SELECTED FACTORS AFFECTING ADOPTION OF IMPROVED FINGER MILLET VARIETIES AMONG SMALL-SCALE FARMERS IN MOGOTIO SUB-COUNTY, BARINGO COUNTY, KENYA.

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DECLARATION AND RECOMMENDATION

Declaration

I declare that this research is my original work and has not been submitted in part or as a whole for any academic award in any other University and where other peoples work are cited they are referenced.

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DEDICATION

This thesis is dedicated to my husband Paul Gitu, children Maryann, Yvonne and Nicolas for their patience, prayers and unreserved support in my academic struggle to accomplish my long cherished dream.

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My humble gratitude goes first and foremost to the almighty God, who has made me what I am, and through whom I have been able to achieve all that I have. My special thanks go to my two supervisors Prof. C.A. Onyango and Dr. James Obara both of the Department of Agricultural Education, Egerton University, for their valuable insights, suggestions and criticisms to make this thesis what it is. I sincerely appreciate the help l received from the surveyed farmers who willingly provided me with their personal data and answers to the questions used in this research, the Extension officers that were involved, the various administrators and leaders in Mogotio Sub-County who made it possible for me to access their areas and to collect the data. To all of them l say, thank you very much and may God bless you abundantly.

ABSTRACT

Finger millet is one of the important traditional, nutritious and drought tolerant food crop grown by small scale farmers in most arid and semi-arid lands (ASALs) of the world. In the ASALs of Kenya, finger millet is grown by small scale farmers who mainly grow low yielding unimproved varieties. Improved high yielding and recommended varieties are available but the farmers' adoption is very low contributing to persistent food insecurity in these areas. The purpose of this study was to establish selected factors affecting the adoption of improved finger millet varieties by small scale farmers in the ASAL Mogotio Sub-County of Baringo County. The factors studied were finger millet varieties technical attributes based on maturity period, yield, grain colour, grain usage in making of "ugali", porridge, tradition brew, other grain uses (sale, baking, tradition gifts) and sources of Agricultural information on production of improved finger millet based on sources from neighbours, friends, farmer groups, Extension staff and Non-governmental Organisations. The study employed a survey research design and used a sample of 297 small scale farmers randomly selected from Mogotio and Emining Divisions in Mogotio Sub-County. The study interviewed the respondent using a structured questionnaire whose reliability was ascertained by a coefficient of 0.86 and validity verified by a panel of experts. The collected data was analyzed using descriptive and inferential statistics and established that the studied factors considerably affected the adoption of improved finger millet varieties. The study recommends sensitization and training of the small scale farmers on the relative advantages of improved finger millet varieties over the unimproved to increase their adoption. The study finding is significant in that finger millet is a nutritious drought tolerant crop that can be used to reduce food insecurity, malnutrition and poverty dry areas of Kenya.

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ABBREVIATIONS AND ACRONYMS

ACTESA	Alliance for Commodity Trade in East and Southern Africa
ASALs	Arid and Semi-Arid Lands
COMESA	Common Market of East and Southern Africa
COMPRAP	Commodity Market for Regional Agricultural Produce
ECARSAM	East and Central Africa Sorghum and Millet Network
FAO	Food and Agriculture Orgainisation
FARA	Forum for Agriculture Research in Africa
GOK	Government of Kenya
ICRISAT	International Crop Research for Semi-arid Tropics
IFPRI	International Food Policy Research Institute
KARI	Kenya Agriculture Research Institute
KEPHIS	Kenya Plant Health Inspectorate Services
KSCO	Kenya Seed Company
MDGs	Millennium Development Goals
MOA	Ministry of Agriculture
NEPAD	New Partnership for Africa Development
WFP	World Food Program
WHO	World Health Organization

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Crop farming in the Arid and Semi-arid Lands (ASALs) is a big challenge due to factors such as the harsh climatic conditions experienced there, low adoption of improved drought tolerant crop varieties and limited farmers' knowledge on appropriate agricultural technologies (Food and Agriculture Organisation [FAO], 2009; World Bank, 2008). These factors contribute significantly to low food production and food insecurity persistently experienced in the ASALs (FAO, 2010; International Food Policy Research Institute [IFRI], 2002; New Partnership for Africa Development [NEPAD], 2010). Low food production forces this population to be dependent on food aids from well-wishers, donors and governments (FAO, 2007). There is thus urgent need to increase food production in the ASALs especially in Africa so as to reduce the food insecurity experienced there. Encouraging farmers in the ASALs to take up easy to adopt agricultural technologies can contribute to increased food production (Qaim, 2000; World Bank, 2003). Farmers in the ASALs should be encouraged to grow improved high yielding drought tolerant varieties such as those of finger millet crop.

Finger millet is an important crop for the low input cereal based farming systems in the semi-arid tropics (SAT) of the world. The crop is nutritious, easy to grow, takes a short time to mature and its grains can store for many years without storage pest damage (International Crops Research Institute for Semi-arid Tropics [ICRISAT], 2008). Finger millet is especially valuable as it contains methionine amino acid which is important in controlling malnutrition. This amino acid is lacking in other starchy diets from maize, wheat, sorghum, rice and root crops of cassava, yams and sweet potatoes (FAO, 2009; Stylinger, 2010). Finger millet can thus contribute significantly towards enhancing food security.in the ASAL regions.

In Kenya, finger millet is a very important traditional crop to almost all households in the ASALs regions, which occupy over 80 percent of Kenya land, and home to over 10 million of Kenya population (Government of Kenya [GOK], 2009; Ministry of Agriculture [MOA], 2006; Tadele, 2009). Most households in the rural and urban areas of Kenya use finger millet for its nutritive and cultural values. Finger millet production in Kenya is estimated at 64,023 tons per year, while its national demand is 138,000 tons per year. Majority of the finger millet farmers obtain an average yield of 0.6 ton per hectare, while the potential production is 3-4 tons per hectare (KARI, 2004; Lenne, 2006; MOA, 2006; Shiferaw B Obare G, and Muricho, G, 2006).

Most small scale farmers in the ASALs of Kenya, grow unimproved finger millet varieties (land races), despite the popularization of improved drought tolerant varieties (ICRISAT, 2008; MOA, 2010). The unimproved varieties are low yielding, late maturing, susceptible to pests and diseases, as opposed to the improved varieties which are better in all these attributes. Continued use of unimproved varieties has contributed to low food production, leading to persistent household food deficit, hunger and poverty in the ASALs. The low food production has resulted to the communities' dependency on food aid from well-wishers and also reduction of national development due to diversion of government resources to feed them at the expense of other developmental programs (GOK, 2004; Nyassy, 2007). Adoption of improved finger millet varieties is reported to have reduced poverty and enhanced food security, in Western part of Kenya, where the crop was considerably popularized. The result was increased production that met farmers' household requirement and surplus that helped to generate household income (KARI, 2004; Oduori, 2005). The Western part of Kenya model can also be replicated in the ASAL areas, but the distribution and adoption of improved finger millet in these areas is not documented.

Mogotio Sub County is one of the ASAL areas of Kenya that experiences harsh climatic conditions making the area unsuitable for ordinary staple food crops such as maize and beans farming (Action aid, 2006; MOA, 2005). Farming in the area requires production of drought tolerant crops such as finger millet. Finger millet has for many years been an important food crop for almost all households in the Sub County, grown for its nutritive and food security values. Majority of the farmers in the County are small scale farmers who are resource poor and persistently grow low yielding unimproved finger millet varieties and this contributes to the low food production persistently experienced in the Sub County. The Sub County is among the areas worst hit by food insecurity, with household food deficit reported as high as 92% caused by low agricultural production (GOK, 2002). Improved and high yielding finger millet varieties have been popularised by stakeholders in the Sub County but the farmers' adoption is very low. Factors affecting this low adoption have not been documented forming the basis for this study. The small scale farmers in the Sub County need to be encouraged to grow improved high yielding finger millet varieties in order to increase their food production and consequently reduce food insecurity in the Sub County.

Previous studies have examined the particular farm-level factors affecting the adoption of new technologies by smallholders and have shown that a farmer's choice to adopt a new technology requires several types of information that may increase adoption (Alene & Manyong, 2006; Doss, 2006; Oster & Thornton 2008; Scalan, 2004). A farmer can be an adopter or non-adopter of a technology due to various reasons. Adoption and adaptation are intertwined, in that adaptation of the technology frequently occurs in the process of implementing it in the on-farm experimentation resulting to an ongoing process of farmer experimentation (Mathenge & Tschirley, 2008). Different behaviors regarding adoption may be as result of different opportunities and constraints as well as of differences in inherent characteristics or perceptions of the technology by farmers (Langyintuo & Mekuria, 2005).

1.2 Statement of the Problem

Finger millet is a drought tolerant cereal crop that is nutritious, easy to grow, matures early and resists storage pests. These qualities make the crop very suitable for food security in the ASALs of Kenya, where food insecurity is persistent. Mogotio Sub-County falls under the ASALs of Kenya and suffers low food production that consequently leads to food insecurity, malnutrition and poverty in the area. Finger millet has been grown for many years in the Sub-County for its nutritive and food security values. The main crop producers in the Sub-County are small scale farmers who have continuously grown low yielding unimproved finger millet varieties and this contributes significantly to low food production. Improved high yielding and recommended finger millet varieties have been popularized by stakeholders in the area, but farmers' adoption is very low. Information on factors affecting the adoption of improved finger millet varieties by these farmers is not readily available, forming the basis for this study.

1.3 Purpose of the Study

The purpose of this study was to establish selected factors affecting the adoption of improved finger millet varieties among the small scale farmers in Mogotio Sub-County.

1.4 Objectives of the Study

The study was guided by the following objectives:

i. To determine the difference in finger millet yields between small scale farmers in Mogotio Sub-County who have adopted improved varieties and those who have not.
ii. To establish whether the technical attributes of improved finger millet varieties affect their adoption by small scale farmers
iii. To determine whether sources of Agricultural information affects the adoption of improved finger millet varieties by small scale farmers.

1.5 Research Hypotheses

The following hypotheses were tested at 0.05% significance level:

H_{o1}: There is no statistically significant difference in finger millet yields and percentage of farmers between adopters and non-adopters.

H_{o2}: There is no statistically significant relationship between improved finger millet varieties technical attributes and their adoption by small scale farmers.

H_{o3}: There is no statistically significant relationship between the improved finger millet varieties sources of agricultural information and their adoption by small scale farmers.

1.6 Significance of the Study

The findings from this study revealed useful information that may guide farmers and Agricultural extension officers to increase adoption of improved finger millet varieties in Mogotio Sub-County. This may lead to increased food production, reduce malnutrition and improve livelihood for communities in the Sub-County. Collaboration between the Sub-County Agriculture Development Planners and the finger millet stakeholders such as the cereal industries, nutritionists, agro-inputs and other service providers may also be enhanced. The information obtained may also guide breeders in the development of even better finger millet varieties that meet the need of farmers in the ASALs and support them to contribute to the economic growth of Kenya.

1.7 Scope of the Study

The study geographical scope was Mogotio and Emining areas in Mogotio Sub-County, selected due to their reported considerable popularisation of farmers to the production of improved finger millet varieties. The study focused on selected factors affecting adoption of improved finger millet by small scale farmers in the Sub-County. The factors studied included: (i) Yields of improved and unimproved finger millet varieties grown by small scale farmers. (ii) Improved finger millet varieties technical attributes (iii) Improved finger millet varieties sources of Agricultural information.

1.8 Assumptions of the Study

The study assumed that:

a. The selected farmers had equal opportunity to interact with the stakeholders popularising improved finger millet varieties in Mogotio Sub-County.
b. The information given was a true reflection of what was happening on ground.

1.9 Limitations of the Study

The study covered small scale finger millet farmers in Mogotio Sub-County and therefore any generalizations made from the findings have to be confined to this group of farmers.

1.10 Definition of Terms.

Adopters: This study referred adopters as those farmers growing improved finger millet varieties.

Adoption: Rogers (1995) define adoption as a process that occurs over time, from the first hearing of an innovation to the stage in which an individual or community makes decision to make use of an innovation as the best course of action. This study used adoption to refer to the growing of improved finger millet varieties by small scale farmers in Mogotio Sub-County

Farm Family: In Kenya, a farm family is defined as a farm land owned and managed by a household (GOK, 2009). The farm family in this study was taken to be a household that owned or leased not more than 10 acres of farm land in Mogotio Sub-County and shared the responsibilities of finger millet production.

House hold: Doss (2003), defines a household as a group of individuals who eat and live together, performing and sharing most domestic responsibilities as a means of survival. In this study a household was used to refer to a group of individuals who ate and lived together, shared and performed other domestic responsibilities concerning finger millet production, had a household head and lived in Mogotio Sub-County.

Non-adopters: This study referred the non-adopters as those farmers found growing only traditional finger millet varieties or at some time grew the improved varieties but later abandoned

Small Scale Farmer: According to Sygenta Foundation (2011), the term small scale farmer is often associated with small-scale and subsistence-level family farming in resource-poor conditions operating with few purchased inputs and limited production technologies. In this study, the small scale farmer referred to households with not more than 10 acres as this was considered the land limit to qualify as small scale in the ASALs of Kenya (MOA, 2006).

Source of Agricultural Information: Information gained by farmers help them to become knowledgeable on farming practices and getting the right information enhances involvement in the appropriate practices (Doss, 2006). For this study source of agricultural information was used to refer to information on improved finger millet production received by farmers from extension staffs, farmers groups, friends/ neighbours and Non-Governmental Organisations [NGOs]/Faith Based Orgainisations [FBOs] that affected adoption of improved finger millet varieties by farmers in the ASALs of Mogotio Sub-County.

Technical Attributes of Finger Millet Varieties: This refers to the technical attributes offered by improved finger millet varieties based on grain color, maturity period, yield, grain use for making porridge, ugali, traditional brew and other uses, that affected their adoption by small scale farmers in Mogotio Sub-County.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews what other researchers have done on adoption of agricultural technologies by small scale farmers focusing on socio cultural factors, sources of agricultural information and varieties technical attributes. Food security status in the ASALs of Kenya, theoretical and conceptual frameworks are also given in the review.

2.2 Adoption of Agriculture Technologies by Small Scale Farmers

Globally, farmers are faced by many challenges in their agriculture practices and these include unpredictable weather, inaccessibility to quality agro-inputs, inappropriate agriculture technologies and suitable market for their produce (Doss, 2006; World Bank, 2002).These challenges affects the farmers' decision to grow crops and consequently food production.

The role of agricultural technological change in reducing farmers' poverty and fostering economic growth has been widely documented in literature and although very complex, the relationship between adoption of technologies and poverty reduction has been reported positive by Doss (2003), ICRISAT (2008), Kidane, Maetz & Dardel (2006) and World Bank (2003). The farmers' decision-making to adopt a new technology is generally complex and (Doss, 2006) emphasizes that multiple factors are involved and include among others food security, available resource base and the farmer's objective. The objectives and the available resources vary among farmers and change over the life cycle of the farm household. Farmers in the same environment may have different objectives and livelihood strategies, and so respond differently to a given technology. Within the farm household, the ability to make decisions regarding resource use and technology varies according to age, gender, and other categories. The actual decisions can depend on a complex bargaining process among household members according to (Kidane & Maetz, 2006; Langyntuo & Mekuria, 2005). Therefore various interventions draw farmers into a wider arena in which various social actors are pursuing their personal and institutional strategies. The outcomes in terms of adoption decisions will highly depend on the interplay between these actors and not merely a clear-cut decision to adopt or not. The differences between the environment in which the technology was developed and the environment of the target community can also prompt farmers to adapt the technology in the process of adopting, resulting in a variety of adoption-adaptation behaviors among the small scale farmers. Being primarily engaged in a particular crop production can lead to commodity-based social institutions, like farmers associations or cooperatives, which can promote production (Alene & Manyong, 2006; Doss, 2006).

Adoption and adaptation are intertwined in that adaptation of the technology frequently occurs in the process of implementing it in the on-farm experimentation, resulting to an ongoing process of farmer experimentation. This experimentation is not be confined to a few research-oriented farmers, but is the process by which almost all farmers incorporate technology into their farming systems and becomes raw material for farmer experimentation as noted by Mathenge and Tschirley (2008). It is therefore important to have an understanding of the processes leading to the adoption of new technologies by smallholders as it is very important to successful adoption of agriculture technologies for there is no clear-cut, one-way progression from research to extension and adoption of any technology (Doss, 2006; Eicher, 2008). This study seek to establish the small scale farmers situation in Mogotio Sub County in order to assist them increase adoption of improved finger millet varieties and increase their food production.

An understanding of the processes leading to the adoption of new technologies by smallholders has long been seen as important to the planning and implementation of successful research and extension programs (Cramb, 2003; Doss, 2003). A successful adoption depends on more than careful planning in research and the use of appropriate methodologies in extension but also depends on farm- household factors and critical external factors that are largely unpredictable as arguably noted by Amundavi (1993), Anderson (2007) and Kibaara, Ariga, Olwande, & Jayne (2008). Most agricultural technologies come in as packages that require a combination of inputs for successful output and it is important that the farmers are able to apply all the packages to attain the intended product (Adams, Place, & Swisher, 2009).

With reference to the developing world, the term small scale farmer is often associated with small-scale and subsistence-level family farming in resource-poor conditions operating with few purchased inputs and limited production technologies (Syngenta, 2011; World Bank 2003).

Empowering small scale farmers can increase food production tremendously as they form over 75 percent of all agricultural producers in the developing countries (Hosseini, Nejad, & Niknami, 2009; World Bank 2003). These small scale producers are characterized by intensive farming on small holdings and when empowered, can contribute greatly to agricultural production. A success story of empowering small scale farmers was demonstrated by Vietnam, where the country could not feed its population by 1970 leading to reliance on food aids but after empowering the small scale holders on rice production, the country is now the second world leading exporter of rice (Mutiga, 2011). The Vietnam small holders achieved this production from an average holding of two acres farm. Kenya can learn from Vietnam and empower small scale farmers with production technologies that will lead to increased production and achieve the most desired food security for its population. Establishing factors that can assist farmers to increase adoption of production technologies may lead to enhanced food production and improved livelihood. This study sought to establish the farmers' situation in Mogotio Sub-County so as to assist them to increase the adoption of improved finger millet varieties.

Farmers' adoption of improved finger millet varieties and the related technologies for continued use, go through a number of individual assertions as they relate to the new technologies (Oduori, 2005). The farmers require to be given accurate information on production technologies especially on quality inputs (Shiferaw, Obare & Muricho, 2000). Availability and access by farmers to quality seeds contributes significantly to increased crop production. Quality agro-inputs include seeds, fertilizer and chemicals and each contributes to enhanced production. Seed is one of the most important basic inputs of crop production and its quality contributes greatly to improved production. The Kenya government recognized the importance of seed quality and initiated a regulatory body called Kenya Plant Health Inspectorate Service [KEPHIS] in 1998 (GOK, 2009) under the Ministry of Agriculture to regulate the quality of seeds offered to the farmers. Under government standards enforced by KEPHIS, seeds offered to farmers have to meet the minimum standards set by the government and offering seeds to farmers that fall below these standards is a violation of laws and one can face prosecution. Seed sellers are required to register and be licensed by KEPHIS and maintain and renew their license annually to ensure compliance to standards (KEPHIS, 2010; GOK, 2009; MOA, 2010).

Surplus production should have ready market and the produce should be sold at a profitable price to encourage production. Information on suitable market and appropriate price should be given to farmers. For improved livelihood, farmers should be able to produce enough for their subsistence use and surplus for income generation (Hosseini, 2009; Alene & Manyong, 2006). The lack of adequate access to credit is found to have significant negative consequences for various aggregate and household level outcomes, including technology adoption, agricultural productivity, food security, nutrition, health and overall household welfare by. Access to credit by farmers is important since extension services cannot achieve the desired changes if other ingredients for change such as credit are lacking and also access to financial support such as grants for empowerment from development partners such as FBOs and NGOs (Anderson & Purcel, 1997).

In Kenya, Baringo County is among the areas worst hit by food insecurity, with household food deficit reported at 62 percent and some areas as high as 92 percent due to low agricultural production (GOK, 2002). In fact, one of the main objectives of the government in the area is to improve food security through activities focused on reducing the perennial food deficit and one of these activities is increased food crop production (Action aid, 2006; Asindua, 2001; MOA, 2005; Nyassy, 2007). The harsh climatic conditions experienced in the County make the area unsuitable for ordinary staple food crops such as maize and beans requiring production of drought tolerant crops such as finger millet. Small scale farmers in Mogotio Sub-County of Baringo County, realize very low yields of finger millet, at less than 200 kilograms per hectare, contributing to food insecurity in the County (MOA, 2010). The national finger millet yields ranges between 500-780 kilograms per hectare, though the potential yield range from 3.5-4.2tons per hectare as reported by Holt (2000) and Takan *et al* (2002). Encouraging farmers in Mogotio Sub-County to grow improved high yielding finger millet varieties can increase food production and consequently reduce food insecurity in the Sub-County.

2.3 Improved Finger Millet Varieties: Technical Attributes

Finger millet is one of the oldest foods known to humans and possibly the first cereal grain used for domestic purposes. Finger millet ranks as the sixth most important grain in the world produced in over 4 million ha and sustaining over a third of the world's population (ICRISAT, 2010; Takan *et al.*, 2001). It was introduced to East Africa more than 5,000 years ago and got to Kenya from Uganda and Ethiopian highlands (Oduori, 2005; Screenivasprasad, 2006), where it is mainly grown for domestic use by small scale farmers. In particular, finger millet is the second most important traditional cereal crop after sorghum in East and Central African Sorghum and Millet Network (ECARSAM, 2009)

The discovery and understanding of the mechanism of genetic inheritance advanced crops improvement. With this understanding man has been able to transfer desirable traits from one plant to another in order to obtain varieties of superior technical attributes for their benefit. Consequently finger millet breeders have used the genetic understanding to obtain improved varieties offering higher quality in grain yields, maturity period, preferred color usage qualities, tolerance to harsh climatic conditions, faster growth, resistant to pests and diseases and many other superior qualities. These variety technical attributes offer farmers options for replacement with the unimproved varieties (Bennetzen *et al,* 2003, KARI, 2009; KEPHIS, 2010). Farmers will adopt and plant finger millet varieties that offer technical attributes that meet their need. This study will seek to find out which attributes affects adoption of improved varieties by farmers in Mogotio Sub County.

Although finger millet is vital for the livelihood of millions of resource- poor Africans, research in these crop lags behind that of crops like maize, wheat and rice. It became less important due to gradual neglect from research and development, resulting in lack of appropriate and modern production technologies as reported by Bosch, Borus and Brinks (2007) and Tadele (2009). Finger millet production in Kenya, has been declining over the 30 years in favour of other cereals such as maize and wheat but production is currently reported to make a comeback with yields rising from between 500-780 tons per ha., to a range of between 3.5-4.2 tons per hectare from use of improved varieties (Lenne, 2006; Takan *et al.,* 2002) and this is mainly due to its nutritive and commercial value. The Western and Rift Valley regions of Kenya, extending to Uganda is the second largest finger millet growing regions in the world after Karnaka in India (ICRISAT, 2009). The Kenya trend has changed in the last decade because traditional crops have received renewed research attention (ICRISAT, 2010; KARI, 2009; Tadele, 2009) resulting in introduction and development of high yielding, drought tolerant and improved varieties (Table

1). However, the adoption of these improved varieties by farmers in the ASALs areas like Baringo, Machakos, Makueni, West Pokot and Marakwet and other semi-arid areas are still low leading to consistent crop failure, low productivity with subsequent hunger and malnutrition among communities there. There is reported enhanced food production, reduced hunger and malnutrition in the ASALs of Turkana County arising from popularisation of growing of drought tolerant crops such as finger millet, as reported by Nyassy (2007) and National Television [NTV] (2011).This model of successful food production in the ASAL of Turkana can be replicated in the ASALs of Mogotio Sub County.

Table 1: Improved Finger Millet Varieties and their Technical Attributes

Variety	Duration (months)	Attitude (masl)	Varieties Attributes	Yields (tons/ha)
P224	3-4	1150-1750	Dark brown grains good for brewing and making of “ugali” and porridge	4
P283	3-4	1150-1750	Brown grains good for making porridge and “ugali”	3.5
U-15	3	300-1700	Brown grains good for brewing and making of “ugali” and porridge	2.5
Nak.fm/1	3-4	1750-2300	Brown grains good for baking, brewing and making of “ugali”	2.8
Kat.fm/1	2-3	250-1150	Whitish brown grains good for baking	3.8
Gulu-E	2	250-1150	White grains good for porridge	2
Okhale	1.8	1000-2100	Dark brown good for brewing and making of “ugali” and porridge	1.8

Source: KARI (2009)

According to Tadele (2009) several constraints limit finger millet production potential and key among these is the exploitation of genetic diversity and poor crop husbandry (Bosch *et al.*; Screenivasaprasad, 2006). These constraints are made worse by the neglect of the crop by the mainstream research and development systems as indicated by the number of improved varieties for finger millet as compared to other cereals such as maize (Bennetzen *et al.,* 2003; KARI, 2009), which has over 70 improved varieties released to farmers in the last four decades

(KEPHIS, 2010; Kenya Seed Company [KSCO], 2011). Demand for finger millet is rising due to public awareness of its nutritive and market values, pressuring for its increased production
Finger millet like other cereals is predominantly starchy and its protein content is nearly equal to other cereals such as sorghum, rice, wheat and maize (Table 2). Finger millet contains low fat, high ash content and is rich in iron and phosphorus. It has high fiber content and the highest calcium content among all the food grains, and the whole grain is an important source of B-complex vitamins, which are mainly concentrated in the outer bran layers of the grain. The grain is non-glutinous, non-acid forming and hence is soothing and easy to digest. It is considered one of the least allergenic and most digestible grains available. The grain is also warming thus helping to heat the body in cold or rainy seasons and climates (Asindua, 2001; FAO, 2010; GOK, 2002). Increasing finger millet production by using improved high yielding varieties in the study area would reduce malnutrition levels significantly.

Table 2: Nutrient Composition of Finger Millet and other Cereals (100g at 12% moisture)

Cereal (g)	Protein (g)	Fat (g)	Ash (g)	Fibre (g)	Carbohyd (g)	Energy (kcal)	Calcium (mg)	Iron mg)	Riboflan
Finger millet	**7.7**	**1.5**	**2.6**	**3.6**	**72.6**	**336**	**350**	**3.9**	**0.19**
Maize	9.2	4.6	1.2	2.8	73	3.58	26.2	2.7	0.2
Rice	7.9	2.7	1.3	1	76	362	33	1.8	0.04
Sorghu	10.4	3.1	1.5	2	70.7	329	25	5.4	0.15
Wheat	11.6	2	1.6	2	71	348	30	3.5	0.1

Source: FAO, Sorghum and Millet in Human nutrition (2010)

Though rarely consumed in the Western world, millet is still the principal source of energy, protein, vitamins and minerals for millions of the poorest people and hence valued for its nutrition and cultural uses, such as the making of traditional liquor for socialization as reported by FAO (2007) and MOA (2009). It has good content of unavailable carbohydrates complemented by the slow release of sugar from millet based diet makes it suitable for management of diabetics and is also used to manage malnutrition, diabetes and AIDS patients according to FAO (2010), Stylinger (2010) and World Bank (2002).

Finger millet is especially valuable as it contains the amino acid methionine, which is lacking in the diets of hundreds of millions of the poor who live on starchy staples such as cassava, rice and maize. The grains can be ground and cooked into cakes, “mandazis”, “chapatis” porridge and when fermented, the grain is made into a festival drink in many parts of Africa and potential for brewing industries. Finger millet makes good fodder for animals and provide up to 61 percent of total digestible nutrients for animals, better than that from other cereals such as maize, wheat and sorghum (Ahmed *et al* 2000; KARI, 2009). Mothers use finger millet flour for child care, breastfeeding and for pregnant mothers to an extent of being referred to as a crop of woman domain as noted by Cheboi (2009 and FAO (2010) and also as a source of energy by making ugali for the family. It has good content of unavailable carbohydrates complemented by the slow release of sugar from millet based diet makes it suitable for management of diabetics and is also used to manage malnutrition, diabetes, AIDS patients and recuperating persons from birth and circumcisions as indicated by FAO (2010), GOK (2006) and Stylinger (2010). The plant remains can also be used for thatching traditional roofs and making walls for traditional granaries and the stalk can also be used as firewood for cooking. Surplus production can be sold to local market and to millers to raise income for the farmers and hence improve their livelihood according to FAO (2007) and Stylinger (2010).

Finger millet can be used for international trade especially among African countries, where it is grown as a traditional food crop. Countries within Common Market for East and Southern Africa (COMESA) region can benefit greatly on finger millet trade in the trade block popularization under COMESA. One of the COMESA objectives is to strengthen the regional markets for trade and food security competitively (COMESA/COMPRAP, 2010); GOK, 2005). Increasing the production of finger millet in the ASALs of Mogotio District will benefit the communities in all these qualities of the crop. There is therefore need to encourage the farmers there to increase adoption of improved finger millet varieties towards this achievement.

2.4 Improved Finger Millet Varieties: Sources of Agricultural Information

A farmer’s will choose to adopt a new technology when certain type of information is available. The farmer must know that the technology exists, its benefits and knowledge of how to use it effectively as indicated by Ellis (1997). This information may come from different sources, such as agricultural extension workers, NGOs, markets, observing the decisions and experiences of neighbors; and from the farmer’s own experience. Information from extension workers may be particularly important for the adoption of new technologies but not all extension workers are motivated to do their job well due to limiting facilities that affect their performance (Commodity Market in East and Southern Africa (COMESA), 2010; World Bank, 2003). In addition, extension workers perform their duties to disadvantaged farmer groups of illiterate to semi-illiterate women and old people who also face various difficulties in their livelihoods (Madhur, 2000). Studies on technology adoption in fields other than agriculture show that individuals learn from others within their social network. The results are however mixed; adoption by one's peers can make adoption more or less likely to have an effect to a new technology as noted by (Doss, 2006). Learning from others can result in a less rapid spread of technology if social networks are small or if the benefits of a technology are hard to observe. According to Madhur, (2000) despite awareness, the potential benefits in the form of productivity will be limited if the farmers do not adopt the recommendations. Other sources of information getting to the farmers could be the media in various forms such as print media in form of farmer's newsletters and daily newspapers, audio visual media in form of radio and televisions. Media can be a good and efficient form of information but at times the information providers may not be experts in the area of reporting hence misadvising farmers. Some media reports, especially the radio and televisions have the disadvantages of little or lacking the opportunity to ask questions when issues are not clear. Print media may be good for those who can read and write but of little use to the illiterate. The literacy level for populations in the study area is comparatively very low and the source of agricultural information is very significant to adoption of improved finger millet and consequently to food production.

Given that the relative importance of different sources of information is likely to vary across technologies and contexts, understanding this difference can help improve the effectiveness of interventions which seek to provide farmers with information to promote technology adoption. Research suggests that the way information is presented, the person presenting the information, how much information is given and in what form, can be as important as the content of the information itself (Hosseini, Nejad,& Niknami, 2009). According to Oster and Thornton (2008), information about a technology is only one of many factors that affect whether a farmer will adopt a technology or not.

Effective dissemination and adoption of technologies by farmers is so dependent on effective extension services and the education level of the farmers (Adams, Place and Swisher, 2009). Agricultural extension has been described as a system of out-of-school education for rural people that gives assistance to farmers to help them identify and analyse their production problems and become aware of the opportunities for improvement (Anderson and Purcell, 1997; FAO, 2010). Extension is also described as an on-going process of getting useful information to people and then assisting those people to acquire knowledge, skills and attitudes to utilize the information (Ariga, Kibaara and Nyoro, 2008). Conventional extension theory, based on the central source model of technology development and diffusion, examines the role of various organizational arrangements and communication techniques in persuading farmers to adopt a recommended technology (Anderson, 2007; MOA, 2004). An effective agriculture extension service is capable of assisting the target communities to raise production and increase incomes by providing support for socio-economic development. While the advisory services has to adapt itself to the existing social framework of the farmers, it must also be active in promoting change towards a more progressive social framework as a prerequisite for technology change (Amudavi, 1993). However, its effectiveness depends upon target decision to adopt the information offered by extension services and thus the need to understand the situation in the study area.

In Kenya agriculture extension services play a key role in enhancing the adoption and sustainability of innovations by the farming groups. The technology dissemination to farmers has been the responsibility of the Ministry of Agriculture through the extension staff but the ministry cannot achieve this in isolation without the participation of other stakeholders especially from the private sectors and local community to enhance ownership of innovations and projects (Eicher, 2006; Qaim, 2000; MOA, 2006). The extension staff links the community with the relevant stakeholders through participation diagnosis involving community at local level. In working with these stakeholders, the extension services build important social and human capital imploring clients to analyze and resolve their own problems (GOK, 2004; World Bank, 2002).

2.5 Theoretical Framework

The study was guided by the adoption of innovation and diffusion of innovation theories (Rogers, 1995). Rogers identify principle characteristics that enhance the rate and effectiveness of the diffusion and adoption of an innovation. The characteristics are concerned with the innovation perceived relative advantage, compatibility, complexity, trialability and communication. The study sought to determine the characteristics of relative advantage, compatibility and diffusion/communication of improved finger millet varieties. The relative advantage principle is concerned with the idea that a new practice is more effective than the one it is replacing. The new practice was the adoption of improved finger millet varieties as a replacement of the traditional varieties grown in the study area. Compatibility is concerned with the degree to which a new practice is consistent with existing values and needs of potential adopters. If the new practice is perceived as an extreme change, it may not be compatible with adopters' experiences and may be slow to diffuse (Rogers, 1995). The study established the compatibility of the new practice with the socio- cultural factors of household land control and labour use in the study area. The principle of communication looks at communication as a process in which participants create and share information with one another to reach a mutual understanding. The information flows through networks whose sources can increase or decrease the likelihood that a new idea, product, or practice will be adopted by members of a given culture (Rogers, 1983). Accurate agricultural information on finger millet production reaching farmers can increase adoption and consequently increase food production.

Based on the two Rogers theories, then, the farmer's choice to adopt a new technology requires that the farmer know that technology exists, that the technology is beneficial and to know how to use it effective. Farm-level adoption of new technologies by smallholders follows a process that is controlled by unpredictable factors such as household and external factors. The household factors associated with adoption vary from one farmer to another in the same area and includes household objectives, available resources and head personal characteristics. The external factor associated to adoption includes social responsibilities of family members, source and presenter of information, and the customization of the technology itself (Ellis, 1997; Nguthi, 2007; FAO, 2009). The two Rogers theories provided a useful framework for this study which was to establish selected factors affecting adoption of improved finger millet varieties by small scale farmers in Mogotio Sub County in Baringo County.

2.6 Conceptual Framework

Based on the literature review, several factors were identified as affecting adoption of agricultural innovations and these include socio cultural, source of information and the innovation itself. These factors affect the adoption of the innovations by farmers in a particular area in different ways. The adoption of improved finger millet varieties was the dependent variable for this study which was measured by determining the number of farmers growing the improved varieties, using quality agro-inputs and the yields attained in tons per hectare, by small scale farmers in Mogotio Sub County. The independent variables for this study were the improved finger millet varieties technical attributes based on maturity period, grain yield, color and grain use for making ‘ugali’, porridge, brewing and baking. The source of agricultural information was another independent variable and focused on extension officers, farmers groups, neighbours and FBOs/NGOs. The interaction between the dependent and independent variables was influenced by extraneous factors. The extraneous factors are independent variables that are not related to the purpose of the study, but may affect the dependent variable (Kothari, 2008). The extraneous variables for the study were the farm size, household head gender and education level. The researcher controlled these extraneous variables by limiting the household farm size to not more than 10 acres and random selection of respondents during data collection. The conceptual framework shows the relationship between the dependent, independent and extraneous variables.

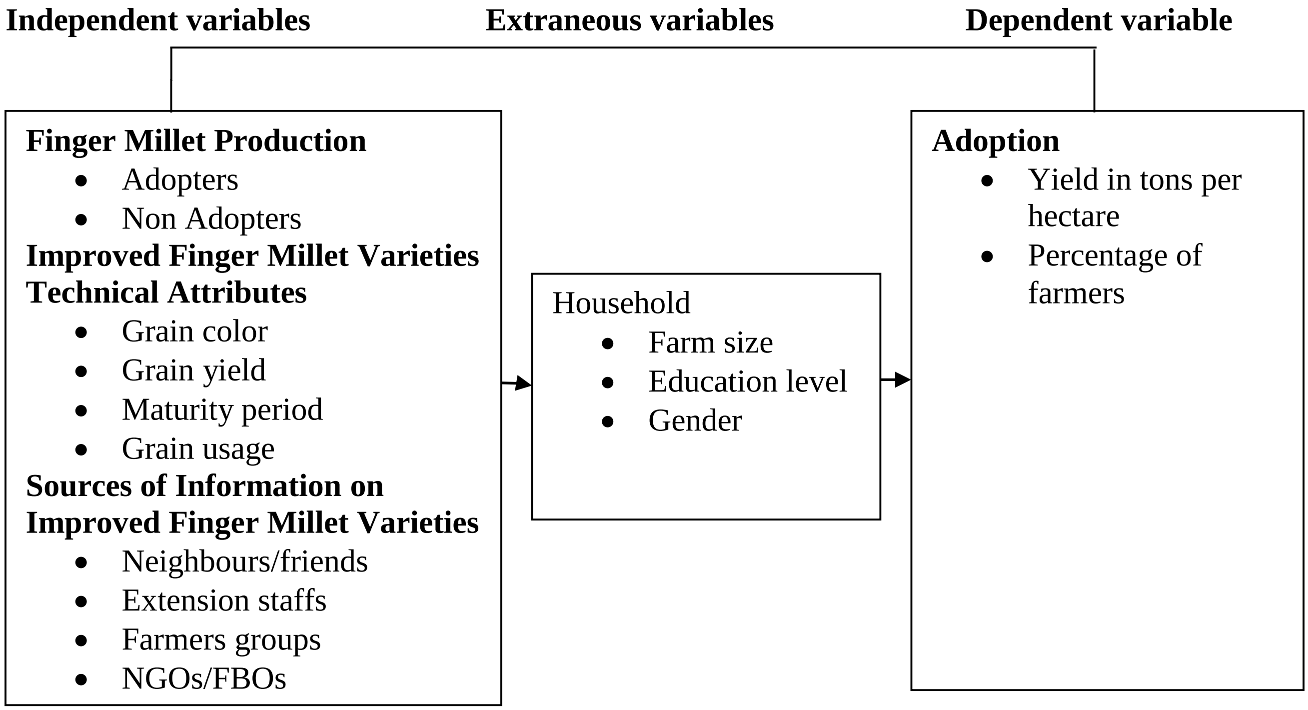

Figure 1. Conceptual framework on selected factors affecting adoption of improved finger millet varieties by small scale-farmers in Mogotio Sub-County

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research procedure used in the study. It covers research design, study location, target population, sampling procedure and sample size, instrumentation, data collection, data analysis and summary of the analytical procedures used in the study.

3.2 Research Design

The study adopted descriptive research survey design to collect data. Descriptive research is recommended as useful for collecting data from naturalistic occurring events, by (Frankel & Wallen, 2000; Mugenda & Mugenda 1999). Surveys are recommended as important in research for they allow economical collection of a large sample of data from a sizeable population (O'connor, 2002) and are useful in describing the characteristic of the population (Frankel & Wallen, 2000; Kothari , 2008). The design was appropriate for the study which collected information from a sample of finger millet farmers then described their characteristics and established their effect on adoption of improved varieties. The design is also useful in making accurate assessment of inferences, distribution and relationship of phenomenon (Gall & Borg, 2003).

3.3 Study Location

The research was carried out in the ASALs of Baringo County. The County is located within 50.44^0N and 35.95E and has 6 Sub Counties with 26 divisions of which 17 divisions fall within the ASAL region. The County has an area of 11,015.34 km^2 with a population of about 203,255, a food deficit of 82 percent, a poverty level of about percent, in some areas food deficit records 92 percent. Finger millet is one of the important traditional crops in almost all households of Baringo County and has been grown there for many years for food security. Mogotio Sub-County is in Baringo and covers an area of 1364.2 $km^{2,}$ lies at 10^0 N, 35^0 E and 1590 meters above sea level. The Sub-County has 5 divisions, two of which are Mogotio and Emining with a total population of 40,781 (MOA, 2010). The farming communities in the sub-county have over the years grown unimproved finger millet varieties of low yields, contributing to low food production in the area. Improved finger millet varieties have been considerably popularized in the two divisions by finger millet stakeholders for farmers to adopt and replace with traditional varieties but their adoption is low.

3.4 Study Population

The target population for this study was 16,166 (Table 3) small scale farmers from Mogotio Sub-County. The accessible population was 8,052 small scale farmers from Mogotio and Emining Divisions in the Sub-County. There were 4,777 small scale farmers in Mogotio and 3,275 farmers in Emining Divisions. The 2 Divisions were chosen because improved finger millet varieties have been considerably popularized to the farmers there by stakeholders.

Table 3: Demographic Profile Mogotio and Emining Divisions

Division	Population	Small-scale farmers	Annual rainfall(mm)	Altitude (masl)	Poverty (%)
Mogotio	22,876	10,274	180-950	1500-1600	63
Emining	17,905	5,892	200-850	1450-1500	59
Total	**40,781**	**16,166**			

Source: MOA (2010)

3.5 Sampling Procedure and Sample Size

The study sample size was determined by the formula:

$$n = \left(\frac{\frac{t^2}{d^2}}{1 + \frac{1}{N}\left(\frac{t^2pq}{d^2} - 1\right)} \right)$$

Where:

Sample size (n) =267

N= Population size =8052

d^2 p= Probability (50%) =0.5

q=1-p = 0.5

t= z-statistic =1.96

d= Margin of error (6%) = 0.06

A sample size can be increased to take care of non-respondents (Kothari, 2008). The researcher increased the study sample size to 300 to take care of cases of non-respondents. Proportionate sampling was used to select 178 and 122 respondents from Mogotio and Emining divisions respectively (Table 4). Proportionate sampling ensures that no sub-group is left out from the sample and avoids overloading in certain sub-populations (Gall & Borg 2003; Kothari, 2008). A table of random numbers was used to select the actual respondents from a sampling frame of the list of small scale farmers obtained from Mogotio Sub County Agricultural Officer.

Table 4: Sample Size and Sample Proportions of Small Scale Farmers

Division	Small-scale farmers	Proportion	Number Selected
Mogotio	4777	4777÷8052 x 300	178
Emining	3275	3275÷8052 x 300	122
Total	**8052**		**300**

3.6 Instrumentation

The researcher used a developed questionnaire to collect the required information from the selected small scale farmers in the study area. The questionnaire was chosen because it saves time, can be used over a large population and is simple to administer for a large sample (Edwards, 2006). The instrument also offered an opportunity for the researcher to effectively clarify and convince the respondents on the importance of the study. Literacy level in the study area is low and clarification and elaboration on the study item enhanced the responses received. The questionnaire had four sections, each comprising of a set of questions developed to address the stated objectives and hypotheses of the study. The researcher read out the questions to the selected respondents and wrote down the responses.

3.6.1 Validity

The researcher's supervisors, experts from the Faculty of Education and Community Studies of Egerton University and discussions with researcher's colleagues, assisted in reviewing the instrument validity. This verified that the instrument content and face validity was adequate and that the questions were suitable to yield valid data from which inferences were made.

3.6.2 Reliability

Reliability is the degree to which a research instrument yields consistent results after repeated trials (Mugenda & Mugenda, 1993). To increase the reliability of the study instrument, a pilot study was conducted to compute reliability coefficient of at least 0.7 and determine internal consistency of the gathered data. The pilot test involved 30 respondents similar to those of the study area and drawn from the neighbouring Kampi ya Moto Division in Rongai Sub-County. The data collected was used to compute Cronbach's Alpha reliability coefficient that yielded a value of 0.86 and was considered to be adequate (Fraenkel & Wallen, 2000; Kothari, 2008).

3.7 Data Collection Procedure

The researcher first obtained approval from the Graduate School of Egerton University and then a research permit from National Commission for Science Technology and Innovations to undertake the study. The researcher thereafter met the Sub county Agricultural Officer in Mogotio District to plan for the data collection in the field. Through the help of the district frontline extension staff, the researcher met the selected respondents read out the set of questions in the questionnaire to the household head and recorded his/her responses. The frontline extension officers or opinion leaders assisted in language translation for cases of illiteracy. In addition to this, field observations were made to authenticate information recorded by the instrument.

3.8 Data Analysis

The collected data was coded, entered into the computer and analysed using the Statistical Package for the Social Sciences (SPSS version 20). Descriptive statistics (mean, mode frequency distributions) were calculated and inferential statistics used in the hypothesis testing of the study as summarized in Table 5.

Table 5: Summary of the Data Analysis and the Statistical Procedures used

Research Hypotheses	Independent variables	Dependent variables	Statistic used
Ho1: There is no statistically significant difference in finger millet production based on yield and percentage of farmers between the adopters and non-adopters in Mogotio Sub-County.	Improved Finger Millet Production Adopters Non Adopters	Yield in tons per hectare Percentage of farmers	Chi-square
Ho2: There is no statically significant relationship between improved finger millet varieties technical attributes and their adoption by small scale farmers in Mogotio Sub-County.	Improved Finger Millet Technical attributes Grain color, Maturity, Yield and Usage	Adoption	Descriptive, Correlations
Ho3: There is no statistically significant relationship between the improved finger millet varieties sources of agricultural information and their adoption by small scale farmers in Mogotio Sub-County.	Improved Finger Millet Varieties Agricultural Information source Extension staff Farmers groups NGOs/FBOs Friends/ Neighbours	Adoption	Descriptive, Correlations

CHAPTER FOUR

RESULTS AND DISCUSSSION

4.1 Introduction

This chapter presents the results of the study in relation to each objective and hypothesis. The purpose of the study was to establish selected factors affecting adoption of improved finger millet varieties by small scale farmers in the semi-arid Mogotio Sub-County. The study outcomes are presented according to the objectives and hypotheses of the study. The study objectives were;

i. To determine the difference in finger millet production based on yields and percentage of small scale finger millet farmers growing improved varieties (adopters) and those growing unimproved varieties (non-adopters) in Mogotio Sub-County.
ii. To establish the improved finger millet varieties technical attributes and affecting their adoption by small scale farmers in the study area.
iii. To determine the sources of Agricultural information on improved finger millet varieties and affecting their adoption by small scale farmers in Mogotio Sub-County

4.2 Characteristics of the Respondents

The characteristics of the respondents were studied to provide information on the background of the small scale farmers who grow finger millet in the study area. The characteristics studied included: gender, education of household head and types of crops grown by household.

4.2.1 Gender of Household Head

At the household level women and men are responsible for different specialized activities for the maintenance of the family. In the rural farming communities, the gender-specific roles and responsibilities allows for opportunity to participate in decision making on exploitation of household resources. Often women are discriminated on decision making of household resources exploitation and training on agricultural technologies, which affects the family food production (FAO, 2010). The gender information was gathered by indicating the gender of the respondents and results given in Table 6.

Table 6: Gender of Household Head

Gender	Frequency	Percentage
Male	282	94.9
Female	15	5.1
Total	**297**	**100.0**

The results indicate that majority of the respondents (94.9%) were male, only 5.1 percent were females. This concurs with Nguthi (2007) that in Kenya, the rural farming communities' household heads are mainly men.

4.2.2 Household Head Formal Education Level.

New agricultural technologies are needed to improve productivity of rural areas and literate people are more inclined to adopt these technologies. The numbers of years of exposure to schooling system contributes significantly to the literacy of an individual (World Bank, 2002). The respondents were asked to indicate there level of education and results given in Table 7

Table 7: Household Head Level of Formal Education

Education level	Frequency	Percentage
None	80	27
Primary	87	29
Secondary	95	32
Post –secondary	35	12
Total	**297**	**100**

Table 7 results indicates that 32 percent secondary level, 29 percent primary level, 12 percent had attained post-secondary education and 27 percent did not have any formal education. Formal education enhances farmers' capacity to adopt agricultural technologies and based on these results it can be explained that 56 percent of the farmers may require technical assistance to enable them adopt the improved finger millet varieties effectively.

4.2.3 Types of Crops Grown by Household

According to ICRISAT (2010), millets, sorghum, chickpeas, pigeon peas and groundnuts are improved drought resistant crops that are available to farmers in the drought prone areas to enhance their food production. The researcher studied this variable get background information on drought tolerant crops grown by farmers in the study area. The results are shown in Table 8

Table 8: Type of Crops Grown by the Household

Type of crop	Frequency	Percentage
Finger millet	297	100
Maize	288	97
Sorghum	96	32
Others	74	25

n=297

Table 8 shows that all the farmers in the study area grew more than one type of crop in their farm land. The major crops grown by these farmers were finger millet, maize, sorghum and other crops (pigeon peas, groundnuts, cowpeas and green grams). This finding concurs with the observation of Kimurto (2007) that the ASALs farming communities are mainly mixed crop growers of maize, beans, finger millet, green grams, cowpeas and sorghum. From Table 8 results all the farmers (100%) grew finger millet. The finding supports Action Aid (2006) in that finger millet is an important food crop for the small scale farmers in Mogotio Sub-County.

4.3 Production of Finger Millet between Adopters and Non Adopters

The study objective one was to determine the differences in yield and percentage of farmers between adopters and non-adopters in the study area. The data for this was gathered by asking the respondents to indicate the finger millet varieties they grew and the yield obtained during the three normal seasons. The researcher took average of the given data. The findings are presented in the following sub sections.

4.3.1 Adopters and Non Adopters

The adopters were the small scale farmers growing improved finger millet varieties while the non-adopters were the small scale farmers growing unimproved finger millet varieties. This data was collected by asking respondents to indicate the finger millet varieties (improved or unimproved) they grew during normal seasons. The result are shown in Table 9

Table 9: Farmers Producing Improved and Unimproved Finger Millet Varieties

Type of farmers	Frequency	Percentage
Adopters	30	10.1
Non Adopters	297	100.0

n=297

The results show that all the farmers (100%) grew unimproved (traditional) varieties while only 10.1 per cent grew the improved varieties. The results concur with that of ICRISAT (2008) that majority of the small scale farmers in the ASALs of Kenya grow traditional varieties.

4.3.2 Yields obtained by Adopters and Non Adopters

This data was obtained by asking respondents to indicate the yields obtained from growing improved and unimproved varieties during the last three normal seasons. The averages of the results were calculated and presented in Table 10.

Table 10: Differences in Yields obtained by Adopters and Non Adopters

Yield(Tons/ha)	Non-Adopters (n=297)		Adopter (n=30)	
	Frequency	Percentage	Frequency	Percentage
(1) Below 1	239	80.5	19	63.3
(2) Between 1-2	37	12.5	7	23.3
(3) Above 2	21	7.1	4	13.3

n=297

Table 10 results shows that majority of the non-adopters (80.5%) obtained yields below 1 ton per hectare and also a higher proportion (63.3%) of adopters obtained yields below 1 ton per hectare. From the results only a small percentage (13.3%) of adopters obtained the expected yields of above 2 tons per hectare. These results concur with the report from (ICRISAT, 2008) and (MOA, 2010) stating that majority of the small scale finger millet farmers in the ASALs of Kenya obtain yields below1ton per hectare.

4.4 Improved Finger Millet Varieties Technical Attributes

The third objective of the study was to determine the finger millet varieties technical attributes affecting the adoption of improved varieties in the study area. The technical attributes studied were the variety maturity period, grain color, yield, use for making of ugali, porridge, local brew and other grain uses (sale, baking, traditional gifts). The information gathered was the importance that famers attached to each of the variety technical attributes when choosing the variety to grow. The findings are presented in the following subsections.

4.4.1 Maturity Period

The data for this variable was collected by asking the respondents to indicate the level of importance of the maturity period variety attribute in choosing the variety to grow. The results are presented in Table 11.

Table 11: Farmers Rating of Finger Millet Varieties on Maturity Period

Rating Scale	Frequency	Percentage
Very important(1)	176	59.3
Important(2)	98	33.0
Not important(3)	23	7.7
Total	**297**	**100.0**

The results from Table 11 indicated that a high proportion (59.3 %) of farmers regarded variety maturity period as very important, 33 percent as important and a small proportion (7.7%) regarded maturity factor not important at all. Based on these results, a high percentage (92.3%) of small scale farmers regarded the maturity period as an important technical attribute of improved finger millet varieties in the study area.

4.4.2 Grain Color

Variety grain color information was obtained by asking the respondents to rate the importance of this technical attribute when choosing the variety to grow. Table 12 presents the results.

Table 12: Farmers Rating of Finger Millet Varieties on Grain Colour

Rating Scale	Frequency	Percentage
Very Important(1)	172	57.9
Important (2)	81	27.3
Not Important (3)	44	14.8
Total	**297**	**100.0**

From the results, majority of the farmers (57.6 %) regarded grain colour as very important, 27.3 percent as important and 15.2 percent of them felt that the grain color was not important at all. The results indicate that a high percentage (85.2%) regarded grain colour as an important technical attribute of improved finger millet varieties.

4.4.3 Variety Yield

The data for this variable was collected by asking the respondents to rate the importance of the yield attribute in choosing a finger millet variety. The results are given in Table 13.

Table 13: Farmers Rating of Finger Millet Varieties based on Yield

Rating Scale	Frequency	Percentage
Very important(1)	144	48.5
Important(2)	135	45.5
Not important(3)	18	6.1
Total	**297**	**100.0**

Table 13 shows that 48.5 percent of the farmers regarded yield as very important, 45.5 percent as important and 6.1 percent not important. Based on the findings, a high percentage of the farmers (94%) regarded yield as an important technical attribute of improved finger millet varieties.

4.4.4 "Ugali" Making

The data for use for ugali making was collected by asking the respondents to rate the importance of the attribute to farmers when choosing a finger millet variety. Table 14 gives the results

Table 14: Farmers Rating of Finger Millet Varieties Use for "Ugali" Making

Rating Scale	Frequency	Percentage
Very Important(1)	217	73.1
Important(2)	71	23.9
Not Important(3)	9	3.0
Total	**297**	**100.0**

The results from Table 14 indicate that the majority of the farmers (73.1 %) regarded the factor ugali making very important to them, important (23.9%) and not important at all (3 %). Based on these finding, a high percentage (97%) of farmers indicates that the use for "ugali" making as an important technical attribute of improved finger millet varieties in the study area.

4.4.5 Porridge Making

The data for the porridge making attribute was collected by asking respondents to rate the importance of the attribute when choosing finger millet varieties. Table 15 presents the results.

Table 15: Farmers Rating of Finger Millet Varieties use for Porridge Making

Rating Scale	Frequency	Percentage
Very important(1)	217	73.1
Important (2)	71	23.9
Not important (3)	9	3.0
Total	**297**	**100.0**

The results from Table 15 indicated that the majority of the farmers (73.1 %) rated porridge making attribute as very important, 23.9 percent important and only 3 percent of them felt it was not important at all. The findings show that 97 percent of the farmers regarded use for porridge making as an important technical attribute of improved finger millet varieties in the study area.

4.4.6 Traditional Brew Making

The data on use for tradition brew making was collected by asking the respondents to rate the importance of the attribute when choosing finger millet varieties. Table 16 gives the results.

Table 16: Farmers Rating of Finger Millet Varieties on Tradition Brew Making

Rating Scale	Frequency	Percentage
Very important (1)	190	64.0
Important(2)	45	15.2
Not important (3)	62	20.9
Total	**297**	**100.0**

The results from Table 16 indicate that the majority of the farmers (64%) regarded the finger millet variety attribute use for tradition brew making as very important, 15.2 percent as important and only 20.9 percent of them felt that the factor was not important at all. Table 16 shows that high percentages (79.2%) of the farmers find the use for traditional brew making as an important technical attribute of improved finger millet varieties in the study area.

4.4.7 Other Uses for the Grain

Other attributes mainly for baking, sale, animal feeds and gifts for tradition ceremonies were examined. The data was collected by asking respondents to rate the importance of the variable to farmers when choosing finger millet varieties. The results are given in Table 17.

Table 17: Farmers Rating of Finger Millet Varieties on Other Uses of Grain

Scale	Frequency	Percentage
Very important(1)	27	9.1
Important (2)	55	18.5
Not important (3)	215	72.4
Total	**297**	**100.0**

The results from Table 17 indicate that the majority of the farmers (72.4 %) regarded the variety other attributes not important, 18.5 percent as important and only 9.1 percent of them felt that the other uses are very important. Based on these findings, only a small percentage (9.1%) of farmers regarded the other uses as an important technical attribute of improved finger millet varieties in the study area.

4.5 Sources of Agricultural Information

This variable was in relation to study objective three that sought to determine whether the improved finger millet varieties sources of agricultural information affected their adoption in the study area. The sources examined were those from farmers' neighbours and friends, farmers groups, extension staffs, NGOs and FBOs. The information aspects examined were on improved finger millet production, recommended varieties, varieties technical attributes, quality agro-inputs and appropriate market. This was operationalised by asking the respondents to indicate whether they got or did not get the information from the stated sources. The findings are presented in the following subsection.

4.5.1 Neighbours/Friends

The variable data was collected by asking the respondents to indicate whether they got or did not get neighbours/friends agricultural information for production of finger millet. The results are given in Table 18.

Table 18: Farmers Responses about Neighbours/Friends as Source Agricultural Information

Information	Frequency		Percentage	
	Yes	**No**	**Yes**	**No**
Production method	236	61	79.5	20.5
Recommended varieties	72	225	24.2	75.8
Quality agro-inputs	173	124	58.2	41.8
Varieties technical attributes	92	205	69.0	31.0
Appropriate market	182	115	61.3	38.7

n=297

Results from Table 18 shows that a high percentage of farmers get neighbours information on finger millet production method (79.5%), varieties technical attributes (69.0%), appropriate market (61.3%) and quality agro-inputs (58.2%). From the results, a small percentage (24.2%) seeks recommended varieties information from their neighbours. This finding supports the view of Doss (2006) that in a community, farmers' peers have a significant role in the adoption of a technology either positively or negatively.

4.5.2 Extension Staffs

The data for extension staffs as sources of agricultural information was collected by asking respondents to indicate whether they got or did not get finger millet production information from this source. The results are given in Table 19.

Table 19: Farmers Responses about Extension staffs as Source of Agricultural Information

Information	**Frequency**		**Percentage**	
	Yes	**No**	**Yes**	**No**
Production method	109	188	36.7	63.3
Recommended varieties	193	104	65.0	35.0
Quality agro-inputs	192	105	64.6	35.4
Varieties technical attributes	216	81	27.3	72.7
Appropriate market	60	20.2	20.2	79.8

The results indicated that farmers got extension services on recommended varieties (65 %) and quality agro-inputs (64.6%). The results further indicates that only a small proportion got extension information on finger millet production method (36.7%), varieties technical attributes (27.3%) and appropriate market (20.2%).

4.5.3 Farmers Groups

The data on farmers groups as sources of agricultural information was collected by asking respondents to indicate whether they got or did not get the required information from farmers groups. The results are given in Table 20.

Table 20: **Responses about Farmer Groups as Source of Information**

Information	**Frequency**		**Percentage**	
	Yes	**No**	**Yes**	**No**
Production method	46	251	15.5	84.5
Recommended varieties	47	250	15.8	84.2
Quality agro-inputs	84	213	28.3	71.7
Varieties technical attributes	47	250	15.8	84.2
Appropriate market	30	267	10.1	89.9

n=297

The results indicated majority of the famers did not get agricultural information from farmers' groups. The results show that farmers groups provided information to a small proportion of farmers on production method (15.5%), recommended varieties (15.8%), quality agro-inputs (28.3%), varieties technical attributes (15.8%) and appropriate market (10.1%).

4.5.4 Non-Government Organisations/Faith Based Organisation

The data for NGO/FBO as sources of agricultural information was collected by asking respondents to indicate whether they got or did not get finger millet production information from this source. The results are given in Table 21.

Table 21: Response about NGO / FBO as Source of Information

Information	Frequency		Percentage	
	Yes	No	Yes	No
Production method	46	251	15.5	84.5
Recommended varieties	32	265	10.8	89.2
Quality agro-inputs	22	275	7.4	92.6
Varieties technical attributes	11	286	3.7	96.3
Appropriate market	32	265	10.8	89.2

n=297

Results from Table 21 results indicates that majority of the farmers did not get their Agricultural information on finger millet from the NGOs/FBOs. The result shows that this source of information was used by small proportions of farmers' production method (15.5%), recommended varieties (10.8%), quality agro-inputs (7.4%), varieties technical attributes (3.7%) and appropriate market (10.8%).

4.6 Test of Hypotheses

The study tested the three research hypotheses that were derived from the three study objectives. The following sub section presents the findings, interpretations and discussion of the hypotheses tested.

4.6.1 Hypothesis One

The hypothesis one stated that; *there is no statistically significant difference in finger millet yields between the farmers growing improved varieties (adopters) and growing unimproved varieties (non-adopters) in Mogotio Sub-County*. The hypothesis was tested to determine if a difference existed between the finger millet yields of adopters and non-adopters. The findings are presented in Tables 22 and 23.

Table 22: Finger Millet Varieties Producers versus Yield Obtained Cross Tabulation

		Yield obtained			Total
		<1 ton/ha	1-2 tons/ha	>2tons/ha	
Farmers	Non adopters	239	37	21	297
	Adopters	19	7	4	30
Total		258	44	25	327

Results in Table 22 show that majority (258) of the respondents obtained yields below 1 ton per hectare and very few obtained yield above 2 tons per hectare. This result concurs with Takan *et. al* (2002) that small scale finger millet farmers obtain average yields of below 1 ton per hectare.

Table 23: Pearson Chi-square Test

	Value	df	Asymp.Sig (2-sided)
Pearson chi-square	4.807	2	.090
Likelihood ratio	4.255	2	.119
Linear-linear association	4.158	1	.041
N of valid cases	327		

Results in Table 23 were obtained when Chi-Square test was applied to test the differences between yields obtained by adopters and non-adopters. This test gave p-value of 4.807 which was higher than the set p-value of .05. The conclusion is that the difference in finger millet yields between the adopters and non-adopters is not significant and thus the hypothesis is not accepted.

4.6.2 Hypothesis Two

Hypothesis two stated that; *there is no statically significant relationship between the finger millet varieties technical attributes and their adoption by small scale farmers in Mogotio Sub-County*

The importance of varietal technical attribute in relation to adoption of improved varieties was analysed and Spearman correlation statistics used to test the hypothesis. The findings and discussions are presented in the following sub section.

Table 24: Percentage Importance of Technical Attributes of Finger Millet Varieties

Varietal Technical Attributes	Very Important	Important	Not Important
Grain Color	57.9	27.3	14.8
Maturity Period	59.3	33.0	7.7
Yield	48.5	45.5	6.1
Use for Making Porridge	73.1	23.9	3.0
Use for Making Ugali	73.1	23.9	3.0
Use for Making Traditional Brew	64.0	15.2	20.9
Use for Sale	13.8	38.4	47.8
Other Uses	9.1	18.5	72.4

n=297

Results in Table 24 show that farmers regarded the most important varietal attributes as the uses for making ugali (73.1%), porridge (73.1%), traditional brew (64%), maturity (59.3%) and grain color (57.9%) The farmers did not rate yield (48.5%) as very important and the least important attributes were rated as other uses (9.1). These findings concurs with the findings of Cheboi (2009) and FAO (2010) that ugali and porridge made from finger millet is the preferred source of energy by most small scale farmers. The results further support Stylinger 2010) in the finding that finger millet is commonly used by local communities to make traditional brews used during social and ceremonial activities. The scale rating of the importance of finger millet varietal technical attributes was used to come up with a varietal technical overall mean. The overall mean was for the 8 items of color, maturity, yield, uses for making ugali, porridge, traditional brew, sale and other uses. Table 25 shows how the overall mean was generated.

Table 25: Improved Finger Millet Varieties: Technical Attribute Overall Mean

Varietal Technical Attributes	**N**	**Mean**	**Standard dev**
Grain Color	297	2.43	.737
Maturity Period	297	2.52	.637
Yield	297	2.42	.606
Use for Making Porridge	297	2.70	.521
Use for Making Ugali	297	2.70	.521
Use for Making Traditional Brew	297	2.43	.815
Use for Sale	297	1.66	.709
Other uses	297	1.37	.645
Overall Mean of Technical Attributes	297	2.2786	.34112

The hypothesis was tested using Spearman Correlation statistical tool and the finding presented in Table 26

Table 26: Spearman's Correlation Test

			Adopters
	Adopters	Correlation Coefficient	1.000
		Sig. (2 tailed)	
Spearman's test		N	297
	Overall mean of technical attributes (2.2786)	Correlation Coefficient	-.076
		Sig. (2 tailed)	.190
		N	297

The Spearman Correlation test results in Table 26 shows a p-value of -0.076 which was above the set value of p=0.05 and the hypothesis thus not accepted. The conclusion is that the relationship between the finger millet varieties technical attributes and adopters is not significant

4.6.3 Hypothesis Three

The third hypothesis stated that; *there is no statistically significant relationship between the improved finger millet sources of agricultural information and their adoption by small scale farmers in Mogotio Sub County.* The hypothesis was tested to determine if a relationship exists between the sources of agricultural information and the adoption of improved finger millet varieties in the study area. An overall mean for all the sources of information was generated and Spearman correlation statistic used to test the hypothesis. The results are presented in Tables 27, and 28.

Table 27.Sources of Agricultural Information on Farmers Percentage and Overall Mean

Sources of Information	N	Percentage		Mean	Std. Dev
		Yes	No		
NGOs/FBOs on finger millet production	297	15.5	84.5	.15	.362
NGOs/FBOs on recommended varieties	297	10.8	89.2	.11	.311
NGOs/FBOs on quality agro-inputs	297	7.4	92.6	.07	.262
NGOs/FBOs on varietal technical attributes	297	3.7	96.3	.04	.189
NGOs/FBOs on appropriate market	297	10.8	89.2	.11	.311
Extension Staffs on finger millet production	297	36.7	63.3	.37	.483
Extension Staffs on recommended varieties	297	35.0	65.0	.35	.478
Extension Staffs on quality agro-inputs	297	64.6	35.4	.65	.479
Extension Staffs on varietal technical attributes	297	27.3	72.7	.27	.446
Extension Staffs on appropriate market	297	20.2	79.8	.20	.402
Farmers' group on finger millet production	297	15.5	84.5	.15	.362
Farmers' group on recommended varieties	297	15.8	84.2	.16	.366
Farmers' group on quality agro-inputs	297	28.3	71.7	.28	.451
Farmers' group on varietal technical attributes	297	15.8	84.2	.16	.366
Farmers' group on appropriate market	297	10.1	89.9	.10	.302
Neighbours on finger millet production	297	79.5	20.5	.79	.405
Neighbours on recommended varieties	297	24.2	75.8	.24	.429
Neighbours on quality agro-inputs	297	41.8	58.2	.42	.494
Neighbours varietal technical attributes	297	31.0	69.0	.31	.463
Neighbours on appropriate market	297	61.3	38.7	.61	.488
Sources of information overall mean	297			.2939	.1294

The results from Table 27 show an overall mean index of 0.2939. The generated mean was used to test if a relationship existed between the sources of agricultural information and the adoption of improved finger millet varieties by use of Spearman correlation statistics. The results are presented in Table 28.

The results from Table 27 further indicate that farmers got information on finger millet production from varied sources. The percentage of farmers seeking for information on finger millet production is very high (79.5%) as opposed to that from experts of extension (36.7%), NGOs (15.5%) and Farmers groups (15.5%). This may support the view of Hosseini, Nejad and Niknami (2009) that the relative importance of the different sources of information, in terms of presentation and how much, are likely to vary technology adoption.

Table 28: Spearman Correlation between Sources of Agricultural Information

			Adopters	**Overall mean of information**
Spearman's correlation	Adopters	Correlation coefficient	1.000	-.065
		Sig. (2-tailed)		.264
		N	297	297
	Overall mean of information(.2939)	Correlation coefficient	-.065	1.000
		Sig. (2-tailed)	.264	
		N	297	297

The results in Table 28 show a p-value of -0.065 which is higher than the set p=0.05 and thus the hypothesis is not accepted, The conclusion is therefore that there is no statistically significant relationship between the sources of agricultural information and the adoption of improved finger millet varieties by small scale farmers in Mogotio Sub County.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter presents a summary of the study main findings, the conclusions made from the analysis of the data and the recommendations made based on the results.

5.2. Summary of the Study

Low food production in the ASALs of Kenya contributes significantly to the persistent malnutrition and poverty experienced in these droughts prone areas. Finger millet is one of the nutritious drought tolerant food security crops that farmers have grown for many years in the ASAL Mogotio Sub County in Baringo County. Majority of these farmers are small scale continuously growing low yielding unimproved finger millet varieties. Improved high yielding and recommended finger millet varieties are available for the farmers to adopt and plant but the adoption is very low. The low adoption has contributed to persistent food insecurity, malnutrition and poverty in the district. The purpose of this study was to establish selected factors affecting the adoption of improved finger millet varieties by small scale farmers in Mogotio Sub County. A structured questionnaire was used to interview 297 randomly selected small scale farmers sampled from Mogotio and Emining Divisions in Mogotio Sub County.

To enable generalisation of the findings, the researcher studied the characteristics of the respondents which established that majority of the house heads were men and the average level of education was between no education to primary level education. The study also established that all households grew more than one crop in their farms and that almost all the farmers grew finger millet.

The study was guided by three objectives. The first objective was to determine the difference in finger millet production based on yield in tons per hectare and percentage of farmers growing improved varieties (adopters) and those growing unimproved varieties (non-adopters) in the study area. The study applied descriptive statistics of frequency to establish that all (100%) of the farmers grew unimproved varieties with a small percentage (10%) growing both improved and unimproved varieties. Pearson Chi-square statistical test gave a p-value of 0.09 which was higher than the set p-value of 0.05. This p-value showed that there was no statistical significant difference in the production of finger millet by adopters and non-adopters in the study area. The second objective was to establish if the finger millet varieties technical attributes affected their adoption by small scale farmers in the study area. The researcher applied descriptive statistical analysis to establish that a high percentage of farmers regarded 7 out of the 8 items as important varietal technical attributes being grain color (85.2%), maturity period (92.3%), yield (94%), use for making ugali (97%), porridge (97%), traditional brew (79.2%), sale (52.2%) and others (27.6%). An overall mean index of 2.2786 for the 8 items was calculated to enable analyse existence of a relationship between the varietal attributes and the adoption of improved varieties. Spearman correlation statistical tool was applied to test statistical significance and established a p-value of -0.076 which is higher than the set p=0.05 showing the no significant relationship. The third objective was to establish if the sources of Agricultural information on improved finger millet varieties affects their adoption by small scale farmers in the study area. Descriptive statistics analysis established that a high percentage of farmers got information on finger millet production from neighbours (79.5%) and from extension staffs (36.7%). An overall mean of 0.2939 was calculated to enable the analysis of existence of a relationship between the sources of Agricultural information and the adoption of improved finger millet varieties. Spearman correlation statistical tool was applied to establish p-value of -0.065 which is higher than the set p=0.05 showing no significant relationship.

5.3. Conclusion

Based on the findings of the study, the following conclusions were made:

i. The study established that the finger millet average yield obtained by adopters and non-adopters was below 1 ton per hectare. The expectation was that the improved varieties would give farmers higher yields but this was not achieved. The observation on ground was that farmers used poor agricultural practices of late planting, poor plant spacing and low use of fertilizer and certified seeds. There is urgent need to capacity build farmers on good agricultural practices to enable them adopt and benefit from growing the improved finger millet varieties in Mogotio Sub County.

ii. The study established that variety technical attributes were important to farmers. It was established that a significant relationship exist between the adoption of improved varieties and the varietal technical attributes. Farmers' choice of varieties is based on the importance attached to their technical attributes. The most important varietal attributes were on the use for making ugali, porridge and tradition brew, grain colour, yield, maturity, and for other uses respectively. Improved finger millet varieties that offer superior technical attributes are available but farmers have not adopted them. Observation on ground was that farmers had little or no knowledge on these varieties There is thus need for sensitisation of farmers on these superior varieties to enhance increased adoption and improve food production in Mogotio Sub County

iii. Apparently most small scale farmers in study area did not grow improved finger millet varieties. The major contribution to this is lack of information from experts such as the extension staffs in collaboration with other stakeholders. Small scale farmers in Sub County should be sensitized on the relative advantages of growing improved finger millet varieties over the traditional varieties. This will increase adoption and increase food production in the Sub County.

5.4. Recommendations

The following can be done to enhance the adoption of improved finger millet varieties by farmers in Mogotio Sub County:

i. Observation on ground was that most farmers used poor quality seeds, planted late with no fertilizer, used poor plant spacing and practiced poor post-harvest handlings. Farmers should be supported by all stakeholders to apply good agricultural practices to enable them benefits on the high yields offered by improved finger millet varieties.

ii. Varietal technical attributes were established as important to farmers when choosing the finger millet variety to grow. Although improved varieties that offer superior technical attributes were available, farmers had little knowledge about them. There is urgent need for collaborative effort by the finger millet breeders and the extension staffs to sensitize and promote these varieties to farmers to increase their adoption. This effort would also identify other related factors that can lead to the development of even more superior varieties for farmer's benefit and food security in the study area.

iii. Advocacy on the relative advantages of growing improved finger millet varieties should be enhanced through appropriate communication and methodologies to increase adoption of improved varieties. This will enlighten farmers on availability of superior varieties for exploitation, link farmers to the larger market of finger millet; such as processing industries and regional markets. Farmers should be encouraged to form farmers groups for ease of access to agro-inputs suppliers, market and information on finger millet production. This would support farmers to increase adoption of improved finger millet varieties, increase food production and reduce food insecurity in the study area.

5.5 Areas for further research

The study recommends the following areas for further research in the future:

i. The influence of other crops grown by the farmers on the adoption of improved finger millet varieties in the study area.
ii. The social cultural influence in the adoption of improved finger millet in the study area
iii. This research was limited by time and resources and the researcher recommends similar study to be undertaken in other areas of Baringo County or at a national level as one Sub County may differ from other Sub Counties and also in the country

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APPENDICES

APPENDIX A: FARMERS QUESTIONNAIRE

Introduction

The purpose of this interview is to gather information on the factors affecting adoption of improved finger millet varieties by small scale farmers in Mogotio Sub County of Baringo County. The study findings will be used to inform the Ministry of Agriculture on ways of serving farmers better for improved food production so as to reduce hunger and poverty in Mogotio Sub County.

You have been chosen to assist in providing the required information, which will contribute greatly towards agricultural development in Mogotio Sub County. Your responses will be treated with the highest level of confidentiality.

PART ONE: PERSONAL DETAILS

Please give your answer to the following questions.

1. Name of respondent____(Optional)
2. Number of respondent _________________________________
3. Division _____________________________
4. Gender **(1)** Female **(2)** Male
5. Education level **(1)** None **(2)** Primary std 1-4 **(3)** Primary std 5-8 **(4)** Secondary **(5)** Post secondary
6. Number of years the respondent has lived in the division ____________
7. Approximate distance to the main market in km ___________________
8. What is the quality of your road to main market **(1)** very bad,**(2)** Bad, **(3)** Average **(4)** Good, **(5)** Very good
9. Household land size **(1)** <5 ha, **(2)** 5-10 ha,
10. Farm ownership **(1)** Owned, **(2)** Leased **(3)** Family
11. Are you a member of any farmers group? **(1)** Yes **(2)** No

12. What other crops do you grow in your farm? **(1)** Finger millet, **(2)** Maize**, (3)** Sorghum, **(4)** Others **(**Specify) ______________________________
13. Do you grow improved finger millet varieties **(1)** Yes, **(2)** No
14. If your answer to Q.13 is Yes, what is your average yield in tons/ha during a normal season? **(1)** below 1 **(2)** between 1-2 **(3)** above 2 tons/ha
15. Do you grow unimproved finger millet varieties? **(1)** Yes, **(2)** No
16. If your answer to Q.15 is Yes, what is your average yield in tons/ha during a normal season? **(1)** below 1 **(2)** between 1-2 **(3)** above 2 tons/ha

PART TWO: SOCIO-CULTURAL ISSUES

17. What part of your farm have you allocated to the stated crops in the last 3 seasons?
    (1) 0**, (2)** $<{}^{1}/_{8}$, **(3)**$^{1}/_{8}$-$^{1}/_{2}$, **(4)**$>{}^{1}/_{2}$, **(5)** Others, specify

	Current season	Previous season	Former season	Total
Maize				
Improved finger Millet				
Landraces finger millet				
Beans				
Sorghum				
Others				

18. What method do you use to produce finger millet in your farm?(**1**) Intercrop,(**2**) Monocrop, **(3)** Others
19. Who controls land use in your household? (1) Men, (2) Both men and women, (3) women
20. Where do you get labour for finger millet production? **(1)** Family members**,(2)** Hire, **(3)** Both 1&2, **(4)** Others, Specify ____________________
21. Who provides labour for the following activities of finger millet production in your farm?

	Men			Women		
	Children	Youth	Adult	Children	Youth	Adult
Land preparation						
Planting						
Weeding						
Guarding						
Harvesting						
Marketing						

22. Who controls your household income? **(1)** Men, **(2)** Women, **(3)** Both **(4)** Others, specify

PART THREE: FINGER MILLET VARIETIES TECHNICAL ATRIBUTES

23. How important are the following attributes to your finger millet cultivation?

Technical Attributes	**Rank** 4.Very important 3.Important 2. Not important 1. I don't know
Grain color (red or white)	
Maturity period	
Yield	
Porridge making	
Ugali making	
Local brew making	
For sale	
Others specify	

PART FOUR: SOURCES OF INFORMATION ON FINGER MILLET PRODUCTION

24. If you wanted the following information, whom would you go to in order to obtain it from?

Type of information	**NGO/FBO**	**Extension staffs**	**Farmers group**	**Neighbour/ friend/ relative**
Importance of finger millet				
Production of finger millet				
Recommended varieties for your area				
Quality agro-inputs (seeds, fertilizer etc.)				
Variety technical attributes				
Appropriate market for finger millet				

PART FIVE: ADOPTION OF IMPROVED FINGER MILLET VARIETIES

25. During a normal and a bad season, please give your estimate yield in ton/ha per year?

Normal season	**Quantity**
Improved varieties	**(1)**<1ton/ha**(2)**.1-2ton/ha, **(3)**.>2tons/ha
Land races/traditional/ unimproved varieties	**(1)**<1ton/ha,**(2)**.1-2tons/ha, **(3)**.>2tons/ha
Bad season	
Improved varieties	**(1)**<1ton/ha,**(2)**.1-2tons/ha, **(3)**.>3tons/ha
Land races/traditional/ unimproved varieties	**(1)**<1tons/ha,**(2)**.1-2tons/ha, **(3)**.>3tons/ha

26. In your opinion, which crop(s) survives a season of very little rain? **(1)** Maize, **(2)** Sorghum, **(3)** Finger millet, **(4)** Others

27. How do you rate your adoption of the following practices that are used for production of improved finger millet varieties in your household?

Finger millet production practices	**Adoption** **1.** None **2.** Low **3.** Moderate **4.** High **5.** Very high
Growing of improved finger millet varieties	
Using of quality agro-inputs e.g seeds, fertilizer, agro-chemicals	
Increasing labour allocated to improved finger millet production	
Increasing land allocated to improved finger millet production	
Using experts information on improved finger millet production	

THANK YOU!

APPENDIX B: MAP OF MOGOTIO DISTRICT