32% do mono cropping and 20% practice inter planting with trees.

Inter-planting with trees is least adopted because most trees shade off the intended crop from the sunshine hence low yields. Most inter-cropping in food crops was practiced to guaranteed household food security.

Findings indicate that respondents use different ways to boost the yield of their crops by adding organic manure, weeding, mulching and pruning off excess vines which would ensure vegetative growth and less tuber formation. Addition of organic manure scored 48%, weeding 25%, mulching 17% and running at 10%. Some respondents confirmed that with the addition of organic manure, an acre yields between 15-20 bags compared to only 10-15 when no additional inputs are used.

The analyzed data indicate those farmers plant vines under shade trees to prolong their lifespan where 32% of the respondents confirming that assertion, 28% do selective harvesting by not uprooting the whole plant, 25% do mulching and 15% use tubers (Triple “S”) to raise new vines. They urged that vines planted under shade tree are deep green and don’t dry easily in hot weather implying these vines losses less moisture to the atmosphere due to heavy canopy provided by the shade tree or shade net.

**Picture 1: Showing different planting materials used by the farmers**



*Source: primary data 2017*

#### **4.3 Examining the effect of age on sweet potato vine conservation methods adopted in Koro Sub-County, Gulu district**

The age bracket was considered in this study in order to know the age that actively were involved in sweet potato cultivation activities. Among the respondents interviewed, the data reveals that majority of the youth are not involved in sweet potato vine conservation and production mainly because most of the youth are engaged in small scale businesses that gives them direct money rather than farming. This is clearly shown in table 6 below;

**Table 6: Showing age of respondents**

Age	Frequency	Percentage
21-30	11	17.5%
31-40	21	33.3%

41-50	14	22.2%
50 and above	17	27.0%
<b>Total</b>	<b>63</b>	<b>100</b>

**Source: Primary Data 2017**

The statistics in table 6 above show that the age bracket 21-30 which constituted only 17.5% are active in sweet potato vine conservation and production, age bracket 31-40 which constituted 33.3% were relatively more involved in the production of sweet potatoes, age bracket 41- 50 constituted 22.2% of the total production and, 50 and above constituted 27.0% of the respondents. By indication, the youthful age which is 35 years in Uganda is less involved in sweet potato vine conservation and cultivation. This is in line with the Aghankan youth survey report (2016), which indicated that only 12% of the youth want to become farmers. The youth are entrepreneurial, with the majority aspiring to start their own business, rather than taking agricultural related activities.

**Table 7: Showing Respondents' engagement in sweet potato vine conservation**

<b>statement</b>	<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Involvement of different age groups in sweet potato vine conservation	Agree	47	75
	Disagree	16	25
<b>Total</b>		<b>63</b>	<b>100</b>

Agricultural technologies employed in sweet potato production	YES	43	68
	no	20	32
<b>Total</b>		<b>63</b>	<b>100</b>
Source of planting material	Own farm	19	30
	Approved nurseries	2	3
	Research station	9	15
	market	33	52
<b>Total</b>		<b>63</b>	<b>100</b>
Variety of sweet potato			
	Local type	9	15
	Improved variety	54	85
<b>Total</b>		<b>63</b>	<b>100</b>
	It's cheap	6	10
Reason for the variety choice	High yielding	25	40
	marketable	13	20
	Resistant to diseases	19	30
<b>Total</b>		<b>63</b>	<b>100</b>
	tubers	13	20

Planting materials	vines	39	62
	others	11	18
<b>Total</b>		<b>63</b>	<b>100</b>

*Source: primary data 2017*

According to the results in table 7 above, different respondents engage in various activities to conserve sweet potato vines. 75% respondents agreed having played different roles in sweet potato vine conservation while 25% disagreed having participated in different activities in vine conservation. Age is a factor to consider, as activities like planting and watering was done by children and the youth, during harvesting and processing, women come on center stage, while silage making and preparing vines is mostly the work of men and elderly.

Findings concerning agricultural technologies employed in sweet potato production indicate, 68% agreed having used different technologies and 32% said they had not used any technology. The technologies used included hand hoe, mulching, and fertilizer application, tractor/ox-plough among others. The variation in the use of various technologies is due to the cost associated with the technologies e.g. hiring tractor /oxen is expensive where each acre is at 120,000 shillings to plough in addition to feeding of the operators. The energetic elderly showed less interest in tractors and more complicated modern tools that require technical skill. As they regard such tools difficult to learn.

The finding indicate that the market is the main source of planting material for most respondents represented by 52%, 30% obtain their planting material from the their own farms/gardens 15% get from research stations or agents and the least number of respondents 3% get planting material from approved nurseries. The market was most preferred by majority due to its accessibility, low

transport cost and affordability of planting material. Sometimes market supply is in excess leading to decreased demand forcing prices to fall.

**Picture 2: Showing a woman harvesting sweet potato vines**



**Source: primary data 2017**

The analyzed data show that 85% of the respondents use improved varieties of sweet potatoes only 15% use local or Acholi varieties. The choice of the variety is dictated by different factors as improved varieties are expensive for some with limited finances to buy; their yield reduces with time, prone to sunshine, among others. Local varieties are always got free from relatives or friends or sometimes at neighbor gardens.

The results indicate that 40% of the respondents said improved varieties are high yielding and is a major reason why they prefer it, 30% said improved varieties are resistant to disease and drought, 20% prefer improved variety because it is marketable and only 10% use improve varieties because it's cheap to obtain vines. The above analysis suggest that farmers mind more about crop yields than other determinant for their choice of the variety.

The result show that, 62% of the respondents use vines as planting material, 20% use tubers as planting material and a least number of respondents use other parts as planting material. The vines

were preferred because they easily sprout and they have growth vigor and also added that if well managed against weeds, it results to high yields.

#### **4.4 Determining the relationship between farmers' gender and sweet potato vine conservation methods adopted in Koro- Sub County, Gulu district**

The study reached both men and women in order to ascertain proportion actively involved in sweet potato vine conservation as shown in table 8 below:

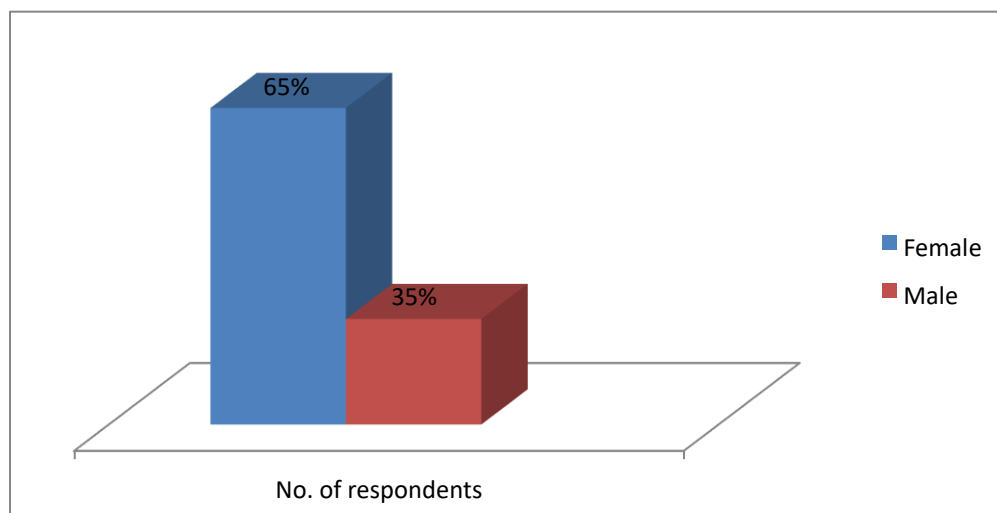
**Table 8: Showing sex of respondents**

<b>Gender</b>	<b>Frequency</b>	<b>Percentage</b>
Male	22.0	35%
Female	40.9	65%
<b>Total</b>	<b>63</b>	<b>100</b>

**Source: Primary data 2017**

Table 8 above shows that among the respondents in this study, 35% were males and 65% were females.

**Figure 63: Showing sex of respondents**



**Source: Primary data 2017**

Figure 3 above, shows that majority of the respondents were female. 65% of females and 35% of males participated in this research, which is an indication that women are more engaged in sweet potato vine conservation than men. This is mainly because, women are perceived as weak gender traditionally and they engage mostly in food production for consumption while men targets production for commercial purposes. In Koro Sub-County, gender defines the role played by different households in that men were involved in commercial farming, planting crops like; sorghum, soy beans, sunflower and so on meanwhile women were mainly in production for consumption. Besides sweet potato growing women cultivated vegetable for home consumption.

**Table 9: Showing respondents' engagement to agricultural related social network**

Statement	Response	Frequency	Percentage
Belonging to a community group	Yes	25	40
	No	38	60
<b>Total</b>		<b>63</b>	<b>100</b>

Activity in the group	VSLA	39	63
	Crop nurseries	3	4
	Baking and weaving	4	6
	Group marketing	17	27
<b>Total</b>		<b>63</b>	<b>100</b>
Amount of land allocated	1 acre	9	15
	2 acres	11	17
	3 acres	32	50
	4 +acres	11	18
<b>Total</b>		<b>63</b>	<b>100</b>
Where to sell after harvesting	Market	19	30
	Processors	9	15
	Individuals	22	35
	Any buyer	13	20
<b>Total</b>		<b>63</b>	<b>100</b>
Constraints affecting potato production	Low prices	13	20
	Pests and diseases	19	30
	Dry spell	26	42
	Perishability	5	8
<b>Total</b>		<b>63</b>	<b>100</b>
Practices to conserve vine during dry season	Save money	10	16
	Buying	19	30
	Borrowing	25	40
	Not sure	9	14
<b>Total</b>		<b>63</b>	<b>100</b>

To increase acreage in a given season	Rent land	32	50
	Hire labour	16	25
	Borrow loan	9	15
	Timely weeding	6	10
<b>Total</b>		<b>63</b>	<b>100</b>
Source of capital	Bank	41	65
	VSLA	9	15
	Friends	8	12
	Others	5	8
<b>Total</b>		<b>63</b>	<b>100</b>
How to ensure enough vine at onset of season	Saving money	10	16
	Borrowing vines	19	30
	Buying vines	25	40
	Not sure	9	14
<b>Total</b>		<b>63</b>	<b>100</b>
Solutions to shortage of vines	Planting other crops	12	19
	Using different plant parts	13	20
	Use resistant variety	16	26
	Train farmers	22	35
<b>Total</b>		<b>63</b>	<b>100</b>

**Source: Primary data 2017**

In table 9 above, farmers were asked if any member of the household currently belonged to an agriculture-related social network such as a farmers group, farmers association or communitybased organization. 40% indicated having belonged to a farmer organization, 60% having no interest in

joining farmer groups. Village level farmers groups were the most common type of farmer organization. Other types of farmer organizations included cooperative unions, and savings and credit groups. Farmers received a number of services and goods geared towards promoting and multiplication of new technologies, especially in the NAADS village groups. Services that were received most included; loans and savings, seed, farm inputs and training on modern crop and livestock farming methods. Topics for training included; soil conservation, income diversification, food security, poultry rearing, bee keeping, child nutrition, home sanitation, use of biogas, farming as a business, record keeping and effective use of credit money.

The results indicate that 50% of the respondents allocate more than 3 acres of land for sweet potato production, 18% allocate more than four acres of land for sweet potato growing, 17% allocate at least two acres and 15% allocate one or less than acre to sweet potato production.

Households received agricultural information from both governmental extension agents and nongovernmental organizations, male- and female-headed households had similar chances of receiving information. More female-headed households had no off-farm income (67.9%) and lacked access to credit (26.4%) than did their male counterparts. Male-headed households had significantly more members who belonged to a farmer organization (44.6%) compared to female-headed households (30.2%).

The results indicate that 63% of the respondents are doing savings in their group, 27% do group marketing, 6% are engaged in baking and weaving and only 4% have tree nurseries. Saving was the dominant activity of most farmer group due to the benefits that accrue like reduced interest rate on loans to members, emergency fund in case a member gets an urgent need for financial help.

The results indicate that 35% of the respondents sell their sweet potatoes to individual buyers, 30% take to the market, 20% sell to any buyer and 25% sell to the processors. Large proportion of farmers sell their sweet potatoes to individual buyers because sweet potato being a perishable product/bulky cannot stay waiting for market and when produced in large quantities cannot be carried to the market with ease hence disposed immediately/on farm in fear of severe loss.

The results indicate that 45% earn less than five hundred thousand shillings (500,000/=) from sale of sweet potatoes, 30% said they earn one million, 20% earn between five hundred thousand shillings (500,000/=) and six hundred thousand shillings (600,000/=). The least number (5%) earn more than one million from sweet potato cultivation. The variation in profits is due to different mode sale used by different farmers, with those in group enjoying more profits.

The results indicate that 42% of the respondents said prolonged dry spell affect sweet potato production, 30% said pest and diseases, 20% blamed low price and 8% said perishability is their main challenge in sweet potato production. Drought ranked the major challenge faced by farmers in sweet potato production and renders vines very scarce at the onset of the rain season.

The results indicate that 40% of the respondents buy vines, 35% borrow, 16% do irrigation and 14% were not sure of what to do to obtain vines. The demands for sweet potato vines tend to shoot high because farmers consider sweet potatoes as quick maturing crop.

The results show that 50% of the respondents rent land to increase acreage, 25% hire labour, 15% get loan and 10% do timely weeding to sustainable production. Due to the availability of large chunks land in the area as long as one has the money to pay land is always available within the community for hire/rent. This land is hired at one hundred to three hundred thousand shillings (100,000/= to 300,000/=) per season basing on it size and fertility.

The result indicate that 45% of the respondents mobilize capital through village savings and loan association, 28% borrow from friends,15% get from the bank and 12% get from other sources.

Village saving loans were most preferred due to low interest rate on borrowed loan and no collateral security attached. Bank loan were less preferred by most farmers because of their strict nature of conditions.

The results indicate that 65% of the respondents water their vines/plant in the valley bottoms to enable them reach next season, 15% do selective harvesting leaving the stalk covered with soil, 12% do mulching and 8% were not sure of what to do. Those that afforded to water had reliable source of water supply (land along the swampy area). Respondents who were not sure normally cultivated sweet potatoes as supplementary crop whereby they concentrate on other crops as they wait for vines from other farmers.

The results show that 35% of the respondents recommended training of farmers on how to conserve sweet potato vines, 26% advocated for the introduction of resistant varieties, 20% suggested use of other plant parts other than vines and 19% said farmers should plant other crops not only sweet potatoes. It was observed that those that recommended more training in sweet potato vines conservation technology were not in any farmers' group.

**Picture 3: Farmers attending group training on sweet potato vine conservation**



Source: primary data 201

## CHAPTER FIVE

### CONCLUSSION AND RECOMMENTATIONS

#### 5.0 Introduction

This chapter presents the conclusion and recommendations of the study findings based on the, objectives and questions. After data was analyzed and presented, there was need for the researcher to present analyzed findings and make conclusions of the whole study relating to findings and objectives and making possible recommendations for the study.

#### 5.1 Conclusion

These conclusions are drawn from the analysis and discussion of the research findings above. Generally both male- and female-headed households were found to have relatively equal but very low access to both agricultural information and credit. There is a need to develop and disseminate integrated sweet potato management messages for better understanding and efficient use, preferably in local languages and through mass media. There is evidence of anti-female household heads' bias in membership to farmer organizations. It is recommended that men receive training

on gender mainstreaming and awareness, so as to appreciate the role women play in the sweet potato value chain.

#### **5.1.1 Conclusion on the effect of educational level on sweet potato vine conservation methods adopted in Koro Sub-County, Gulu district**

On the effect of the education on the method of sweet potato vine conservation method adopted by the farmers, it shows that education has influence in the choice of variety, crop field management approaches adopted by different farmers in conserving sweet potato vines as noted in chapter four, more educated respondents embraced modern agronomic practices, accessed information through, farmer group trainings, radio and newspapers, they showed flexibility in using different planting materials like vines and tubers to raise sweet potato plants, easily adopted drip irrigation technique to avoid desiccation during long dry spell, most of the educated farmers were aware of the period vines take to sprout, they kept various records in farming but mainly input supply for the season, mixed farming was mainly practiced on food crops with addition of organic manure to boost production.

#### **5.1.2 Conclusion on the effect of age on the sweet potato conservation method adopted in Koro Sub-County, Gulu district**

On the effect of age on the method adopted by farmers, majority of farmers agreed having participated in different conservation activities and though a few disagreed having participated in sweet potato vine conservation, technology employed was also determined by the age bracket of the respondents where the elderly could not afford ox-plough but used hand hoe to open up land. In addition they said these technologies like ox-plough and tractors, irrigation was associated with high costs which they could not afford, sourcing of the planting material during planting season was mainly through local markets, use of improved varieties was common among youth and average respondents and vines were the most common material used to plant sweet potato fields.

### **5.1.3 Conclusion on the relationship between farmers' gender and sweet potato conservation method adopted in Koro Sub-County, Gulu district**

On the relationship of farmers' gender and sweet potato vine conservation, the result indicate a few farmers showed interest in joining community groups growing sweet potato and marketing together. In balance sharing of benefits as group members, the main activities embraced by most groups was saving money which was later used to buy sweet potato planting materials, more land was allocated to sweet potato production per season due to availability of large chunks of land in the area and sweet potatoes was quick maturing crop only 6 months, making it a food security crop. This community groups had more women than men; women worked more in garden as men concentrated on cash crop growing. In marketing, most respondents sell their harvest to any available buyer due to the fear of perishability and bulkiness of sweet potatoes, profits accrued from sweet potato production per household was peak at one million shillings with increased acreage, prolonged drought was cited a major production constrain among others, buying was the only way most farmers ensured enough stock of sweet potato vine before the onset of the season. In order to increase production, most farmers had to rent land, capital for sweet potato production was mobilized through Village Savings and Loan Associations (VSLA) or from friends other than the banks to avoid high interest rate and too much collateral security restriction of the banks, farmer training was the most recommended suggestion by most respondents to ensure availability of sweet potato vine at the beginning of the season.

### **5.2 Recommendations**

The recommendation reveals that farmer's knowledge on conservation of sweet potato vines were mostly watering/valley bottom production, farmers need to be educated to adopt the use of other methods like, triple 'S', and rapid multiplication. Most of the youth are engaged in other income

generating activities like boba boda riding and small scale businesses other than sweet potato vine conservation and other agricultural production.

Youths should be mobilized in groups and encouraged to engage in crop production and also benefit from the on-going government program like operation wealth creation. The general community should also come out to promote sweet potato vine conservation with the youth; popularizing agriculture through songs, drama, cultural and religious leader engagement, extension workers holding sensitization meetings with the communities/ packaging integrated sweet potato vine management conservation in the local dialect, and introducing agricultural clubs at schools. These would help promote food security in Koro Sub- County.

Most of the men like engaging in what give them money directly micro- businesses, and less engaged in sweet potato production and vine conservation. The district must liaise with other commercial structures to add value and market sweet potatoes, so that farmers are able to sell their sweet potatoes at a good prize to enable it becomes one of the prioritized agricultural products.

### **5.3 Areas suggested for future research**

The researcher feels that the following are areas that need more research;

1. The study of farmers' knowledge on sweet potato pest identification and management.
2. The study of farmers' empowerment in sweet potato production and marketing.
3. An assessment of market opportunities for sweet potato growing farmers.
4. There is need to investigate other problems faced in regards to sweet potato production.

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## APPENDICES

### APPENDIX 1: QUESTIONNAIRE FOR SELECTED RESPONDENTS

Dear respondent,

My name is **Aber Stella**, a student at Uganda Martyrs University, pursuing Bachelors of Science in Agriculture. I am carrying out research on *“Evaluating the effect of selected social economic factors in sweet potato vine conservation method adopted by the farmers. A case study of Koro*

*Sub-County Gulu District*". I kindly request you to provide me with information. The information you give will be treated with utmost confidentiality and used for academic purposes only.

## QUESTIONS

### SECTION A: BIODATA

1. Sex: Male  Female
2. Age range: a) 15 – 25 years  b) 30 –  40 years  
c) 40 – 50 years  d)   
above 50yrs
3. Level of education  
a) Primary  b) Secondary  c) College/university
5. Period under sweet potatoes growing?  
1-2 years  2-4 years  5years and above

To examine the effect of education level on sweet potato vine conservation methods adopted in Koro Sub-County, Gulu District.

7. Do you grow sweet potatoes?

- (i)Yes  (ii) No  (iii) not sure  8.

How do you get information on sweet potato growing?

- i. Television

- ii. Radio station    iii. Newspapers    iv. Market

9. Which material do you use to plant sweet potatoes?

- (i)..... (ii)..... (iii)..... (iv).....

10. How do you conserve and multiply potato vines during dry season?

- (i).....(ii).....(iii).....(iv).....

11. How long do potato vines take to sprout when planted?

- (i)..... (ii)..... (iii).....(iv).....

12. Which records do you keep when cultivating sweet potatoes?

- i. cash books
- ii. Input supply    iii. Annual yields
- iv. Market information
- 

13. Are you engaged in any other activity apart from farming?

- (a) Yes
- (b) No

If yes, what other activity do you engage in? .....

14. What system of farming do you practice?

- Mono-cropping
- Mixed cropping with food crop
- Intercropping with tree crop

15. What other crop(s) do you cultivate in addition to sweet potato?

.....

16. What do you do to boost the yield of sweet potato?

(i)..... (ii).....(iii).....(iv).....

17. State any other way you can conserve and multiply sweet potato vines.

.....  
 .....  
 .....

To investigate the effect of age on the sweet potato conservation method adopted in Koro SubCounty, Gulu District.

18. Involvement of different persons in sweet potato vine conservation (**tick agree or disagree**)

Age years	Activity	person	agree	Disagree
15-20	Planting and watering	Children and youth		
20-25	Harvesting	women		
25-30	Processing	women		
30-35	Silage making	men		
35 and above	Conserving vines.	elderly		

19. Agricultural technologies employed in sweet potato production

**(Tick Yes or No to reflect your opinion)**

Technology employed	YES	NO
Mulching		
Hand hoe		
Crop rotation		
Intercropping		
Fertilizer application		
Plant spacing		
Herbicide use		
Early planting		
Ox-ploughing/Tractor		

20. What is the source of your planting material?

- a. Own farm
- c. approved nurseries
- d. Research stations (NARO)
- e. Market
- d. other specify.....

21. What variety of sweet potato do you cultivate?

- a. Local type
- b. orange fleshed varieties
- c. other specify  
 .....  
 .....

22.. Why do you prefer this specific variety?

It's cheap

High yielding

Marketable

Resistant to disease and drought

Others specify.....

23. What planting material do you use when cultivating sweet potatoes?

Tubers

Vines

Others, specify .....

To determine the relationship between farmers' gender and sweet potato conservation method adopted in Koro Sub-County, Gulu District.

24. Do you belong to any community group/association?

Yes  No

If yes state the activities your group is engaged in?

a. VSLA

c. Crop nurseries

d. product development

e. Group marketing

Others specify.....

25. How much land do you allocate for sweet potato production in a given season?

(i)..... (ii).....(iii).....(iv).....

26. Where do you sell the potatoes you grow after harvest?

(i)..... (ii)..... (iii)..... (iv).....

27. How much money do you invest in growing sweet potatoes?

(i)..... (ii)..... (iii)..... (iv).....

19. State any constraints affecting potato production.

(i).....

(ii).....

(iii).....

(iv).....

28. During dry season, what do you do to ensure you have enough vines?

(i).....

(ii).....

(iii).....

(iv).....

29. What do you do in case you want increase potato acreage in a given season?

(i).....

(ii).....

(iii).....

(iv).....

30. How do you mobilize capital to invest in sweet potato production?

(i).....

(ii).....

(iii).....

(iv).....

31. In case of water scarcity, what do you do to make sure you vines can reach next season?

(i).....

(ii).....

(iii).....

(iv).....

32. Suggest any remedy to shortages of potato vines in a planting season/at the beginning of rains.

.....  
.....  
.....

END

*Thank You for your cooperation!*

## **APPENDIX II: INTERVIEW GUIDE**

Dear respondent,

My name is **Aber Stella**, a student at Uganda Martyrs University, pursuing bachelors of Science in Agriculture. I am carrying out research on *“Evaluating the effect of selected socio economic factors in vine conservation method adopted by farmers in Koro Sub-County, Gulu district.* I kindly request you to provide me with information. The information you give will be treated with utmost confidentiality and used for academic purposes only.

## **QUESTIONS**

1. How do farmers conserve and multiply sweet potato vines during dry season?
2. Which category of people mostly conserves sweet potato vines during dry spell?
3. In case a farmer does not have enough land how do they acquire land
4. What are the mains sources of capital for potato farming?
5. State other alternative ways of boosting sweet production commonly used by farmers.
6. How do farmers get information on sweet potato cultivation?
7. How have government and other partners helped to deal with the problem of pests and diseases in this area?
8. How do farmers avoid manipulation by buyers of sweet potatoes?
9. What do you think should be done to improve potato production in Koro Sub County?

***Thank You for your cooperation!***

**APPENDIX III: TABLE FOR DETERMINATION OF SAMPLE SIZE (S) FOR A GIVEN POPULATION (N)**

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	256	3000	341

20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1000	285	5000	357
40	36	160	113	380	191	1100	291	6000	361
45	34	170	118	400	196	1200	297	7000	364
50	44	180	123	420	201	1300	302	8000	367
55	48	190	127	440	205	1400	306	9000	368
60	52	200	132	460	210	1500	310	10,000	370
65	56	210	136	480	214	1600	313	15000	375
70	59	220	140	500	217	1700	317	20000	377
75	63	230	144	550	226	1800	320	30000	379
80	66	240	148	600	234	1900	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	100000	384

**Source:** Adopted from R.V. Krejcie & D.W. Morgan (1970).

