

**CHALLENGES AND OPPORTUNITIES IN GRAIN AMARANTH
CULTIVATION: A STUDY ON SMALL SCALE FARMERS IN MWEIGA
LOCATION KIENI WEST DISTRICT.**

BY

KAMINDU AGNES WAITHERA

Registration Number. C50/P/8970/06

**A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE AWARD OF MASTERS OF ARTS
DEGREE IN SOCIOLOGY (COMMUNITY DEVELOPMENT) IN THE
UNIVERSITY OF NAIROBI**

NOVEMBER 2012

DECLARATION

I, the undersigned declare that this is my original work and has never been submitted to any university other than the University of Nairobi for the award of academic credit.

Signed: -----

Date: -----

Agnes Waithera Kamindu

Reg. No. C50/P/8970/06

This project paper has been presented for examination with my approval as the university supervisor:

Signed: -----

Date: -----

Dr. K. Kiemo

Department of Sociology and Social Work,

University of Nairobi

DEDICATION

This research project is dedicated to my family, friends all those who gave me financial and moral support.

ACKNOWLEDGEMENT

This project is a product of the enormous and valuable support received from a number of individuals. First and foremost, I would like to thank most sincerely my university supervisor Dr. Karatu Kiemo for his guidance and advice throughout the period of writing this project.

I also extend my heartfelt gratitude to my husband Professor Nicholas Kamindu and our children Gikonyo, Kamau, and Gathua for their moral support and constant encouragement throughout the period of my post graduate study. Without their support and understanding I would not have realised my dreams.

I also extend my thanks to Kieni west Agricultural office for their cooperation during my research and all those who were involved in one way or another in this work, since their critical roles contributed in making this project a reality. Without their support, the project would have been extremely difficult to accomplish.

Special thanks to Prof. Nicholas K. Gikonyo of the Department of Pharmacy and Complementary/Alternative Medicine, Kenyatta University; the Principal investigator in the Kenya Agricultural Productivity Project (KAPP), project number KAPP06/PRC-SECBCCI-06-FP2006023 which supported this research.

TABLE OF CONTENTS

DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
LIST OF TABLES	viii
ACRONYMS/ABBREVIATIONS.....	ix
ABSTRACT.....	x
CHAPTER ONE: INTRODUCTION	1
1.1 Background of the Study	1
1.2 Problem Statement	4
1.3 Objectives of the Study	5
1.3.1 General Objective	5
1.3.2 Specific objectives	5
1.4 Significance of the Study	6
1.5 Scope of the Study	6
1.6 Definition of Terms.....	7
1.7 Summary	7
CHAPTER TWO: LITERATURE REVIEW	8
2.1 Introduction.....	8
2.2 Review of Past Studies.....	8
2.2.1 Origin, Species and Production of Grain amaranth	8
2.2.2 Farmers Access to Information and Support Services	10
2.2.3 Marketing grain Amaranth produce.....	13
2.2.4 Adoption Level of Grain Amaranth Cultivation.....	16
2.3 Theoretical Framework.....	18
2.3.1 Rational Choice Theory	18
2.3.2 Diffusion Innovation Theory	18
2.3.3 Conceptual Frame Work.....	20

CHAPTER THREE: RESEARCH METHODOLOGY	21
3.0 Introduction.....	21
3.1 Site Selection and Description.....	21
3.2 Research Design.....	22
3.3 Population and Sampling Design.....	22
3.3.1 Population	22
3.3.2 Sampling Design.....	22
3.3.2.1 Sampling Technique	23
3.3.2.2 Sample Size.....	23
3.4 Unit of Analysis	23
3.5 Sources of Data and Methods of Data Collection.....	24
3.5.1 Sources of Data	24
3.5.2 Methods of data Collection.....	24
3.6 Data Processing Analysis.....	24
CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION.....	25
4.0 Introduction.....	25
4.1 Demographic Information.....	25
4.1.1 Gender.....	26
4.1.2 Marital status.....	27
4.1.3 Education level.....	27
4.1.4 Age.....	27
4.1.5 Occupation.....	27
4.2 Farmers Access to information and other Support service	30
4.3 Marketing and amaranth cultivation	34
4.4 Level of Grain Amaranth Adoption.....	38
4.5 Challenges and Opportunities in Grain Amaranth cultivation.....	39
4.6 Opportunities in Amaranth Cultivation	42
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND FINDING	44
5.1 Introduction.....	44
5.2 Summary of findings.....	44
5.4 Conclusions.....	47
5.5 Recommendations.....	48

REFERENCES.....	50
APPENDICES	55
Appendix I: Introduction Letter.....	55
Appendix 2: Questionnaire	56
Appendix 3: Key Informants Interview Guide	62

LIST OF TABLES

Table 4.1 Demographic Information.....	26
Table 4.2: Occupation of the Respondents	28
Table 4.3 Other Agricultural Activities Practiced by the Respondents their Contribution to Monthly Incomes.....	29
Table 4.4: Year when amaranth was first cultivated, Amount and Percentage of Farmers involved	30
Table 4.5: Farmers First source of information on amaranth from 2008-2010	31
Table 4.6: Source and cost of seedlings.....	32
Table 4.7: Farmers Support from Cooperatives.....	32
Table 4.8: Source of information on technical skills on Cultivation of Grain.....	33
Table 4.9: Grain amaranth buyers, prices offered from 2008 to 2010.....	35
Table 4.10: Disposal of grain amaranth from 2008-2010.....	36
Table 4.11: Challenges Experienced by Farmers	39
Table 4.12 Opportunities available in amaranth cultivation.....	42

ACRONYMS/ABBREVIATIONS

ASALS	Arid and Semi Arid Lands
ASDS	Agricultural Sector Development Strategy
BOSTID	Board on Science and Technology for International Development
CBOS	Community Based Organizations
FAO	Food and Agricultural organization
GDP	Gross Domestic Product
KAPP	Kenya Agricultural Productivity Programme
KARI	Kenya Agricultural Research Institute
KEFRI	Kenya Forestry Research Institute
MDGS	Millennium Development Goals
NALEP	National Agriculture and Livestock Extension Programme
NAS	National Academy of Sciences
NGOs	Non-Governmental Organizations
PEC	Poverty Eradication commission

ABSTRACT

Due to its unique properties grain amaranth has gained an increased attention in the world. The grain has some agricultural ability to grow successfully in adverse environment like the arid and semi-arid lands due to its drought tolerant characteristics. The grain matures fast, can be intercropped with other crops and has got high returns in a good season. It's known to have high nutrition value than most grains. Grain amaranth therefore has got the ability to fight food insecurity and levels of poverty among the world rural poor and especially in Kenya where the long-term goal of food security has not been met. In spite of its positive attributes the levels of grain amaranth cultivation are still very low the world over and especially in Mweiga location.

The study sought to find out the challenges facing small scale farmers cultivating grain amaranth in Mweiga location. This was done through; establishing farmers' access to information and support services; marketing and its influence on grain amaranth cultivation; and establishing the level of grain amaranth cultivation in Mweiga location.

The research relied on data collected from 51 small scale farmers engaged in the cultivation of grain amaranth and identified through purposive sampling. A structured questionnaire was used for personal interviews. A second interview was carried out through the key informant the Kieni west Agricultural officer. The primary data was collected and presented through descriptive statistics using Microsoft excel computer software.

The study revealed that farmers received information from reliable sources, the KAPP officials and the agricultural officer. The majority farmers had access to a cooperative society and a reliable source of certified seedling. The only challenge with access to information was lack of follow-ups in the farms. Marketing was the major challenge that discouraged the farmers from cultivating amaranth for commercial purposes. Farmers lacked a forward link to the local and national markets and the prices offered were low compared to other crops already being grown in the area.

Findings from the study show the levels of Grain amaranth cultivation was low. This has been attributed to challenges in Marketing and competition from other crops and farming activities practiced in the area. The survey noted that although there challenges, there were also opportunities that can be exploited where grain amaranth can be used to provide for food security and generate income for the households when cultivated for commercial purposes.

The study recommended the need for all the stake holders to work together towards commercialization of grain amaranth, sensitize all farmers through intensive training on the need to increase acreage on grain amaranth. This will call for the increase in numbers of agricultural extension officers and by encouraging farmers to form groups for easy reach. There is need to enlarge the market base of the grain by creating awareness on its nutritional value, diversifying its markets through value addition and use of market Led approach strategy through contract farming.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Grain Amaranth, locally known as Terere in Central Province, or Ododo in Nyanza Province, is a member of amaranthaceous group of plants, and is classified as a pseudo cereal. It was a primary food for central America Indians before Columbus arrived in new world but its production was outlawed by the Spanish conquistadores for political and social reasons. It is said to have originated from Mexico where it was planted for its grains, unlike the variety found in most parts of Africa, which grows as wild and is used as vegetable only.

Amaranth family consists of more than 60 species, most of which are widely dispersed weeds. Amaranth does not belong to the grass family as other cereal do but produces seeds which are grains and are classified into the family of pseudo cereals (National Academy of Sciences, 1984). In this study the main concern is amaranth which is used as a grain. Amaranth plants yield tinny seeds that can be used as grain to make flour used for porridge, cakes and other foods.

There are two main grain amaranth varieties that are adapted to Kenya's climatic conditions. The short species which is suited to low rainfall and the tall species suited to humid areas. Apart from its early maturity among cereals, other features associated with the grain amaranth is known to tolerate drought conditions, low fertile soils, pests and diseases. It uses only a third of the water required by other grains (O'Brien and Price 1983). This is made possible by its extensive deep root system and ability to go dormant under extreme weather conditions (Meyer, 1996).

Grain amaranth is known to have a high nutritional value having 75% of the nutrients required by the human body. The grain has a high medicinal value and has proved to be successful in the treatment, management and prevention of various diseases. It is known to enhance human growth and development, improve health and strengthen body immunity (Legacy 2003, Alemu 2005, Spetter and Thompson 2007).

Grain amaranth other benefits include its special oil component which is an important ingredient in Pharmaceutical industries especially in the preparation of skin

cosmetics. It's also used as a lubricant in servicing computers. Its chemical content is comparable to that found in cod liver oil, a product given to children to strengthen their immune system. (Poverty Eradication commission 2007).

Poverty and food insecurity is widespread in developing countries. Although major gains were made in its eradication during the last decades of the twentieth century in countries like East Asia, and South East Asia, the magnitude and intensity of today's poverty still remains unacceptably high. More than 1.2 billion people in Africa, Asia and Latin America Live in absolute poverty subsisting on less than 1 dollar a day and a further 2 billion are deficient in one or more micronutrients (Azam, Ali and Battcock, 2001). Of all the regions of the world, poverty is most intractable in Africa where a half of its population of about 300 million people lives on less than a dollar a day. There is therefore need for government in Africa to come up with policies that will curb poverty.

Kenya's long-term goal of food sufficiency remains unmet. Frequent droughts which precipitate requests for donor-provided food aid to mitigate the ravages of famine especially in the arid and semi arid regions. In order to arrest the situation of food and poverty among the rural poor, the government has come with measures among them utilization of drought tollerant crop varieties like sorghum and grain amaranth.

One of the opportunities to be exploited among others in grain amaranth cultivation is the fact that it has the potential to contribute to food security, nutrition, health, income generation and therefore poverty alleviation. The cultivation the grain has generated great interest among stakeholders and farmers due to their potential economic value. These new and underutilized plant species with significant food or/and industrial potential remain under-utilized due to lack of coherent strategy for their evaluation and development.

The research effort to bring amaranth into and commercial system is a recent undertaking. It has been reinforced by the economic support given by the National Academy of sciences, through its Board on Science and Technology for International Development to a number of researchers in various parts of the world such as Thailand, Mexico, Kenya Guatemala and Peru. In comparison to the funding given to

other agricultural crops, the support is relatively small; however, some significant advances have been made and recognition of the potential of this crop throughout the world is beginning to show through their adoption (Kauffman and Weber, 1990).

Rodgers defines adoption process as a mental process an individual passes from after first hearing about an innovation to the final adoption stage (Rodgers, 1976). Final adoption of a technology at individual farm level is the degree of new use of technology when the farmer finally has full information about the new technology and it's potential. Research has shown that farmer's failure to adopt a new technology makes sense from the farmer's point of view.

Innovations entail, in most cases, a subjective risk (that yield is more uncertain with an unfamiliar technique) and, quite often also, objective risks (due to weather variations, pests susceptibility, uncertainty regarding timely availability of crucial inputs etc). Farmers adoption of a new innovation, are based on their subjective probabilities and hence on their exposure to information regarding the new technology. Domestically developed new varieties of crop are favorably adopted by farmers than unfamiliar imported ones (Gerson, Richard, and David, 1982).

Grain Amaranth cultivation is a new innovation imported to Kenya from Mexico through Kenya Agricultural Research Institute and supported by the legal notice number 287 of 19/7/91. In terms of its agronomic value, amaranth grain is drought tolerant, requiring less than half of the water needed for growing wheat or maize. This is supported by Kenyan farmers in regions with marginal rainfall who prefer growing amaranth to maize because they believe there is less risk of crop failure with amaranth (Gupta, 1986).

In order to shift from a resource-based to technology based system of agriculture underlies the demand and supply of agricultural information and technology. Agricultural extension sector is therefore a conduit of information and technology to farmers and back to researchers and policy makers of farmers' problems, needs and concerns (Judd, Boyce and Evenson, 1986). Without a well-trained human resource in the agricultural extension sector grain amaranth quality and quantity of production will be affected negatively. In Kenya, agricultural extension is confined to public

domain through the Ministry of Agriculture. Extension provision to the farmers is therefore not adequate due to lack of enough information and capacity among the extension officers. The few private organizations and NGOs have limited collaboration among them causing duplication of services.

Marketing of farm products is one of the major challenges facing farmers in Kenya today (James E. Boyle et al). A perfect marketing system waits on a perfect production system. Poor production means poor marketing, marketing should therefore be recognized as a pre-requisite and not a result of production despite the quality and the quantity of surplus available (Geoneowald, 1981).

Most small holder farmers and especially ones cultivating grain amaranth focus on production with no forward linkages to large buyers which decrease sales potential. Markets on new and emerging crops are Limited and poorly developed due to limited supply of commodities, low demands and set standards. Although small scale farmers have limited outlets, they still find channels of their choice to market their produce. The produce is therefore sold locally for subsistence use on individual basis with no organized channels. There is limited market information with no market niche. Trade in these crops benefits a few agents' brokers and exploiters leaving majority in the value chain. There is therefore little or no benefit to the local communities growing these crops because of low profitability resulting into low productivity.

1.2 Problem Statement

Amaranth has been studied extensively for its exceptional nutritional value, its benefits for the sick, young and the aged is a well-known factor. Amaranth grain has a characteristic of producing high yields even in relatively dry areas within a short period. It is a new crop that was introduced to small scale farmers to increase the variety of crops grown, generate another source of income and improve food security and raise poverty levels. This was a dream crop that would deal with the problem of highly fragmented pieces of arable land and semi-arid conditions through increased production.

Farmers in Kenya face similar challenges of soil conservation, climatic changes, and infrastructural problems when they cultivate amaranth as well as when they grow other annual crops. The farmers are still growing these annual crops despite all these problems (Weber, 1988). The paradoxical question is why despite its high nutritional value, drought resistance characteristics and high productivity amaranth is poorly cultivated and its production is low in semi-arid parts of central Kenya. The crop is being cultivated by a few farmers mostly for subsistence use and not for commercial purposes.

This study address the constraints that the small scale farmers are facing in the cultivation of the new grain amaranth crop in Mweiga location of Kieni west district. Specifically, the study looks at constraints related to access to information, support services and market availability as the major drawbacks for its adoption, and production. The study also looks at the opportunities that can be exploited to enhance grain amaranth adoption .The study was guided by the following research questions:

1. How farmer's access to information and support services in cultivation and production of grain amaranth in Mweiga Location?
2. How do grain amaranth farmers market their produce?
3. What is the level of grain amaranth adoption in Mweiga location?
4. What are the challenges and opportunities experienced by farmers cultivating grain amaranth in Mweiga location?

1.3 Objectives of the Study

1.3.1 General Objective

To determine the challenges and opportunities experienced in the cultivation of amaranth grain by small scale farmers in Mweiga Location.

1.3.2 Specific objectives

1. To establish farmers' access to information and support services in the cultivation and production of grain amaranth.
2. To determine how grain amaranth farmers market their produce.
3. To establish the level of grain amaranth adoption in Mweiga location.
4. To establish challenges and opportunities experienced by small scale famers cultivating grain amaranth in Mweiga location,

1.4 Significance of the Study

The study focuses on grain amaranth cultivation in Mweiga location of Kieni District. This is done through examination of opportunities and challenges experienced by small scale farmers in adoption and cultivation of grain amaranth. The study focused on the farmers' access to information and support services, marketing and how they affect grain amaranth cultivation.

The findings of the study provide information on the level of grain amaranth adoption by farmers in Mweiga Location and the challenges they experienced and how these challenges were addressed. The study also explored the opportunities and how they can be used by the farmers to help them in increasing levels of amaranth cultivation for commercial purposes.

These findings can be applied by researchers and government officers when introducing any other new technology or crop to farmers. The important lessons learnt in the study would prepare them in order to avoid repeating the mistakes revealed in the study which leads to low levels of adoption.

1.5 Scope of the Study

The study on grain amaranth limited itself to understanding the level of grain amaranth cultivation. It examined the farmers' source of information and farm inputs, their source of credit and the support they received from the government through the extension officers and researchers. The study also explored whether the farmers belonged to a cooperative society or a farmers group.

This study further explored grain amaranth's disposal after harvest, and availability of markets for the grain. It sought to understand the buyers of the grain and, the prices offered. The study examined the level of grain amaranth adoption through the amounts planted, harvested and sold in the year 2008, 2009 and 2010.

The study also explored on the challenges that the farmers are experienced in the cultivation of grain amaranth and how they affected grain amaranth adoption. The study sought to find out opportunities that can be tapped in improving grain amaranth cultivation and adoption. The study did not focus on problems related to climatic

changes, soils, crop diseases, politics, cultural practices and infrastructure because they also affect other annual crops which have been cultivated by the farmers.

The study was conducted on small scale farmers of Mweiga Location, Kieni West district, Nyeri County. This community was selected because grain amaranth was introduced some years back and despite its great qualities mentioned above it has dragged in levels of cultivation and production. This area is a rural set up that is relatively dry and relies on agriculture.

1.6 Definition of Terms

Agriculture: Agriculture is the production, processing, marketing, and use of foods, fibers and byproducts from plant crops and animals.

Grain Amaranths: Amaranths are usually large bushy plants that normally grow between 90 and 130cm in height. Amaranths are famed for their colorful grains; these can be in many different colors, especially purple and gold.

Small scale farmer: A farmer is a person, engaged in agriculture, who raises living organisms for food or raw materials, generally including livestock husbandry and growing crops such as produce and grain. A small scale farmer operates on small parcels of land approximately 5acres and below. These farmers practice mixed farming and use their own labor.

1.7 Summary

Majority of the poor in Kenya, live in the rural areas. Agricultural growth and development is therefore crucial for Kenya's overall economic and social development. Introduction of new crops like grain amaranth has generated great interest among various stake holders and farmers. There are challenges facing the cultivation of the new crops and adoption resulting in low production. The study looks into issues related to knowledge and information flow and market; and how they affect cultivation and production. The study covers small scale farmers in Mweiga location of Kieni west district.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The main purpose of this literature review will be to understand what other writers have written about grain amaranth cultivation. Studies have been made by different Authors on, Adoption Level of Grain Amaranth Cultivation, Farmers access to Information and Support Services and influence of Market on Level of Amaranth Cultivation in Adoption of Grain Amaranth. This chapter therefore will help to appreciate what other researchers have contributed towards this field and assess what possibly need to be researched further.

2.2 Review of Past Studies

2.2.1 Origin, Species and production of Grain amaranth

In pre-Columbian times grain amaranth was one of the basic foods. It was nearly as important as beans and corn. Grain amaranth was introduced in Spain in the 16th century from where it spread to Europe and it had reached Africa and Asia by the 19th century where it was grown as vegetable and cereal food. An Australian investigator in 1973 and the book “Unexploited Plants with Promising Economic Value” helped to raise interest in grain amaranth cultivation and use (Berghoefer, Schoenlechner 2002).

Grain Amaranth is an annual herb, not a ‘true’ grain native to the south and Central America. It a non-grass cereal classified in a very unique food group called pseudo-cereal. Grain amaranth was cultivated in Mexico in a place called Inca where it was used to cover the deserts. (Obrien and Price 1983).It grows mostly in temperate and topical regions and can produce 40000 to 60000 tiny seeds per plant .There about 60 species of amaranthus crop which are cultivated as leave vegetable , cereals ,and for ornamental purposes while others occur naturally as weeds(Reiley 1993). Amaranth is one of the genera whose species were domesticated in old and new worlds with the United States of America being the leading commercial producer of the grain (Meyers, 1996; National Academy of Sciences, 2006).

In Kenya, Grain amaranth grows naturally in the open fields and at least every ethnic group has a name for it. In central Kenya, the Kikuyu call it Terere, Waswahili, Mchicha while the Luos call it Ododo. Grain Amaranth was gazetted by the Ministry of Agriculture legal notice No. 287 of 19/7/91(Alemu 2005).

There are two main grain amaranth varieties that are adapted to Kenya's climatic conditions. The short species which is suited to low rainfall and the tall species suited to humid areas. Apart from its early maturity among cereals, other features associated with the grain amaranth are its ability to tolerate drought conditions, low fertile soils, pests and diseases. It uses only a third of the water required by other grains (Obrien and Price 1983). This is made possible by its extensive deep root system and ability to go dormant under extreme weather conditions (Meyer , 1996).

Grain amaranth minimizes on the space it occupies as it is planted in narrow spaced rows, shallowly in fine prepared soils. It has the capability of doing well when intercropped with other crops a quality which makes it a potentially viable crop in central Kenya where pieces of land are small and highly fragmented. (Mposi 1999; National Academy of sciences, 2006). Grain amaranth early maturity coupled its high productivity is quality that can be exploited to improve food security and also reduce poverty among the rural poor in Kenya (Weber, 1987, Meyers and Putman 1988).

Grain amaranth is known to have a high nutritional value having 75% of the nutrients required by the human body. The grain has a high medicinal value and has proved to be successful in the treatment, management and prevention of various diseases. It is known to enhance human growth and development, improve health and strengthen body immunity (Legacy 2003, Alemu 2005, Spetter and Thompson 2007).

Grain amaranth other benefits include its special oil component which is an important ingredient in Pharmaceutical industries especially in the preparation of skin cosmetics. It's also used as a lubricant in servicing computers. Its chemical content is comparable to that found in cod liver oil, a product given to children to strengthen their immune system. (Poverty Eradication commission 2007).

Grain amaranth therefore has the ability to bring about development in Kenya and especially in the dry areas of Mweiga location. According to PEV (Poverty Eradication Commission), as a commercial crop, Grain amaranth has the ability increasing family income levels. Grain amaranth oil is capable of being a major foreign exchange earner for our country. Its waste can be used in industries to make animal feeds for chicken, dairy cows, and rabbits. Apart from its high nutrition value the grain has medicinal qualities which can be utilized to make medicines for prevention and managing serious diseases. The levels of cultivation in Mweiga location are very low making it impossible to achieve any notable developmental changes.

2.2.2 Farmers Access to Information and Support Services

Acquisition of innovation about a new technology makes it more available to the farmers. Information reduces the uncertainty about a technologies performance hence may change individuals assessment from being purely subjective to objective over time (Caswell, Fugie, Ingram, Jans and Kasca 2001)

Exposure about a new technology significantly affects farmer's choices about it. Information for the farmers is acquired through informal sources like media, extension personnel, visits, meetings, and farm organization through farm organization through formal education. It is important that this is information is reliable, consistent and accurate. In order for any new crop to be adopted by farmers effectively these information must be communicated well to the farmers to enable them to make an informed choice.

In rural Kenya today the most common way of transferring information to farmers is through agricultural extension workers. The Food and Agricultural Organization (FAO) defines an Agricultural extension as non-formal out of school education service for training and influencing farmers to adopt improved practices in crop and livestock. Agricultural extension work endeavors in the transfer of agricultural information to enhance the productive capacity of farmers. New technologies and production approaches in the farming activities is increasingly becoming important in order to help governments meet the challenges of feeding the rapidly expanding

population and decreasing availability of agriculturally productive land (Dina L. et al 1994).

In order to successfully shift from a resource-based to technology based system of agriculture underlies the demand and supply of agricultural information and technology. Agricultural extension sector is therefore a conduit of information and technology to farmers and a conduit back to researchers and policy makers of farmers' problems, needs and concerns (Judd et al, 1986).

Agricultural extension is therefore the work of agricultural experts often government employees, teaching improved methods for farming, demonstrating innovations and helping the farmers to organize and solve their problems. It is a link between the farmers to transfer the best practices. FAO survey on Agricultural extension organization 1988-1989 confirms the dominant role the public sector plays in agricultural extension. Approximately 81% of extension work around the world is carried out by the ministry of agriculture (Swanson et al, 1990).

In sub Saharan Africa agricultural extension has been confined to the public domain through the ministry of agriculture and the parastatals. These structures are centralized in capital cities, Districts and Regional levels. At field levels the extension staff is poorly trained, with scarce or no operational facilities like vehicles. The problem of financial crisis and budget cuts which were associated with structural adjustment programmes, poor governance of publicly run programs have led to decline of services in agricultural extension in Africa (Dina et al, 1994).

In Kenya the most common method used by agricultural extension workers involves farm visits, demonstrations, training courses, field days, shows and tours (Republic of Kenya, 2001). In Kenya, Grain amaranth farmers who are small scale farmers are reluctant to contact extension officers to visit their farms. The farmers willing to access information are the educated and those who hold prestigious places in the society, women and the poor in most cases do not demand extension services. This affects the cultivation and productions of the crop since majority of the farmers are women and the rural poor.

In order to realize increased production of grain amaranth, there has to be exchange of information between the farmer and the extension worker. This requires direct interface which has been affected by the declining resources in governmental extension agencies. The effect of increasing demands for information from rural sectors and the emerging challenges like climatic adaptations, biotechnology and farmer innovation techniques have overstretched available extension agencies. Decline in Agricultural extension agencies have made it difficult for farmers to acquire enough and quality information to assist them in crop production, processing and in marketing their products (FAO 2009).

Good Extension programs and contacts with farmers are an aspect in technology dissemination and adoption. It commonly stated that a new technology is only as good as the mechanism of its dissemination. In order to register increased agricultural production of grain amaranth and other new crops, the extension service should be revolutionized to ensure that farmers are provided with full information on production, profitability and marketing (IFPRI 2009).

The extension staff should be armed with all the necessary information starting with production, gross margins and availability of markets and any other pros and cons of the new technology. This demand should be created through staff training, strengthening research-extension-farmer linkages and frequently distributing latest production manuals at public forums (barazas) and market places.

In developing countries like Kenya, governments have tried to provide market information services to farmers with problems of sustainability. Most farmers use communication channels such mobile phone short messaging service (SMS) or FM Radio Stations which generates localized market information. Internet services which is a more effective way of disseminating information is not commonly used in the rural areas due to challenges of electricity and education. Where there is access to marketing information, farmers need interpretations from the extension workers.

Provision of credit to farmers is necessary to facilitate purchase of farm inputs to improve production of grain amaranth and other crops. The Kenya government estimated that by 1996, agriculture needed Ksh160 billion to achieve its expected

growth rate, yet it only received 10% of its requirement with only 2% going to small scale farmers. The deficit in credit has greatly affected cultivation of new and orphaned crops like grain amaranth which are cultivated mostly by small scale farmers.

Some farmers continue to employ poor crop/livestock husbandry due to weak and inadequate delivery system. Farmers complain of not seeing extension staff while the extension staff blames it on all inadequate funding. The problem with the extension staff is that they promote the production grain amaranth crop without providing farmers with the information on the existence of a market for the commodity, how such a market can be accessed and what prices can be expected. Without a forward link in marketing their produce the amaranth farmers are either discouraged in cultivating the crop or are not ready to take a risk that is not rewarding.

Beside public extension providers, the private sector and local communities should be encouraged to take up provision of extension services. NGOS, CBOS and successful cooperative societies working in this area should be encouraged to expand their coverage and provide the grain amaranth and other farmers with information and necessary support that will improve on productivity.

In Kenya there is poor linkage from the research-extension-farmer. Various research Institutes like (KARI), Kenya Forestry Research Institute (KEFRI) and other international research institutes which deal with agriculture should be encouraged to work directly with farmers in developing and expanding new technologies. This will ensure research breakthroughs do not just remain within the institutes but is spread to farmers. These breakthroughs are recorded in journals by local regional and international organizations but have not reached the target groups. New varieties of crops like beans, cow peas and even grain amaranth have not been adopted well because their dissemination to the target group has remained low.

2.2.3 Marketing grain Amaranth produce

Marketing is a general term used to describe the activities that lead to sale of a product. It is the process of planning and executing pricing, promotion and distribution of programs to satisfy customers' needs. It involves collecting

information analyzing alternatives market outlets developing different products to compete in market places, defining the scope of the proposed market area and meeting the consumer needs. Marketing is more than just selling a product or service. It is an essential part of a business or farming. Without a good marketing program, even the best business fail.

There is no agricultural problem being discussed more widely today than marketing (James et al.). Market is the major challenge to the agricultural sector in Kenya. A perfect marketing system waits on a perfect production system. Poor production means poor marketing, marketing should therefore be recognized as a pre-requisite and not a result of production despite the quality and the quantity of surplus available (Geoneowald, 1981).

Agricultural marketing covers the services involved in moving an agricultural product to the consumer. It involves planning production, growing harvesting grading packaging, Transport, storage, agro food processing, distribution and sales. All these activities depend on exchange of information and availability of finances. Marketing requires support through provision of market infrastructure and supply of market information.

Efficient market information benefits farmers and traders positively. Up-to-date information on prices enables farmers to negotiate with traders and also facilitates spatial distribution of products from rural areas to towns and markets. Market infrastructure includes wholesale, retail and assembly markets and storage facilities. Efficient market infrastructure enhances cost effectiveness among the traders.

Most grain amaranth or small holder farmers focus on production with no forward linkages to large buyers which decrease sales potential. Although small scale farmers have limited outlets, they still find channels of their choice to market their produce. Choice of marketing option depend on a number of aspects which include, availability of markets , prices offered, distance to the markets and the potential of the markets to absorb the sale or the stock. In order for grain amaranth farmers to be successful the situation of a perfect market should prevail (Paterson, 1997). This means that there

has to be many buyers, many sellers, defined products, a market place and a market organization.

There is insufficient market information to small scale farmers due to their large numbers, inefficient communication systems and low levels of literacy (Fenyves et al 1985). Providing information to small scale farmers maintains transparency and inclusiveness. With the information the farmers are made aware of the markets and they can easily access them as well as reduce their risks (Bailey et al, 1999). Information on markets will prepare the grain amaranth farmers on market conditions, demand of the product, quantity, quality, prices and also the opportunity available (Frick et al, 1999).

Exploitation of grain amaranth farmers by middlemen distorts markets and prices therefore affecting the productivity of the value chain. Expanding markets offer farmers new value-addition opportunities, compared to primary production, and exporters and agro-processing enterprises furnishing crucial inputs and services to the farm sector. Absence of an adequate marketing infrastructure makes the investment unprofitable (World Bank, 1975). Lack of infrastructure makes marketing of outputs unduly costly. The problem of middle men can be dealt with if the grain amaranth farmers can create farmer based organizations at the grassroots level to empower them and enable them to handle all their production and related issues without depending on brokers.

Grain amaranth markets are limited and poorly developed due to the limited supply of the grain, low demand and no set standards. The grains are normally collected and sold locally for subsistence use. Marketing is normally done on individual basis with no organized channels. The markets information is limited and there is no niche market for grain amaranth. There are therefore little or no benefits to farmers growing amaranth because of low profitability.

Considering that farmers frequently find marketing as their major problem, there is need for them to learn new skills new techniques and new ways of obtaining information otherwise they may not succeed in marketing their amaranth products. This is where services of extension officers employed by the government, and NGOs

are required. The officers however lack knowledge on marketing. In order for them to develop knowledge on these areas, they need to be trained using generic guides and other materials available from FAO. The information should be ideally tailored to fit national circumstances.

Most grain amaranth farmers sell their produce raw from the farms without adding value to their produce. Value addition refers to extra features added to an item of interest that go beyond the standard expectations and provide value. Value added feature give a competitive edge to a product. Any product can be considered value added if it is originally grown by the farmer and increased in value through labor and creativity. Value added products developed by small to medium scale farmers by processing and selling their products direct to the consumer through farmer markets, individual and direct wholesale fetch more than the raw ones. The grain amaranths farmers can shift from commodity based to value added agriculture in order have an edge in marketing of their products (Farr, 2002).

Inappropriate laws can distort and reduce the efficiency of markets, increase the cost of doing business and retard the development of a private sector. Poor roads increase the cost of doing business, reduce payment to farmers and increase consumer prices. These are common factors that affect farmers in general as well as those involved in grain amaranth farming.

2.2.4 Adoption Level of Grain Amaranth Cultivation

Innovation is a key component of economic evolution, therefore development (Nelson and Winter, 1982; Treillon, 1992; Dougherty, 1996). For millenniums, farmers have continuously domesticated, bred, and used new crops, invented new implements, changed their ways to produce crops, recombining their production factors (labor assets, capital, cash and land) in order to improve production, food security and income.

Amaranth grain is a new innovation or a new agricultural product that has been introduced in Kenya and other parts of the world. The funding for its research has been supported by Board of science and technology for international Development (BOSTID) for the National Academy of Science (Kauffman and Weber, 1990).

Rodgers defines adoption process as a mental process an individual passes from after first hearing about an innovation to the final adoption stage (Rodgers E 1976). Final adoption of a technology at individual farm level is the degree of new use of technology when the farmer finally has full information about the new technology and its potential. Agricultural technologies are introduced in a package and if they are not adopted as a package they may not be effective (Gershon F. et al, 1982).

Research has shown that farmer's failure to adopt a new technology makes sense from the farmer's point of view. Complexity of the innovation makes the farmers more resistant to adoption because the innovation is difficult to understand. Farmers therefore act rationally by not adopting complex innovations which involve high risks. Innovations which provide concrete economic benefits are easily adopted than those with low or no economic benefits. There is resistant in adoption of technologies that are expensive and uncertain in terms of capital and other resources invested in the farm (Geertz 1963). There is resistant into adopting a new technology especially if farmers are receiving contradictory information from numerous sources (Van clay, 1992).

In Africa there is lack of demand for new technology by the farmers. The lack of demand for technology is associated with problems like inappropriate government policies, low market prices for agricultural products, and inadequate financial resources for farmers to buy the needed inputs. Poor infrastructure linking the farms to markets is also considered as a serious problem.

Technological advancement at farm and enterprise level should be directed to obtaining more and better output from the same input. Technology therefore, should be directed at expanded output on the same land area with as little capital as possible. Agro-processing levels in Rural Africa are in most cases inexistent or just very basic. Access to Agro-processing technology is very limited due to lack of expertise know how and affordable cost. The technological inadequacy coupled with lack of innovation results in undiversified low quality products which are not able to compete in the markets.

The small holder farmer due to poor application of technology in the farm experience low production and post-harvest losses and unstable productions. These problems affect the performance of specific value chains because the quality and quantity of supply to the processors and eventually to the market or the consumer is affected. Accessing the technologies for farm use or for application by the processors is not always affordable. This is based on the fact that the taxation systems in the developing countries like Kenya are very high making the cost of the equipment very high for small holder farmer and processor. This affects the value chains in that the final products become very expensive and unable to compete in the market.

In Kenya amaranth grain has been grown for the last ten years in central, western, Eastern, and Nyanza Provinces. Like any new innovation, the farming and production of the Amaranth grain has been faced by numerous challenges in the production, processing, retail, and marketing stages. The challenges being faced in the production, processing and marketing stages of grain amaranth has affected its adoption rate despite its exceptionally high nutritional value.

2.3 Theoretical Framework

2.3.1 Rational Choice Theory

The theory assumes that humans are purposive and goal oriented. It also assumes that humans have sets of hierarchically ordered preferences or utilities .In choosing lines of behavior, humans make rational calculations about; utility of alternative lines of conduct with reference to preference; the cost of each of each alternative n terms of utility foregone and the best way to maximize utility (Jonathan, 2003). The theory explains the cultivation of grain amaranth by the small scale farmers in Nyeri North district. According to the theory famers will choose to grow amaranth through rational calculations about the cost of its cultivation and alternatives in order to maximize the profit. The small scale farmers will therefore adopt amaranth cultivation if it has a ready market and gives good returns compared to other crops in the area.

2.3.2 Diffusion Innovation Theory

Diffusion of innovation is a theory is a theory that explains why and how any rate of new ideas spread through cultures. Rodgers defines diffusion as “the process by

which an innovation is communicated over time among members of a social system” (Rodgers 1993).

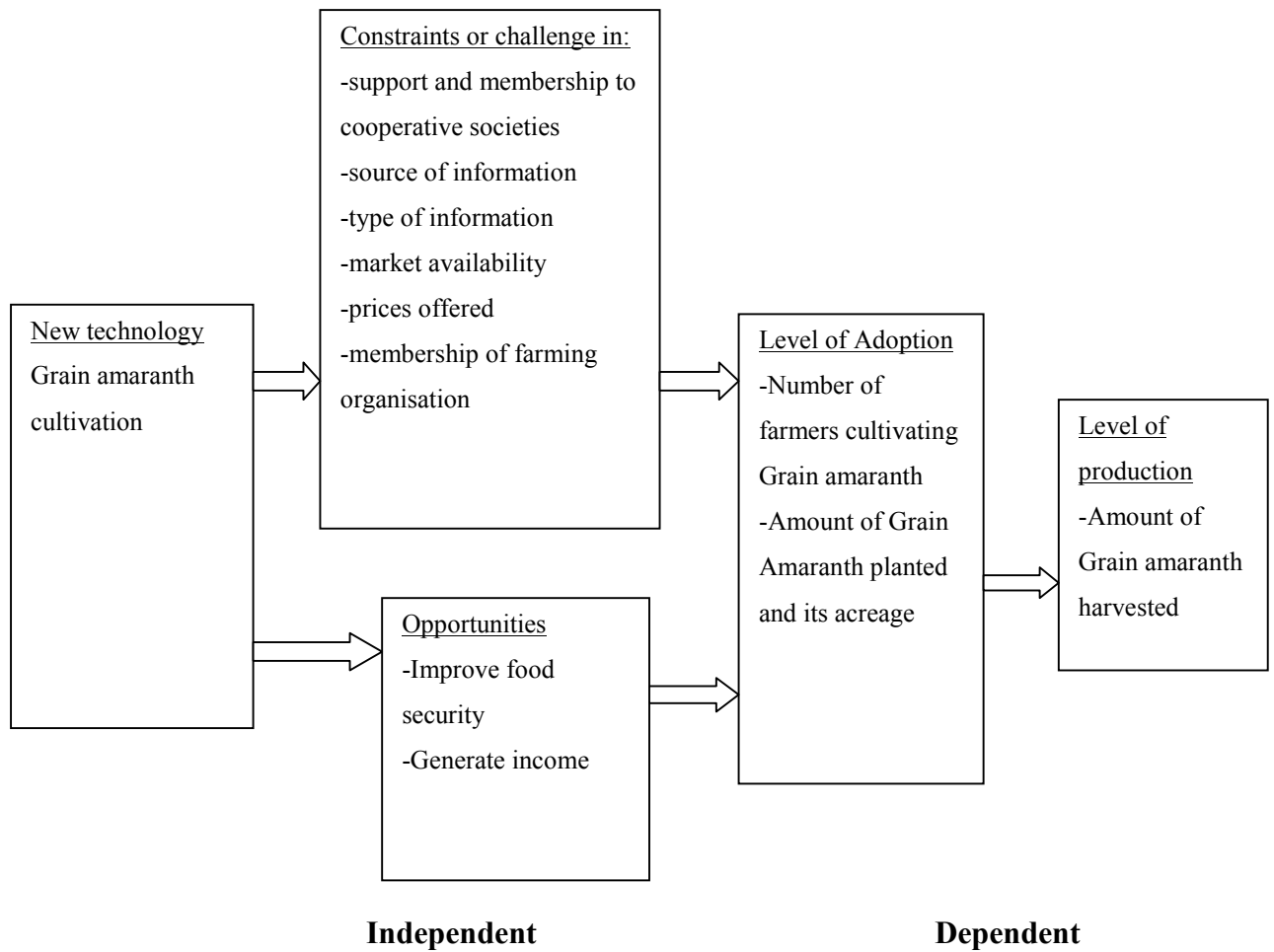
This theory has been applied in the rural context with the focus being the uptake of agricultural innovations such as new crops, hybrid seeds, fertilizers and herbicides. Diffusion of a new innovation however differs from adoption of the new technology in that it is the process by which new technology spreads among users whereas adoption is said to be an individual internal decision (Fisher, sonka, and Nelson 2000).

In this case grain amaranth can be defined as the innovation or the new idea according to Rodgers theory. Communication channel is the means by which the message gets from one individual to another. In this study the communication channel used to transmit the ideas about cultivation of amaranth to the farmers is the KAPP officials and the Kieni west Agricultural officers (Rodgers 1983).

The rate of adoption is the relative speed with which an innovation is adopted by members of a social system. This is usually measured by the length of time required for a certain percentage of a social system to adopt an innovation. The extent of adoption on the other hand is measured from the number of farmers adopting the innovation, and by the measuring the area put on amaranth cultivation and the constraints being faced.

The social system is defined as sets of interrelated units that are engaged in joint problem solving to accomplish a common goal. (Rodgers 1983). In the study the interrelated social systems that work together are farmers, government officers in the Agricultural department, KAAP officers who first introduced the crop in the area ,the farmers ,the traders or those who purchase grain amaranth and also the cooperatives who support amaranth cultivation through lending finances and consumers all make the social system.

2.3.3 Conceptual Frame Work



CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This chapter explains the methodology the researcher used in the study. It explains the strategy used to implement the study. It also identifies the type and sources of data used. It explains how the data was collected and analyzed to answer the research questions. This chapter therefore includes research design, target population, research instruments used and methods of data analysis.

3.1 Site Selection and Description

The study focused on small scale farmers in Mweiga location, Kieni West district, Nyeri County. The district covers an area of 623 km squared and it's situated between longitude 36 40" east and 37 20" east and between the equator and latitude 0 38 south. In terms of altitude the district lies between 3076 meters to 5188 meters above sea level. It registers mean monthly temperatures ranging from 12.8'c to 20.8'c and monthly rainfall ranging between 500mm and 2400mm per annum.

The district is made up of two divisions, Gatarakwa and Kieni west division. There are five locations namely, Migunda, Gatarakwa, Endarasha, Mwiyo, and Mweiga. The District is divided into 26 sub locations. The district has a population of 79,312 and a density of 127/km square according to 2009 census. Mweiga location which is the area of study consists of Kamatongu, Njengu, Amboni, and Bondeni sub-locations and has a population of 12089 people.

The main physical feature of the district is the Aberdares ranges (3,999m) to the west. The topography of the district generally is flat. The district experiences equatorial rainfall due to its location and being within highland equatorial zone. The long rains occur from March to May while the short rains come in October to December but sometimes this pattern is occasionally disrupted by abrupt changes in climatic conditions. The annual rainfall ranges between 500mm in dry areas to 800mm in Aberdares hills.

The above factors, coupled with rainfall and the land tenure system have a tremendous influence on the economic activities in the district particularly agricultural development which is the backbone of the districts economy. Much of the agricultural products produced are from small holder's farms, where subsistence, drought resistance crops and livestock rearing predominant the local economy. The majorities of the people lives in the rural areas and engage in small holder farming.

Mweiga location which is Kieni West District has been selected because; it is a semi arid area where grain amaranth has been grown as a drought resistant crop. Despite of its great qualities, it has dragged in levels of cultivation and production. This area is a rural set up that predominantly relies on farming and animal husbandry. The target population will be of small scale farmers in Mweiga location who grow grain amaranth. The Kieni District Agricultural Officer was interviewed as key informants.

3.2 Research Design

Survey research design is a method of collecting data by asking questions, through face- to -face interviews, through telephones by mails. In the case of this study the researcher used face to face -to- face interviews with the small scale farmers in Mweiga location who were engaged in the cultivation of grain amaranth.

3.3 Population and Sampling Design

3.3.1 Population

According to Koul (1984), a population is the total collection of elements about which we wish to make inferences. The study population for this study consists of all small scale farmers in Mweiga location. The target population is small scale farmers in Mweiga location who are involved in cultivation of Grain Amaranth.

3.3.2 Sampling Design

Sampling is taking any portion of the population from the universe as a representative of the population (Kerlingen, 1964). To be representative means to provide a close approximation of a certain characteristic of the target group. Sampling design refers to the part of research plan that indicates how cases are to be selected for observation (Orodho, 2005). According to Koul (1984), sampling is the process by which a relatively small number of individuals or measures of individuals, objects, or events is

selected and analyzed in order to find out something about the entire population from which it was selected. There are two types of sampling designs probability and non-probability sampling designs.

This study utilized non-probability sampling design. This sampling design is mainly used when the researcher requires a maximum degree of insight into the problem with comprehensive information. This study employed non-probability sampling design due its convenience .The interest of the study was to gain insight into the problem by selecting only informed persons (that is, small scale farmers who were engaged in the cultivation of grain amaranth at the time the research was carried out). There was no reliable complete list of these farmers who cultivate amaranth to warrant probability sampling.

3.3.2.1 Sampling Technique

The study used snowball sampling technique to indentify small scale farmers who were cultivating grain amaranth at the time the research was being done. This meant that few grain amaranth farmers who were already known helped indentify other farmers in Mweiga location cultivating amaranth grain.

3.3.2.2 Sample Size

A sample size of 51 small scale farmers cultivating grain amaranth was adopted and assumed that the samples corresponded to the population of interest. The sample size has been adopted because these were the only farmers who were found growing grain amaranth among all the small scale farmers in Mweiga location. They were the only ones who had first-hand information about its cultivation production and marketing.

3.4 Unit of Analysis

A unit of analysis is the entity about whom or which the researcher gathers information. A unit of analysis can also be said to be the element or aggregation of elements (for example individuals, groups, nations, regions) from which information is analyzed. There are times when the unit of analysis is different from the observation unit, that is, the element from which information is collected (Singleton, 1993). In the case of this study, the unit of study used was households where Amaranth was cultivated in Mweiga location. The households were used because the

researcher wanted to establish whether the household head was also the individual farmer. The unit of observation in the study was individual farmers together with the agricultural officer as key informant. The unit of observation was used in order to provide more information on the subject of the study.

3.5 Sources of Data and Methods of Data Collection

3.5.1 Sources of Data

Data can be classified under different aspects, referring to the way in which they have been collected or to some of their intrinsic properties. Primary is data collected by a researcher for a particular purpose of their research. Primary data is the most adequate to fulfill the aims of research since it seeks to address precisely the questions raised by the researcher. This study used primary data.

3.5.2 Methods of data Collection

According to Koul (1984), methods of data collection are the ways to obtain relevant qualitative and/or quantitative data or information for a particular study from the relevant sources. In conducting this research, the following data collection methods or techniques and instruments were used.

A structured questionnaire was used for personal interviews with the small scale farmers growing amaranth in Mweiga location. These interviews were carried face –to face by the researcher to the farmers and interpreted in the language that the farmers could understand. Another questionnaire was administered face- to-face to the Agricultural officer who was the Key informant in this study.

3.6 Data Processing Analysis

Data obtained from the open and closed-ended questions was first be coded in a code sheet and then the computer was used in organizing, interpreting and presenting the data for the purpose of analysis. Descriptive statistics such as frequencies and percentages were used to analyze data through Microsoft excel computer software. The data was then presented in form of frequency and percentage tables. All the analyzed data was presented thematically in this research project paper guided by the objectives of the study.

CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION

4.0 Introduction

This chapter presents findings of the study. The study sought to investigate the challenges and opportunities in Amaranth Grain cultivation, in Mweiga location of Kieni west District. Mweiga location is the only location where Amaranth Grain has been cultivated in the District. The study was carried out in six Villages (Thathua, Bondeni, Gachuchi, Ark road, Muti - Uri – cieni and Riiru) of three sub-locations (Njeng'u, Bondeni and Amboni).

The findings were based on 51 respondents who are all small scale farmers involved in the cultivation of Amaranth grain and had knowledge about its cultivation. A key informant, the Kieni District Extension and Training officer was also interviewed. The findings are presented in both table and figure form. The analysis of quantitative data is done by use Microsoft Excel. Statistical methods have been used to summarize data to give meaningful information. This has mainly been done by use of descriptive statistics.

The findings are presented in the subheadings of demographic information, access to information and support services, marketing and grain amaranth cultivation, levels of grain amaranth cultivation, challenges and opportunities faced by the small scale farmers in Mweiga.

4.1 Demographic Information

The information contained in the table below includes sex, marital status, education level, household head and religion of the respondents.

Table 4.1 Demographic Information

		Percentage of Respondents	Percentage of Respondents
	21-30	2	4
	31-40	7	13
	41-50	9	17
	51 and above	33	66
	Total	51	100
Gender	Male	14	27.5
	Female	37	72.5
	Totals	51	100
Marital Status	Married	30	58.8
	Single	14	27.5
	Widow/widower	7	13.7
	Divorced/Separated	0	0
	Totals	51	100
Education Levels	No education	7	13.7
	Primary level	22	43.1
	Secondary	17	33.3
	College	4	7.8
	University	1	2
	Total	51	100
Grain Amaranth Farmer	Household head	30	60
	Household member	21	40

Table 4.1 shows the demography of the respondents in Mweiga location and their percentages in term of ages, gender, marital status and education level.

4.1.1 Gender

The study shows that the percentage of females cultivating amaranth is greater than that of the males, 72.5% of the respondents were female compared to 27.5% male. This could be attributed by the fact that there more males who move out or are engaged in other income generating activities elsewhere. A majority of farmers

engaged in cultivation of amaranth interviewed belong to KabaThayu self help group which is a women's group. The study also revealed that 60% of the respondents were house hold heads and therefore in control of the decision made whether to cultivate grain amaranth and in what quantities. The other 40% of the farmers were members of the house hold.

4.1.2 Marital status

Majority of the respondents, 58.8% are married while 27.5% are single. 13.7% of the respondents have been married but are single due to the death of a spouse. Marital status of the respondent is important because it determines who are the household head and therefore the decision maker.

4.1.3 Education level

A well educated population is informed and likely to take risks by trying new ideas. With high level of education farmers are able to access information from other sources like internet, magazines and books. A good number of the respondents 33.3% have secondary level of education, 43.1% has primary level of education while 13.7% has no formal education. The study found out that over 86% of the respondents had at least primary level of education.

4.1.4 Age

Age is an important factor when it comes to adopting new ideas. The youth are more flexible in trying out new ideas. Majority of the respondents involved in cultivation of amaranth grain are above 51 years of age. This means that 66% of the respondents are elderly as compared to 30% aged 31-50 years. Only 4% of respondents aged between 20-30 years of age were involved in the cultivation of Amaranth.

4.1.5 Occupation

Occupation of the respondent was important because it determined whether the respondent had other ways of earning a living, or they depended on farming. Occupation of the respondents is a good indicator of the other activities that the farmers engage in and which competed with cultivation of amaranth especially in provision of labour. The statistics collated was then presented as shown in Table 4.2.

Table 4.2: Occupation of the Respondents

Occupation	Responses	
	N	Percentage
Own farm labour	39	76.5
Livestock herding	33	64.7
Employed (salaried)	5	9.8
Petty trade	3	5.9
Waged labour(casual)	1	1.9

Table 4.2 is a summary of the occupations of the respondents from the most common to the least common occupation .

The study revealed that the respondents were involved in more than one occupation. The most common forms of occupation include own farm labour which is practiced by 76.5% of the respondents ,followed by livestock herding which accounts for 64.7% of the respondents. A few respondents 9.8% are on salaried employment while 5.9% are engage in petty trade and 1.9% working as a casual labourer.

The information contained in the study show that majority of the respondents were involved in activities that are related to the farm. A few of the farmers work away from home although they combine their activities with farming activities. This shows that grain amaranth farmers provided their own labour in its cultivation.

Table 4.3 Other Agricultural Activities Practiced by the Respondents their Contribution to Monthly Incomes.

Farm produce	Contribution to Monthly income in Kshs						Total	Percentage
	Below 2500	2501-5000	5001-7500	7501-10000	10001-12500			
Milk	30	13	5	2	1	51	100	
potatoes	17	7	3	7	1	35	68.6	
Horticultural crops	20	5	3	6	1	35	68.6	
Other Grains	15	6	0	3	0	24	47.1	
Livestock	10	2	3	5	1	21	41.2	
Eggs	3	1	0	1	0	5	9.8	
honey	2	0	0	0	0	2	3.9	
Total	97	34	14	24	4			
Percentage	56.1	19.7	8.1	13.9	2.3			

The above table 4:3 ,illustrates other agricultural activities that farmers who engage in cultivation of amaranth practice in their land and their contribution to the households incomes . This explains why amaranth must be a viable crop and provitable in order to be adopted well by the farmers.

Dairy farming is the most popular agricultural activity among the farmers. The study shows that all the 51 respondents keep Dairy cattle for milk production both for household use and as a source of income to the families. More than half or 58.8% of the farmers who kept dairy cattle recieved less than ksh2500 per month from the sales of milk.

Potatoes and horticultural products ranked second largest popular contibuters of income with 68.6% of the respondents for each activity. There were 41.2% of the farmers keeping livestock other than for dairy purposes. Eggs and honey were the least utilized forms of land use wiht 9.8% and 3.9% repecively. The study shows that majority of the farmers were small scale and earned below kshs 2500 from the sales of the farm produce. This reveals that the farmers had other agricultural activities that

gave grain amaranth unfair competition because they had been cultivated for a prolonged period. According to rational choice theory, farmers are rational beings who will choose to engage in a farming activity that is profitable and not risky (Jonatha 2003). Grain amaranth must therefore qualify to be better paying in order to get the preference of the farmers.

4.2 Farmers Access to information and other Support service

In order for any new ideology to be adopted effectively information not only needs to be provided, but to be well communicated. A person must be well informed in order to make the right choices. The same case applies to farmers when adopting any new crop introduced to them. In order to effectively a new technology farmers need assurances that the new practices will give better results. The farmers will otherwise not risk their families' wellbeing which is often directly influenced by crop yield and profitability. The source of information and how the technology is communicated determine the success of adoption. The table 4.4 below shows the amounts of grain amaranth planted and number of farmers involved from the year 2008 to 2010

Table 4.4: Year when amaranth was first cultivated, Amount and Percentage of Farmers involved

Year	Amount planted in kilograms	Number of farmers	Percentage
2008	10.5	21	41.1
2009	2.5	1	2
2010	7.3	29	56.9
Total	20.3	51	100

The study found out that 41.1% of the farmers interviewed started cultivating amaranth in 2008, while only one farmer was introduced to amaranth cultivation in 2009. Majority of the farmers interviewed started cultivation of amaranth in the year 2010.

The year 2008 the farmers planted the highest amount of grain amaranth at 10.5 kilograms. In the year 2009 the level of amaranth greatly reduced to 2.5 kilograms for

22 farmers. The number of farmers cultivating amaranth increased to 51 while the kilograms planted increased to 7.3. The findings indicate that the farmers in Mweiga location were cultivating grain amaranth for subsistence use and not for commercial purposes. Farmers are risk averse when it comes to adopting new crops which they know little about their profitability. Farmers will not risk the wellbeing of their families which is directly influenced by the crop yield since this is an agricultural community. There is resistance in adoption of a new technology especially if the farmers are not certain in terms of returns (Geertz 1963).

Table 4.5: Farmers First source of information on amaranth from 2008-2010

Year	Source	No of farmers	Percentage
2008	KAPP	16	31.4
	Friend	5	9.8
2009	Friend	1	2
2010	Agri-officer	29	56.8
	Total	51	100

The farmers' first source of information about an idea matters a lot in its implementation process. The source of information determines whether the information received is distorted or not. The studies conducted in Mweiga location among Amaranth cultivating farmers indicate that 41.2% started cultivating grain amaranth in the year 2008. Approximately 31.4% of the farmers received information on cultivation of amaranth from the KAPP officials who introduced it there while 9.8% relied on information from their friends. In the year 2009 the study located only one new farmer who had been introduced to grain amaranth cultivation by a friend.

Majority of the farmers 56.8% started cultivating grain amaranth in the year 2010. These farmers received their first information on amaranth cultivation from the Agricultural officer of Kieni West district. In conclusion it is evident that 31.4% of the farmers received information from KAPP researchers and 56.8% from agricultural office which are reliable sources of information. Only a minority of the respondents 11.8% received information from friends which could have been distorted. FAO

survey on agricultural extension 1988-1989 confirms the dominant role played by the public sector in agricultural extension (Swanson, Farmer, and Bahal 1990).

Table 4.6: Source and cost of seedlings

Source	No. of farmers	Percentage	Cost
African amaranth	29	56.8	500
KAPP	16	31.4	Free
Friend	6	11.8	Free
Total	51	100	

Table 4:6 shows the source of grain amaranth for the respondents. The study found out that 56.9 % of the farmers bought certified seedlings from African amaranth limited at a cost of Kshs 500.00 per kilogram. KAPP provided free certified seedlings to 31.4% of the farmers while 11.8% of the farmers were given seedlings by their friends. Majority of the farmers received their seedlings from a reliable source and their seeds were certified. The source of seedling and the reliability is important because it dictates the production during the harvest.

Table 4.7: Farmers Support from Cooperatives

Response	Source of Finance	No. of Farmers	Percentage
without support	Own savings	22	43.1%
with support	Uwezo cooperative	29	56.9%
Total		51	100%

The above table 4.7 shows farmers support from the cooperatives. It indicates how farmers financed grain amaranth cultivation. Majority of the farmers 56.9% belong to a cooperative and receive financial support in the forms of loans to fund agricultural projects. These farmers belonged to Uwezo cooperative society where they borrowed money for financing cultivation of amaranth and other crops. The other 43.1 % of the farmers did not receive financial support from a cooperative and used their own savings to purchase farm inputs and hire labour in the amaranth farms.

Membership to a cooperative society for small scale farmers plays an important role in improving production. Cooperatives provide credit to farmers in order to facilitate purchase of farm inputs hiring of labour and any other expenses that the farmer may experience (Birchall,J 2004). The 43.1% of farmers who did not have access to a cooperative society may have experienced this challenge which affected grain amaranth production.

**Table 4.8: Source of information on technical skills on Cultivation of Grain
Amaranth**

Source of skills	Type of skill Transferred	No of farmers	Percentage
Agric-officer	Land preparation, manuring	29	56.8
KAPP	planting, hallowing, weeding and thinning, harvesting winnowing cleaning and storing	16	31.4
Friend/Neighbor	Copying the friend	6	11.8
Total		51	100

Table 4:9 above summarizes the skills that the farmers received from the Agricultural extension officer, the KAPP project and the friends or neighbors. The study found out that 56.8% of the farmers received skills in the cultivation of amaranth from the agricultural officer of Kieni west district. Another 31.4 % from the KAPP officials while a simple minority of 11.8% from their neighbors'. The farmers who received information from KAPP and the agricultural officers indicated that they were taken through all the stages of cultivating amaranth intensively in field demonstrations.

The 56.8% of farmers who received information from the agricultural officer belonged to kabathayu women's group. These farmers could easily be reached by the officer in one place and were educated on the cultivation of the crop. Agricultural extension is required to offer information and reduce uncertainty regarding the true returns of a new crop. Without proper information transmission the farmers are insecure with the new crop and therefore poor adoption and production is experienced (FAO, 2005).

It was clear from the study that majority of the farmers had received first hand information on skills transfer from the agricultural officers and the KAPP officials on cultivation of grain amaranth. The agricultural officer who was the key informant indicated that it was difficult to reach every individual farmer because the Agricultural extension officers were few. The agricultural extension officer to the farmer ratio was 1:1115 in Kieni West district which resulted to poor crop husbandry and therefore poor production. The deficit in the number of agricultural officers in the field was contributed by the budget cuts that resulted into SAPS. Most government officers including agricultural officers were retrenched in Africa and Kenya was not spared either (Clever and Schreiber 1995).

In sub-Saharan countries agricultural extension staffs have scarce operational facilities like vehicles. In Kenya where agricultural extension is the main domain of ministry of agriculture majority of the officers were retrenched through structural adjustment programmes (SAPS). The problem of scarce agricultural officers has persisted up-to-date and is still affecting farmers. This problem is however being addressed by encouraging the farmers to form farmer groups like kabathayu to enable easy access by the agricultural officers.

4.3 Marketing and amaranth cultivation

Market remains to be one of major factors affecting cultivation of any crop including grain amaranth. Without a ready market, most farmers are discouraged from cultivating the crop in large scale and end up cultivating it for subsistence use only. Without a ready market, Farmers are insecure with use of a new technology like cultivation of grain amaranth. They need some security through provision of ready market and good prices.

Table 4:9 below is summary of the buyers of the harvested grain, the prices offered in kshs per kilogram, and the percentage of farmers who sold and those who did not sell the grain from the year 2008 to 2010.

Table 4.9: Grain amaranth buyers, prices offered from 2008 to 2010

Year	Buyer	No. of farmers	Percentage	Price/kg in kshs
2010	Local	24	47.1	100
	Broker /farm gate	3	5.8	50
	Allgrain comp	0	0	
	Did not sell	24	47.1	
Total		51		
2009	Local	0	0	
	Broker/farm gate	8	36.4	50
	Allgrain comp	0	0	
	Did not sell	14	63.6	
Total		22	100	
2008	Local	1	4.7	80
	Broker /farm gate	1	4.7	50
	Allgrain company	10	47.6	60
	Did not sell	9	42.9	
Total		21	100	

Table 4:4 indicated that amaranth grain was first cultivated in Mweiga location in the year 2008 and 21 small scale farmers were reached who continued cultivating amaranth up to the year 2010. Table 4:9 above indicates that 47.6 %% of the farmers in the year 2008 sold their produce to Allgrain Company at a cost of Kshs 60.00 per kilogram. A total of 42.9% of the farmers did not sell their produce and consumed it at home or shared with neighbors and friends. A small percentage of the farmers 4.7% sold the crop to brokers at the farm gate while another 4.7% of the farmers sold their amaranth produce at the local market and fetched the best price of ksh 80 per kilogram. The Farmers during this year had an external marketing link to Allgrain Company through the help of KAPP officials where they sold their produce.

In 2009, 22 farmers were reached still cultivating amaranth. There was one new farmer who had not cultivated amaranth in 2008. During this year the Allgrain Company did not buy the grain from the farmers. Approximately 36.4% of the farmers sold their crop at farm gate at a price of Kshs 50.00 per kilogram. A majority

of farmers, 63.6% did not sell but used it for household consumption and also shared with friends. The marketing link with Allgrain Company was not followed up and therefore had ended. Marketing should be a pre-requisite for and not a result of production despite of the quality and quantity of surplus available (Geoneowald 1981). The farmers did not know what to do with the grain harvest when Allgrain Company failed to purchase their produce.

In the year 2010 there were a total of 51 farmers interviewed cultivating amaranth. There were new 29 farmers while 22 of the farmers had cultivated amaranth in the last 2 years. In this year 47.1 % of the farmers sold their produce at the local Market while 5.8% sold to the broker at the farm gate. Allgrain Company did not buy grain from the farmer in this year. The study also revealed that 47.1% of the farmers did not sell amaranth grain they harvested but consumed the grain at home or shared it with friends and relatives.

Table 4.10: Disposal of grain amaranth from 2008-2010

Amount in kilograms	Year 2008	Percentage	Year 2009	Percentage	Year 2010	Percentage
Consumed	175	11.9	64	29.1	162.5	40.6
Shared	103	7	23	10	63	15.8
Stored	16	1.1	7	3.2	3	0.8
sold	1148	77.8	120	54.6	165.8	41.5
harvested	1476	100	220	100	400	100
Total cash in kshs	78720.00		5700.00		15310.00	

Table 4:10 is a summary of how the farmers' disposed of their grain amaranth harvest from 2008 to 2010. In the year 2008 the farmers produced about 1476 kilograms of the grain. Approximately 1148 kilograms or 77.8% of the year's harvest was sold and fetched Kshs.78720.00. It's evident from the study that the amount consumed at household level was 11.9%, while 7% was shared with friend and only 1.1% was stored.

In the year 2009, 22 farmers cultivated grain amaranth. The amount planted greatly reduced from 10.5 kilograms to 2.5 kilograms. The harvest also dropped to 220 kilograms. 120 kilograms or 56.4 % of the grain was sold and fetched a total of Kshs 5700.00. The remaining of the harvested grain 29% was consumed at home while 10% was shared with friends and 7% stored.

In the year 2010 the number of farmers cultivating amaranth increased with more than 50% to 51 farmers. This was attributed to Kabathayu Women's Group which ventured into grain amaranth cultivation as one of their income generating activities. The amount of amaranth planted increased to 7.3 kilograms from 2.5 kilograms planted the previous year. The farmers harvested 400 kilograms and only sold 168.5 kilograms or 41.5% of the harvested amaranth which fetched Kshs.15310.00. The remainder was consumed at home or stored or shared with friends.

The study reveals that there has been a decrease in the amounts of grain amaranth planted, harvested and even sold from 2008 to 2010 although the number of farmers increased in 2010. This can be attributed to the challenges in marketing and poor prices offered by brokers, discouraging the farmers from cultivating grain amaranth for commercial purposes. Failure by farmers of not forming farm based organizations exposed them to brokers who offered poor prices for their produce. The farm based organizations would have given the farmers a better bargaining power and better prices (World Bank 1975).

Table 4:10 also shows the amount of money or income that grain amaranth generated from the year 2008 to 2010. The study shows that in the year 2008 grain amaranth sold, fetched good amounts of money Kshs. 78720.00 as compared to the year 2009 and 2010 where it fetched Kshs. 5700.00 and Kshs.15310.00 respectively. The year 2009 is the year that farmers planted the lowest amount of grain amaranth, harvested the lowest and fetched the least amount of money from its sales. This was attributed to the challenges experienced by farmers as explained later in the study.

The year 2010 is the year a kilogram of amaranth fetched the best price. This can be explained by the fact that the farmers from Njeng'u had a farmers group "Kabathayu". This helped the farmers to Bargain as a group while selling their produce which gave

them a better bargaining power. The farmers were able to fetch an average of Kshs. 92.00 per kilogram as compared to Kshs. 68.00 per kilogram in 2008 and Kshs. 47.00 per kilogram in 2009. Working as a group helped the farmers to deal with the broker who was offering low prices.

4.4 Level of Grain Amaranth Adoption

The levels of amaranth cultivation were low as confirmed by the amounts of amaranth planted by the farmers. Table 4:4 indicates very clearly amaranth has been grown in very small amounts. In the year 2008 there were a total of 21 farmers who planted 10.5kilograms of amaranth. In this year the farmers planted an average of 500grams per farmer which occupied a half an acre piece of land.

In the year 2009 22 farmers were reached cultivating grain amaranth. During this year the amounts of grain amaranth planted greatly reduced as compared to the last year. The farmers planted a total of 2.5kilograms of the grain amaranth; on average each farmer planted 114 grams as compared to an average of 500grams the previous year.

In the year 2010 the amount of grain amaranth planted increased to 7.3 kilograms and the number of farmers increased to 51 from 22 in the year 2009. In average each farmer planted 143 grams compared to 114grams the previous year. This study revealed that there was a slight increase in the amount of amaranth planted although the number farmers more than doubled.

Table 4.10 shows that a good number of the farmers cultivated amaranth for subsistence use and not for commercial purposes. In the year 2008, 42.9% of the farmers did not sell amaranth, in the 2009, 63.6% did not sell their produce while in 2010, 47.1% did not sell amaranth. This explains that these farmers cultivated the grain for household consumption.

Low levels of adoption for a new crop as in this case of grain amaranth cultivation is a result of the new idea going through the process of diffusion. According to (Rodgers 1993) this the process an innovation is communicated over time among members of a social system. The findings indicated that the grain has only been grown for a period of 3years only. With time the levels could improve other factors of production held

constant. This would counter the problem of food insecurity in Mweiga location which is an ASAL especially during the short rains season as indicated in the Kieni West strategic plan 2008-2012.

4.5 Challenges and Opportunities in Grain Amaranth cultivation

Table 4:11: Challenges Experienced by Farmers

Response	Frequency	Percentage
Competition for space with other existing crops	37	72.5
Lack of ready Market	37	72.5
Low prices for amaranth	30	58.8
Fear caused by lack of enough information on amaranth full potential and profitability	25	49
Lack of follow up at the farm level by KAPP officers	21	41.2
Brokerage by middle men	20	39.2
Lack of finances to hire labour and farm inputs	15	29.4

Table 4.11 outlines the challenges experienced by the small scale farmers cultivating grain amaranth in Mweiga location and which have contributed to the low levels of cultivation. The study revealed that 72.5% of the farmers interviewed in Mweiga location indicated that they experienced challenges in cultivation of amaranth while 27% of the farmers felt that there were no challenges.

A majority 72.5% of the farmers agreed that competition for space with other crops which have been cultivated for a longer period of time has contributed to the low levels of grain amaranth cultivation. As shown in table 4.3 majority of the farmers opted to grow crops like potatoes, maize and beans which bring high incomes and that form the main diet of the people. Amaranth grain crop is new in the market and could not compete very well like these other crops.

Marketing of grain amaranth produce was seen as a problem by 72.5 % of the farmers. Grain amaranth is a new crop in the area and the local population has not known its good qualities and therefore do not buy it. The local market was very small therefore no ready market for grain amaranth discouraging the farmers from cultivating it for commercial purposes.

The study shows that 58.8% of farmers were of the view that the prices offered for the sale were low, table 4:9 shows that in the year 2009 farmers who sold grain amaranth were offered prices of ksh 50.00-60.00 per kilogram. Farmers are rational beings and will only choose to cultivate crops that are profitable to them. These farmers indicated that they did not find grain amaranth profitable as compared to milk, potatoes and other horticultural crops that they cultivated.

The study revealed that about 49% of the farmers indicated that they failed to grow amaranth for commercial purposes due to fear of incurring losses. A good number of farmers as shown in table 4.7 did not have support from cooperative societies; they also did not have access or a link with external market. Information reduces the uncertainty about a technologies performance in this case grain amaranth. Access to information on Marketing prepares the farmer on market conditions, demand opportunities prices therefore reducing their risks (Frick and Geoneowald 1999).

A total of 41.2% of the farmers said that after amaranth was introduced to them there was no follow-up by KAPP officers. The farmers did not know where to get information when they experienced problems while cultivating the crop. The farmers also indicated that they did not have information on where to sell amaranth grain after harvesting it.

Brokerage from middle men has contributed to the low prices offered in sales of amaranth. This is a challenge affecting amaranth cultivation as shown by 39.2 % of the farmers interviewed. This is not as serious problem because the farmers have tried to get a market beyond the farm gate where brokers intercept their produce.

According to (Geoneowald 1981), Marketing should be recognized as a pre-requisite and not a result of production. The farmers in Mweiga location cultivated grain amaranth without first establishing the market. This view is shared by the agricultural officer who indicated the Framers were not creative enough to looking for markets and waited for brokers who offered them poor prices for their commodity.

How to Address Challenges Facing Grain Amaranth Farmers

Majority of the farmers in Mweiga location were in agreement that there were challenges facing grain amaranth cultivation. The farmers were however optimistic and came up with solutions to these problems which would help to increase its cultivation and production.

Majorities 72.5 % of the respondents were of the view that by creating awareness among the members of public on its benefits, there would be an increase in its consumption and therefore high demand. Another 72.5% of farmers indicated that by creating and maintaining forward links with both local and national markets, grain amaranth markets would be expanded. This would result into a high demand for the product hence enabling its prices to rise making it profitable to cultivate. Amaranth being a viable crop to cultivate would compete well for space with other forms of land use like dairy farming.

The study also revealed that 49 % of the farmers indicated that the challenges can be addressed by offering extensive training to the farmers and also follow-ups by agricultural officers and other agricultural organizations. The farmers were of the view that just like other new crops introduced in the area ,amaranth would face the same fate of being abandoned by farmers due to lack of follow up.

The farmers were also of the view that groups would help the farmers solve some of the problems that they are facing. A simple majority or 58.8% of the farmers agreed that by forming groups or organizations they would address issues concerning the quality of amaranth cultivated by controlling the grades. They would also market their products as a group which would help them fight for better prices and also do away with the brokers. The Agricultural officers would also reach them with ease while they are in a group.

A good number of the farmers don't belong to a cooperative. The study revealed that 58.8% of the farmers were of the view that if farmers join a cooperative they would have access to finances in form of loans which would enable them to purchase farm inputs and also help them hire labour. The farmers would also be in a position to get

credit to finance to fund value addition activities which would diversify grain amaranth market. Grain amaranth being a new crop faced competition with other agricultural activities in the area which had been cultivated there for longer period and had competitive advantage. In order to remain competitive the farmers agreed they needed to be creative and come up with innovative ways of marketing the grain through value addition (Farr 2002).

4.6 Opportunities in Amaranth Cultivation

Table 4:12 Opportunities available in amaranth cultivation

Response	Explanation	Frequency	Percentage
Contribution to food security in the household	As a source of food amaranth is consumed by the family members	48	94
	Improves nutrition and health especially for the young, old and the sick	48	94
Contributes to income generation	Generates finances from its sales	39	76.4
	Creates employment	24	47
	Used as Animal feed	8	15.7

The study found out those farmers who were interviewed in Mweiga location agreed that there were opportunities that can be exploited in order to benefit farmers in spite of the challenges being faced in grain amaranth cultivation. When the opportunities are exploited grain amaranth is capable of revolutionizing the small scale farmers through development

A good majority of the farmers, 94% indicated that grain amaranth contributes to household food security because it is used as an alternative source of food by the families. The grain matures fast, is highly productive and can withstand relatively dry conditions therefore the crop can be cultivated during the short rains in relatively dry areas (Weber, 1987, Meyers and Putman 1988). Grain amaranth has an advantage over other crops which take long to mature and are not drought resistant. Grain amaranth is likely to do well in Mweiga location which is an ASAL area.

Grain amaranth therefore can be used to diversify traditional agricultural activities. Majority of the farmers 94%, were of the view that Grain amaranth contributes to

improvement of nutrition of the households and therefore better health (Legacy, 2003, Alemu2005, Spetter and Thompson, 2007). By enhancing food security, grain amaranth reduces the number of people suffering from hunger in Mweiga location therefore helping the government to meet millennium development goals (MDGS).

The respondent agreed that amaranth contributes to the family's income but in different ways. Approximately 76.4 respondents claimed that grain amaranth generate an income for the family from its sales. The study showed that 47% of the farmers indicated grain amaranth contributed to income generation for the families in terms of job creation for those cultivating amaranth for sale. The farmers were the opinion that this can be enhanced by engaging in value addition activities therefore turning grain amaranth cultivation into an agribusiness. Grain amaranth has a potential of creating wealth for the rural community therefore reducing Levels of poverty and propelling development. (Poverty Eradication commission 2007).

A simple 15.7 % of the farmers indicated that Grain amaranth contributes indirectly to income generation as an animal feed. The respondent indicated that they fed their animals with grain amaranth stalks after harvest. This is an indication that there is nothing that is wasted from the amaranth crop.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND FINDING

5.1 Introduction

The purpose of this chapter is to summarise the findings of this study and to draw conclusions based on the same results. It also provides some recommendations thought to be useful in policy formulation and implementations and proposed areas of further research.

5.2 Summary of findings

This study explored the cultivation of grain amaranth cultivation through constraints and opportunities faced by the small scale farmers of Mweiga location of Kieni west district. The specific objectives were; to establish farmers' knowledge and access to information and support services; to explore how availability of market has influenced grain amaranth cultivation and production: to establish the grain amaranths level of cultivation in Mweiga location and to identify the challenges experienced by the small scale farmers and the opportunities there in. It explored how these challenges could be arrested and the opportunities exploited to enhance grain amaranth cultivation.

In order to achieve these objectives the study used primary source of data. Personal interviews were carried out among small scale farmers cultivating grain amaranth who were identified through snowball sampling technique. The Kieni west district officer was interviewed to give in depth information on the challenges of grain amaranth cultivation in the area.

Demographic characteristics of the respondents are known to have an influence on the adoption of a new technology (Rodgers 1996).Some of these characteristics include; Age, sex, level of education, position in the household and occupation. Out 51 respondents 72.5 % were females and 27.5% males. The study revealed that respondents' level of education was high with 86% having attained primary level of education. Majority of the respondents were elderly, 66% indicated that they were aged 51years and above. A small population of about 17% were age 40 years and below were identified cultivating amaranth.

The study findings revealed that the respondents were mainly small scale farmers with 76.5% providing their own farm labour. Dairy farming was the main land use form which every respondent practiced. Majority of the respondents were low income earners with 56.1% earning below Kshs. 2500 from these other forms of land uses. These activities had a competitive advantage over grain amaranth which was a new crop in the area therefore affecting its level of adoption. This supports the rational choice theory that farmers are rational beings and will choose to engage in a farming activity that is productive.

Access to information and support services is known to be a very important aspect in adoption and production of new crop like grain amaranth. Since farmers are rational beings they will not risk their families' wellbeing by cultivating a crop they have little information on its production and profitability (Gershon, Richard, and David 1982). The farmers in Mweiga location had a reliable source of information. 56.9% received their first information, and skills transfer in the cultivation of grain amaranth from the agricultural officer in Kieni west and 31.4% from KAPP project.

Farmers need support in provision of credit by cooperative to enable them purchase certified seedling and other inputs including hiring labour (Birhall, J. 2004)The study findings show that 56.9% of the farmers belonged to Uwezo cooperative society while 43.1% of farmers did not belong to a cooperative society and used their own savings. The 56.9% of the farmers also belonged to Kabathayu women's group registered with the ministry of Gender and social welfare in Kieni west district. Farmers' group help in spreading newly developed technology like cultivation of amaranth, and pooling the farmers together for easy access by the overstretched agricultural extension (Swanson, Farmer, and Bahal 1990).

Market remains to be one of the major factors affecting cultivation of grain amaranth. Without a ready market, most farmers are discouraged from cultivating the crop. According to (Geoneowald, 1981) marketing should therefore be a pre-requisite for production and not a result of production despite of the quality and quantity of surplus available. The Farmers were selling small percentages of the crop with most of the crop getting into the household consumption. The study findings showed that majority

of the farmers cultivated grain amaranth for consumption at the household level and not for sale.

The study found out that the level of Grain amaranth was low in Mweiga location. This is supported by the fact that the grain was being cultivated in very small amounts and could not be used for commercial purposes but for subsistence use. This is well elaborated by the amount of amaranth planted by the farmers in the three years that they grew the crop.

The study findings revealed that the poor adoption of grain amaranth by farmers in Mweiga location was attributed to various challenges. The farmers involved in the cultivation of grain amaranth are small scale farmers who practice mixed farming. Amaranth as a new crop was facing stiff competition for space with already existing crops. Amaranth was therefore cultivated on relatively small amounts like on trial basis making its production poor as indicated by 72.5% of the respondents.

Further findings from the study revealed that 72.5% of the respondents indicated that grain amaranth's local market is not well established, it is small hence low demand for amaranth production. The farmers have focused on production without being creative enough to look for markets with large buyers who process the grain in big towns. The farmers in Mweiga location market grain amaranth in its raw form without processing to add value. Value addition would have helped them diversify their products expand the market and therefore fetch better prices.

The study findings show the government extension officers are understaffed and are not able to reach individual farmer in the district to educate them through field demonstrations. According to the Kieni Agricultural District Officer, the officer to farmer ratio was 1:1115 which made it difficult for the officers to effectively educate, and support farmers in cultivation and marketing.

The findings show that these challenges that have affected the adoption of grain amaranth can be addressed. A majority of the farmers 72.5% were of the view that sensitization of members of public on benefits of the grain, can open up new markets both at the local and national levels which would help improve prices which and

encourage farmers to increase acreage put under amaranth cultivation. The farmers should be encouraged to maintain the market links already established like the Allgrain Company as they establish new ones.

The findings revealed that there was not enough dissemination of information to the farmers. A good number of farmers 49% were of the view that the training they received should have been enhanced and follow-ups made. The study also showed that 58.8% indicated that farmers should be encouraged to form farmer groups and cooperatives for support.

A good majority of farmers 94% were of the view that there were opportunities in production and marketing of grain amaranth. Only 6% did not see any opportunities in grain amaranth cultivation and production. The rest of the farmers who saw opportunity in amaranth cultivation indicated that, the grain has a potential, of contributing to the household food security and therefore helping in achieving the MDGS. This is so because grain amaranth is nutritious and contributes to the families' good health. In order to achieve this goal proper information distribution is important to help reduce the fears the farmers have on new crops that they see as risky to cultivate.

A majority of the farmers 76.45 indicated that grain amaranth can be used as an income generating activity for the community. This can be achieved through creation of markets and value addition. Value addition activities like packaging and processing of the grain would help in creating jobs for the community therefore reduce the poverty levels. This can be achieved successfully through farmer education and effective financial support from the cooperative societies

5.4 Conclusions

The study found out that the farmers' first source of information and technical support was from a reliable and qualified personnel, the agricultural officer and the KAPP officials. The farmers' first seedlings were certified and were either given freely by KAPP or bought from African Amaranth stockists. Majority of farmers' were members of Uwezo cooperative society that provided finances to purchase farm

inputs and hire labour. The farmers who belonged to farmer group were easily reached by the agricultural officer and used the group to market their produce.

Grain amaranth production and marketing has the potential to improve the income of small scale farmers in Kenya. The study has found out that, currently the production levels are non-commercial and incapable of supporting the needs of the sub sector. This was attributed to the challenges faced by the farmers in access to information, support services and in marketing of grain amaranth produce. This was mainly attributed to challenges in marketing. The market for grain amaranth is small and the prices offered are low discouraging the farmers from cultivating for commercial purposes.

Grain amaranth has got a potential of bringing about development in Mweiga community. This can be achieved through increased production of grain amaranth and market expansion. The farmers should also diversify their market through value addition. Grain amaranth is a high nutrition food which is capable of dealing with malnutrition, and other related illness. The grain, with its drought resistant characteristics has the potential of fighting food insecurity in Mweiga location which is an arid and semi-arid area

5.5 Recommendations

Based on the results of this study several recommendations and suggestions were made in an attempt to address the challenges facing farmers in cultivation and production of grain in amaranth Mweiga location.

A market led approach to production of grain amaranth is expected to play a major role in the success of the sub sector. There is need to create awareness among the members of public in order to expand the existing local market for grain amaranth and therefore increase production. Diversification of the market through value added products by the use of simple techniques and technologies can help in solving the marketing problem. Farmers can also be encouraged to venture into contract farming with the buyers.

There is need for clear policy on commercialisation of grain amaranth sub sector. Currently, the crop is being cultivated in very low levels and by very few farmers. The sub sector should be supported through a concerted effort by the key stakeholders; the farmer, the ministry of Agriculture, the large companies that process the grain, cooperative societies. The stakeholders should complement each other instead of duplication of activities.

In order to enhance the commercial status of grain amaranth cultivation there is need for intensified sensitisation aimed at increasing the participation of farmers in production hence increasing overall acreage on grain amaranth. This can be done by training farmers through NALEP organised forums.

There is need for the government to increase the number of agricultural officers in the field. The farmers should also be encouraged to form groups or organisation that can enable the extension officers to reach them with ease to pass the necessary information and knowledge on cultivation of grain amaranth.

REFERENCES

- Aldeman, H., Hoddinott, J., Lawrence, J., and Urdu, C. (1995). Gender Differentials in Farm Productivity; FCND Discussion Paper 6, International Food Policy Research Institute (IFPRI).
- Alemu, J., (2005). A plant Full of Medicinal Values .The African Executive(2009).
- Ardayfio S., and Nii, K.S., (1996). Gender and Poverty in Ghana. World Bank Washington, D.C
- Azam, A.S and Battcock, M. (2002). Fermented Fruits and Vegetables. A global perspective. FAO Agricultural services Bulletin g Services.
- Berghofer, E., Schoenlenchner, R. (2002). Grain Amaranth. In Belton ,P., Taylor J(eds): Pseudo cereals and Less Common Cereals , Grain Properties and Utilization potential. P 219-260.
- Birchall, J. (2004). Cooperatives and Millennium Development Goals. International Labour Organization, Geneva.
- Caswell, M., Fugie, K., Ingram, C., Jans, S. and Kasca, K. C.(2001). Adoption of Agricultural Production Practices: Lessons Learned from the U.S Department of Agriculture Area Study Project. Washington DC. Economic Division, Economic Research Service, Agricultural Economic Report No. 792.
- Clever, K.M and Schreiber, G.A (1994). Reversing the spiral; The population, Agriculture and Environmental Nexus in sub Saharan Africa. The World Bank, Washington DC.
- Doss, C.R., M.L., Morris, (2001). How Does gender Affect Adoption of Agricultural Innovations; The Case of Improved Maize Technology in Ghana. Agricultural Economics Vol 25.

- FAO survey on Agriculture (1988-1989).
- FAO,(2005).The State of Food Insecurity in the world 2004 .FAO Rome
- Fenyés, T.I and Groenewald, J.A (1985). Aspects of Agricultural Marketing in Lebowa; Development of South Africa vol.2 (3)
- Frick, A. and Groenewald, J.A (1999). The need for Agricultural Information in the New South Africa. SAJEMS, vol, 384.
- Geertz, C., (1963). Agricultural Involution. Berkeley: University of California Press.
- Gereffi, G.M, and Korweniewiz, R. (1994). “Introduction: Global Commodity Chains”. In Commodity chains and Global Capitalism, eds.Gereffi, G and Korweniewiz, M 114, west Port: Green Wood Press.
- Gershon, F., Just, E. and R, Zilberman, D., (1982). Adoption of Agricultural Innovations in Developing Countries; survey of World Bank Staff working Paper (1982).
- Gilbert, R.A.,W.D ,Sakala and T.D.Benson (2002). Gender Analysis of National Wide Cropping System Trial survey in Malawi: African Studies Quarterly 6, no.1.
- Government of Kenya (2008). First Term Plan, 2008-2012.Nairobi.
- Groenewald, J.A (1981).Reforms to Size and Structure of Agriculture. A suggested Interpretation; Development South Africa, vol 8.
- Gupta, V.K, (1986).Amaranth Grains in Kenya. In: proc. Third Amaranth conference. Rodale Press, inc., Emmaus, PA.

International Food Policy Research Institute (2009). Gender and Governance in Rural Services .Insight from India, Ghana and Ethiopia; Gender and Governance Author Team. IFPRI, Washington ,DC.

James ,E . B. 1926:The America journal of Economics Review

Judd, M.A., Boyce, J.K., and Evenson, R., (1986). Investing in Agricultural Supply; The Determinants of Agricultural Research and Extension Investment Economic Development and Cultural change.

Kagoda, A., (2008).Educational Research and Review .Vol. 3, 12 p365-369). 2008 Academic Journals. The effect of land Tenure Systems on women's Knowledge, Base and Resource Management in Manjiva County, Uganda.

Kauffman, C, S., Weber, L.E., (1990). Amaranth Grain p.127-139In Janick J, Simon J.E, .Advanced in New Crops. Timber press, Portland, OR.

Kenya Interim Poverty reduction Strategy paper (2003-2007): prepared by Government of Kenya, Nairobi Kenya.

KNBS (Kenya National Bureau of Statistics) 2008-09 *Kenya Demographic and Health Survey* Nairobi, Kenya Government Press.

Kenya Vision 2030, Government of the Republic of Kenya (2009). Ministry of Planning and National Development and the National Economic Social Council, Nairobi Kenya.

Mabberley, D.J (1997) The Plant Book; A Portable Dictionary of Vascular plants (2nd edition).Cambridge University press, Cambridge, U.K.

Maundu, P.M, Ngugi G.W, Kabuye C.H.S, (1999). Traditional Food Plants of Kenya. National Museums of Kenya, Nairobi Kenya.

- Meyers, L.R., (1996).Amaranth: New Crop Opportunity.P207-220 in Janick(ed),
Progress in new crops. ASHS Press , Alexandria, VA
- Ministry of Agriculture, strategic Plan (2008-2012).
- National Academy of Sciences, (1975). Under exploited Tropical Plants with
promising Economic Value. Nat. Acad.Sci., Washington, D C.
- National Academy of Sciences, (1984). Amaranth Modern prospects for an ancient
crop.1984. Nat. Acad.Sci., Washington, D C.
- National Academy of Sciences, (2006).Last Crops of Africa: Vol.2: Vegetables
.Description and Assessment of Individual Species. National Academy of
Sciences, Washington, DC.
- Nelson, R., and Winter, S., (1982). An Evolutionary Theory of Economic Change.
Harvard University Press U.K.
- Nyeri North District Development Plan, 2008-2012.
- Obrien, G.K.,Price , M.L (1983).Amaranth:Grain and Vegetable Type.Echo Technical
Note.ECHO.17391 Durrance Rd ,North Ft Meyers ,Fl 33917, USA.
- Ogolla, B.D., and Mugabe (1996). Land Tenure and Soil conservation: In Land we
trust Initiatives Publishers, Nairobi Kenya
- Perterson, A.G (1997) Farm Support Services in South Africa. Unpublished Report of
South African Midland.
- Poverty Eradication Commission (2007).Grain Amaranth Project. Special News
Letter- February 2007.

- Quisumbing, A. R., Otsuka, K., Suyanto, J., Aidoo, B and Payangong (2001). Land Trees and women. Evolution of Land Tenure institution in Western Ghana and Sumatra. Research Report 121 Washington ,DC: International Food Policy Research Institute (IFPRI).
- Randolf, S. (1988). Constraints to Agricultural Production in Africa: A Survey of female Farmers in the Ruhengeri Prefecture of Rwanda, Studies in comparative International Development.
- Rodgers, E., (1976).New Product Adoption and Diffusion. A Journal of Consume Research Vol. 2.
- Rodgers, E., (1993). Third Generation Extension Towards an Alternative Model, Rural Extension. Agricultural Extension and Rural Development Department, University of Reading. Bulleting No.3
- Swanson, B., Farmer, B.J., and Bahal, R., (1990). The Current Status of Agriculture Extension Worldwide. In FAO Report of the Global Consultations on Agricultural Extension; Rome.
- Umali, D.L., and Schwartz, L, (1994) Public and Private Agricultural Extension; Beyond Traditional Frontiers. In World Bank discussion Paper 236.
- Vanclay, F., (1992). The Social Context of farmers of Environmentally Sound Farming.
- World Development Report (2008).
- Zilberman, D., (1984). Technological Change, Government Policies and Exhaustible Resources in Agriculture; American Journal of Agriculture Economics.

APPENDICES

Appendix I: Introduction Letter

Dear Respondent,

How are you today Sir/Madam? My name is Agnes Kamindu. I am a student at the University of Nairobi, undertaking a research study titled “**The Role of Amaranth Grain in Poverty Alleviation: A Study on Opportunities and Challenges in Nyeri North District**”. I am therefore requesting you to respond to questions related to the subject based on your knowledge and experience. The information to be collected will enable me to generate knowledge on the subject matter and to complete my Masters Degree Research Project for examination by the University. Kindly note that all the information gathered from you will remain confidential.

Thank you.

APPENDIX 2: QUESTIONNAIRE

Amaranth Grain in cultivation: A Study on Opportunities and Challenges in Mweiga Location, Kieni west District

Identification of Respondents.

Division _____ Location _____ SubLocation _____
Village _____ Plot Number _____
Date of Interview _____ Name of Interviewer _____
Name of respondent _____

Section 1: Demographic information

1. Sex of the respondent
Male ____ Female ____
2. Marital Status of the respondent
Married ____ Single ____ Separated/Divorced ____ Widow/widower ____
3. Education level of respondent
No Education ____ Primary ____ Secondary ____ College ____ University ____
4. Religion:
Roman Catholic ____ Protestant ____ Islam ____ Traditionalism ____
Other (Specify) _____
5. What is the your length of stay in the area ____
6. Who is the owner of the home? _____
7. Who is the house hold head? _____
8. Who makes decisions in the households? Household head _____
Other. Specify _____
9. How many people live in this household and share meals? _____

10. Provide information of household members on age, sex, education, occupation, marital status and income. **Indicate respondent by marking “R” in the first column.**

S/No	Name (Initials)	Age	Sex	Education	Occupation	Marital status	Income per month
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

KEY

Sex: 1.Male 2. Female

Education level:

1 = Pre-school 2 = Primary incomplete 3 = Primary complete 4 = Secondary incomplete 5 = Secondary complete 6= College (certificate) 7 = College (Diploma) 8= University (degree) 11= Adult education 12= none

Occupation:

1= Own farm labour, 2=Livestock herding, 3=Employed (salaried) 4=Waged labour (Casual), 5=Petty trade, 6=Unemployed 7=Merchant/trader, 8=Housewife 9=Firewood/charcoal burning 10= Brewing 11=others (Specify).....

Marital status:

1= Married 2 = Divorced/separated 3 = Widowed 4 = Single

Income per month:

1= Below 2,500. 2. = Ksh. 2,501 – 5,000. 3= Ksh. 5,001 – 7,500. 4= Ksh. 7, 500 – 10,000. 5. =Ksh.10, 001 – 12,500. 6. =Ksh.12, 501 – 15,000. 7. = Above. Kshs. 15, 001

11. What is your monthly income from farm produce in Kshs? (Use Key above)

Potatoes ___ Surplus grains ___ Livestock ___ Milk ___ Honey ___ Eggs ___

Horticultural crops e.g. kales _____

Any other source of income _____

Section 2: Questions on Amaranths Knowledge, access to information and support services

12. When did you start growing Grain Amaranth? _____
13. How did you come to know about Grain Amaranth? _____
14. What type do you grow? Golden _____ White _____
Other (Specify) _____
15. What is the source of your seedling? _____
16. How much does it cost per kg? _____
17. What is the average length of the production cycle of grain amaranth planting and harvesting? _____
18. Do you have access to local cooperatives and other formal, informal and groups' networks and relationships help in cultivation of amaranth? _____

19. How do you finance the purchase of inputs for grain amaranth production?

20. If credit was used:
What was the source? _____
For what inputs was the credit obtained? _____
21. Who provides you with technical skills on grain amaranth production?

22. What are the technical skills provided? _____

23. How much amaranth have you harvested (kilograms) and how did you dispose of it the last couple of years? Fill in the table.

Year	Planted	Harvested	Consumed at home	Shared	Stored	Sold	Price per Kg.
2010							
2009							
2008							
2007							
2006							

Grain amaranth cultivation and Marketing

24. Who were the most important buyers of your grain amaranth?

Year	Name of buyer of grain amaranth	Amount of grain amaranth bought (Kg)	Average price offered per kg.
2010			
2009			
2008			
2007			
2006			

Grades and standards

25. Are there grades and standards you have to attain in production of grain Amaranth? _____

- ✓ If yes what are they? _____
- ✓ Who defines them? _____
- ✓ Who enforces them? _____
- ✓ What are the penalties of not meeting the standards? _____
- ✓ Who enforces the penalties? _____
- ✓ How are the penalties enforced? _____
- ✓ In your opinion how should they be enforced? _____

Membership of a producers' organization.

26. Do you belong to a grain amaranth producers' organization?

- ✓ If yes which one? _____
- ✓ If not why not? _____

27. When was the producers' organization formed? _____

28. What are the activities of the producers' organization?

- a. _____
- b. _____
- c. _____
- d. _____

29. How would you rate your satisfaction with the services of this organization?
(1=Satisfied, 2=Indifferent, 3=Dissatisfied)
30. Does the group undertake value addition activities in grain amaranth beyond production? _____
31. Are there grades and standards of grain amaranth you have to attain in Marketing? Y/ N
- ✓ If yes, what are they? _____
 - ✓ Who defines them? _____
 - ✓ Who enforces them? _____
 - ✓ What are the penalties of not meeting the standards? _____
 - ✓ How are the penalties enforced? _____
 - ✓ In your opinion how should they be enforced? _____

Membership of a marketing association.

32. Do you belong to a grain amaranth marketing association?
- ✓ If yes, which one? _____
 - ✓ If not, why? _____
33. When was the marketing association formed? _____
34. What are the activities of the marketing association?
- a. _____
 - b. _____
 - c. _____
 - d. _____
35. How would you rate your satisfaction with the services of this association?
(1=Satisfied, 2=Indifferent, 3=Dissatisfied).

Level of Grain Amaranth Cultivation

36. In your view how would you rate the level of grain amaranth cultivation in Mweiga Location? (a) High

(b) Medium

(c) Low

35. (a) Are there any challenges in Amaranth farming and disposal? 1. Yes 2. No

(b) If yes in question above, probe for challenges in:

(1) Availability of adequate land for Amaranth farming _____

(2) Marketing and brokerage/middlemen _____

(3) Poor prices offered by buyers _____

(4) Availability of technical support and/or training on Amaranth farming from Government and Non-government agencies _____

(5) Financial support in Amaranth farming _____

(6) Farmers' access to information and support services on Amaranth _____

(7) Any other challenge _____

(c) How can the challenges in Amaranth farming/cultivation be addressed? _____

36. (a) Do you think there are any opportunities in Amaranth farming .

1. Yes 2. No

If no please explain your answer _____

(b) If yes in question above, probe for opportunities in:

(i). Contribution to food security: _____

(ii) Contribution to Health and Medicine: _____

(iii) Contribution to income generation: _____

(vi) Any other opportunity: _____

APPENDIX 3: KEY INFORMANTS INTERVIEW GUIDE

Section 1: Introduction

1. Name _____
2. Designation _____
3. What is the main source of livelihood for households in Mweiga location?

4. What kind of economic activities that involve buying and selling of goods and services does community in Mweiga location?

Section: 2

5. When Grain amaranth was first introduced for cultivation in Nyeri North district? _____
6. Who introduced grain amaranth in this area? _____
7. Is grain amaranth cultivated in all the locations of the district? Yes/no
If it is not in which locations is it
grown? _____
8. What role does the extension officer play in introduction of a new crop like grain amaranth? _____
9. In your view has grain amaranth been adopted well in this area?

10. How would you gauge the level of grain amaranth adoption in your area?
a) high b)medium c) low
11. Please explain your answer _____

12. What challenges are being faced by farmers which have affected its cultivation and production as a new crop?

Marketing

13. In your opinion is there a great demand for amaranth grain? Yes/No

Please explain your answer _____

14. Who are the most important buyers of amaranth?

15. Are there brokers involved in the marketing of grain amaranth? Yes/No

If yes how do they affect marketing of grain amaranth? _____

16. What challenges are being experienced by farmers in marketing amaranth grain?

Section 3: Opportunities in Amaranth Grain cultivation.

(a) Do you think there are opportunities in Amaranth grain cultivation?

- 1. Yes
- 2. No

(b) In your view what are the opportunities in Amaranth farming production?

(c) In your view what would you recommend in order to improve amaranth cultivation?

